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# JANUARY & APRIL 2019 ATTEMPT (PC)

# ATOMIC STRUCTURE

- 1. What is the work function of the metal if the light of wavelength 4000 Å generates photoelectrons of velocity  $6 \times 10^5$  ms<sup>-1</sup> form it ? (Mass of electron =  $9 \times 10^{-31}$  kg Velocity of light =  $3 \times 10^8$  ms<sup>-1</sup> Planck's constant =  $6.626 \times 10^{-34}$  Js Charge of electron =  $1.6 \times 10^{-19}$  JeV<sup>-1</sup>) (1) 0.9 eV (2) 4.0 eV (3) 2.1 eV (4) 3.1 eV
- 2. If the de Broglie wavelength of the electron in  $n^{th}$  Bohr orbit in a hydrogenic atom is equal to 1.5  $\pi a_0(a_0$  is Bohr radius), then the value of n/z is :
  - (1) 1.0 (2) 0.75
  - (3) 0.40 (4) 1.50
- The upper stratosphere consisting of the ozone layer protects us from the sun's radiation that falls in the wavelength region of :
  (1) 600-750 nm
  (2) 0.8-1.5 nm

(3) 400-550 nm (4) 200-315 nm

4. Heat treatment of muscular pain involves radiation of wavelength of about 900 nm. Which spectral line of H-atom is suitable for this purpose ?

 $[R_{\rm H} = 1 \times 10^5 \text{ cm}^{-1}, \text{ h} = 6.6 \times 10^{-34} \text{ Js},$  $c = 3 \times 10^8 \text{ ms}^{-1}]$ 

- (1) Paschen,  $5 \rightarrow 3$
- (2) Paschen,  $\infty \rightarrow 3$
- (3) Lyman,  $\infty \rightarrow 1$
- (4) Balmer,  $\infty \rightarrow 2$
- 5. The de Broglie wavelength  $(\lambda)$  associated with a photoelectron varies with the frequency (v) of the incident radiation as,  $[v_0$  is thershold frequency]:



The ground state energy of hydrogen atom is -13.6 eV. The energy of second excited state He<sup>+</sup> ion in eV is :

$$\begin{array}{ccc} (1) -6.04 & (2) -27.2 \\ (3) -54.4 & (4) -3.4 \end{array}$$

- 7. Among the following, the energy of 2s orbital is lowest in :
  - (1) K (2) Na (3) Li (4) H
- 8. Which of the graphs shown below does not represent the relationship between incident light and the electron ejected form metal surface ?



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- 9. Which of the following combination of statements is true regarding the interpretation of the atomic orbitals?
  - (a) An electron in an orbital of high angular momentum stays away from the nucleus than an electron in the orbital of lower angular momentum.
  - (b) For a given value of the principal quantum number, the size of the orbit is inversely proportional to the azimuthal quantum number.
  - (c) According to wave mechanics, the ground

state angular momentum is equal to  $\frac{h}{2\pi}$ .

- (d) The plot of  $\psi$  Vs r for various azimuthal quantum numbers, shows peak shifting towards higher r value.
- (1) (b), (c) (2) (a), (d)
- (3)(a),(b)(4)(a),(c)
- 10. For emission line of atomic hydrogen from  $n_i = 8$  to  $n_f = n$  the plot of wave number

$$(\overline{v})$$
 against  $\left(\frac{1}{n^2}\right)$  will be (The Rydberg

constant, R<sub>H</sub> is in wave number unit).

- (1) Linear with slope  $R_{\rm H}$
- (2) Linear with intercept  $R_{H}$
- (3) Non linear
- (4) Linear with slope  $R_{H}$
- 11. If p is the momentum of the fastest electron ejected from a metal surface after the irradiation of light having wavelength  $\lambda$ , then for 1.5 p momentum of the photoelectron, the wavelength of the light should be:

(Assume kinetic energy of ejected photoelectron to be very high in comparison to work function)

$$(1) \frac{1}{2}\lambda \qquad (2)$$

$$(3) \frac{2}{3}\lambda \qquad (4) \frac{4}{9}\lambda$$

- 12. For any given series of spectral lines of atomic hydrogen, let  $\Delta \overline{v} = \overline{v}_{max} - \overline{v}_{min}$  be the difference in maximum and minimum frequencies in cm<sup>-1</sup>. The ratio  $\Delta \overline{v}_{Lyman} / \Delta \overline{v}_{Balmer}$  is : (2) 4 : 1
  - (1) 27:5
  - (4) 9:4(3) 5:4

13. Which one of the following about an electron occupying the 1s orbital in a hydrogen atom is incorrect?

(The Bohr radius is represented by  $a_0$ )

- (1) The electron can be found at a distance  $2a_0$ from the nucleus
- (2) The probability density of finding the electron is maximum at the nucleus.
- (3) The magnitude of potential energy is double that of its kinetic energy on an average.
- (4) The total energy of the electron is maximum when it is at a distance  $a_0$  from the nucleus.
- The graph betweeen  $|\psi|^2$  and r(radial distance) 14. is shown below. This represents :-



- (1) 3s orbital (2) 1s orbital
- (4) 2s orbital (3) 2p orbital
- 15. The ratio of the shortest wavelength of two spectral series of hydrogen spectrum is found to be about 9. The spectral series are:
  - (1) Paschen and P fund
  - (2) Lyman and Paschen
  - (3) Brackett and Piund
  - (4) Balmer and Brackett

16. The electrons are more likely to be found



(1) in the region a and b

- (2) in the region a and c
- (3) only in the region c
- (4) only in the region a

6.

7.

### **CHEMICAL KINETICS**

- Decomposition of X exhibits a rate constant of 0.05 µg/year. How many years are required for the decomposition of 5 µg of X into 2.5 µg ?
  - (1) 50 (2) 25
  - (3) 20 (4) 40
- 2. If a reaction follows the Arrhenius equation, the

plot lnk vs  $\frac{1}{(RT)}$  gives straight line with a

gradient (-y) unit. The energy required to activate the reactant is :

| (1) y unit  | (2) –y unit  |
|-------------|--------------|
| (3) yR unit | (4) y/R unit |

3. The reaction 2X → B is a zeroth order reaction. If the initial concentration of X is 0.2 M, the half-life is 6 h. When the initial concentration of X is 0.5 M, the time required to reach its final concentration of 0.2 M will be :-

| (1) 18.0 h | (2) 7.2 h  |
|------------|------------|
| (3) 9.0 h  | (4) 12.0 h |

4. Consider the given plots for a reaction obeying Arrhenius equation ( $0^{\circ}C < T < 300^{\circ}C$ ) : (k and E<sub>a</sub> are rate constant and activation energy, respectively)



Choose the correct option :

- (1) Both I and II are wrong
- (2) I is wrong but II is right
- (3) Both I and II are correct
- (4) I is right but II is wrong

5. For an elementary chemical reaction,

A<sub>2</sub> 
$$\xrightarrow{k_1}$$
 2A, the expression for  $\frac{d[A]}{dt}$  is :  
(1) 2k<sub>1</sub>[A<sub>2</sub>]-k<sub>-1</sub>[A]<sup>2</sup>  
(2) k<sub>1</sub>[A<sub>2</sub>]-k<sub>-1</sub>[A]<sup>2</sup>  
(3) 2k<sub>1</sub>[A<sub>2</sub>]-2k<sub>-1</sub>[A]<sup>2</sup>  
(4) k<sub>1</sub>[A<sub>2</sub>]+k<sub>-1</sub>[A]<sup>2</sup>  
For the reaction, 2A + B → products, when the

- For the reaction,  $2A + B \rightarrow$  products, when the concentrations of A and B both wrere doubled, the rate of the reaction increased from 0.3 mol  $L^{-1}s^{-1}$  to 2.4 mol  $L^{-1}s^{-1}$ . When the concentration of A alone is doubled, the rate increased from 0.3 mol  $L^{-1}s^{-1}$  to 0.6 mol  $L^{-1}s^{-1}$  Which one of the following statements is correct ?
  - (1) Order of the reaction with respect to Bis2(2) Order of the reaction with respect to Ais2
  - (3) Total order of the reaction is 4
- (4) Order of the reaction with respect to B is 1 For a reaction, consider the plot of ln k versus 1/T given in the figure. If the rate constant of this reaction at 400 K is  $10^{-5}$  s<sup>-1</sup>, then the rate constant at 500 K is :



- (3)  $10^{-6} \text{ s}^{-1}$  (4)  $4 \times 10^{-4} \text{ s}^{-1}$
- 8. The following results were obtained during kinetic studies of the reaction :
  - $2A + B \rightarrow Products$

| Experment | [A]                       | [B]                       | Initial Rate of reaction            |
|-----------|---------------------------|---------------------------|-------------------------------------|
|           | (in mol L <sup>-1</sup> ) | (in mol L <sup>-1</sup> ) | $(\text{in mol } L^{-1} \min^{-1})$ |
| (I)       | 0.10                      | 0.20                      | $6.93 \times 10^{-3}$               |
| (II)      | 0.10                      | 0.25                      | $6.93 \times 10^{-3}$               |
| (III)     | 0.20                      | 0.30                      | $1.386 \times 10^{-2}$              |

The time (in minutes) required to consume half of A is :

(1) 10 (2) 5

(3) 100 (4) 1

9. For the reaction 2A +B → C, the values of initial rate at different reactant concentrations are given in the table below. The rate law for the reaction is :

| $[A] (mol L^{-1})$ | $[B] (mol L^{-1})$ | Initial Rate (mol $L^{-1}s^{-1}$ ) |
|--------------------|--------------------|------------------------------------|
| 0.05               | 0.05               | 0.045                              |
| 0.10               | 0.05               | 0.090                              |
| 0.20               | 0.10               | 0.72                               |

- (1) Rate = k [A][B]
- (2) Rate =  $k [A]^2 [B]^2$
- (3) Rate =  $k [A][B]^2$
- (4) Rate =  $k [A]^2[B]$

**10.** For a reaction scheme 
$$A \xrightarrow{k_1} B \xrightarrow{k_2} C$$
, if

the rate of formation of B is set to be zero then the concentration of B is given by :

- (1)  $\left(\frac{k_1}{k_2}\right)$ [A] (2)  $(k_1 + k_2)$  [A]
- (3)  $k_1 k_2 [A]$  (4)  $(k_1 k_2) [A]$
- **11.** The given plots represent the variation of the concentration of a reactant R with time for two different reactions (i) and (ii). The respective orders of the reactions are :



12. For the reaction of  $H_2$  with  $I_2$ , the rate constant is  $2.5 \times 10^{-4}$  dm<sup>3</sup> mol<sup>-1</sup> s<sup>-1</sup> at 327°C and 1.0 dm<sup>3</sup> mol<sup>-1</sup> s<sup>-1</sup> at 527°C. The activation energy for the reaction, in kJ mol<sup>-1</sup> is: (R=8.314J K<sup>-1</sup> mol<sup>-1</sup>)

(1) 72 (2) 166 (3) 150 (4) 59

**13.** In the following reaction;  $xA \rightarrow yB$ 

$$\log_{10} \left[ -\frac{d[A]}{dt} \right] = \log_{10} \left[ \frac{d[B]}{dt} \right] + 0.3010$$
  
'A' and 'B' respectively can be :

- (1) n-Butane and Iso-butane
- (2)  $C_2H_4$  and  $C_4H_8$
- (3)  $N_2O_4$  and  $NO_2$

(4) 
$$C_2H_2$$
 and  $C_6H_6$ 

14.  $NO_2$  required for a reaction is produced by the decomposition of  $N_2O_5$  in  $CCl_4$  as per the equation

 $2\mathrm{N}_2\mathrm{O}_5(\mathrm{g}) \to 4\mathrm{N}\mathrm{O}_2(\mathrm{g}) + \mathrm{O}_2(\mathrm{g}).$ 

The initial concentration of  $N_2O_5$  is 3.00 mol  $L^{-1}$  and it is 2.75 mol  $L^{-1}$  after 30 minutes. The rate

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of formation of NO<sub>2</sub> is :

- (1)  $2.083 \times 10^{-3} \text{ mol } \text{L}^{-1} \text{ min}^{-1}$
- (2)  $4.167 \times 10^{-3} \text{ mol } \text{L}^{-1} \text{ min}^{-1}$
- (3)  $8.333 \times 10^{-3} \text{ mol } \text{L}^{-1} \text{ min}^{-1}$
- (4)  $1.667 \times 10^{-2} \text{ mol } \text{L}^{-1} \text{ min}^{-1}$

# THERMODYNAMICS-01

1. Consider the reversible isothermal expansion of an ideal gas in a closed system at two different temperatures  $T_1$  and  $T_2$  ( $T_1 < T_2$ ). The correct graphical depiction of the dependence of work done (w) on the final volume (V) is:



2. An ideal gas undergoes isothermal compression from 5 m<sup>3</sup> to 1 m<sup>3</sup> against a constant external pressure of 4 Nm<sup>-2</sup>. Heat released in this process is used to increase the temperature of 1 mole of Al. If molar heat capacity of Al is 24 J mol<sup>-1</sup> K<sup>-1</sup>, the temperature of Al increases by :

(1) 
$$\frac{3}{2}$$
K (2)  $\frac{2}{3}$ K  
(3) 1 K (4) 2 K

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- 3. Which one of the following equations does not correctly represent the first law of thermodynamics for the given processes involving an ideal gas ? (Assume non-expansion work is zero)
  - (1) Cyclic process : q = -w
  - (2) Isothermal process : q = -w
  - (3) Adiabatic process :  $\Delta U = -w$
  - (4) Isochoric process :  $\Delta U = q$
- 4. For silver,  $C_p(JK^{-1}mol^{-1}) = 23 + 0.01T$ . If the temperature (T) of 3 moles of silver is raised from 300K to 1000 K at 1 atm pressure, the value of  $\Delta H$  will be close to

| (1) 21 kJ | (2) | 16 kJ |
|-----------|-----|-------|
|-----------|-----|-------|

- (3) 13 kJ (4) 62 kJ
- 5 moles of an ideal gas at 100 K are allowed to undergo reversible compression till its temperature becomes 200 K.

If  $C_V = 28 \text{ JK}^{-1}\text{mol}^{-1}$ , calculate  $\Delta U$  and  $\Delta pV$  for this process. (R = 8.0 JK<sup>-1</sup> mol<sup>-1</sup>]

- (1)  $\Delta U = 14 \text{ kJ}; \Delta(\text{pV}) = 4 \text{ kJ}$
- (2)  $\Delta U = 14 \text{ kJ}; \Delta(\text{pV}) = 18 \text{ kJ}$
- (3)  $\Delta U = 2.8 \text{ kJ}; \Delta(\text{pV}) = 0.8 \text{ kJ}$
- (4)  $\Delta U = 14 \text{ kJ}; \Delta(\text{pV}) = 0.8 \text{ kJ}$
- 6. Among the following, the set of parameters that represents path function, is :

| (A) $q + w$     | (B) q                |
|-----------------|----------------------|
| (C) w           | (D) H–TS             |
| (1) (A) and (D) | (2) (B), (C) and (D) |
| (3) (B) and (C) | (4) (A), (B) and (C) |

During compression of a spring the work done is 10kJ and 2kJ escaped to the surroundings as heat. The change in internal energy, ∆U(inkJ) is:

(1) 8 (2) 12

- (3) 12 (4) –8
- 8. An ideal gas is allowed to expand from 1 L to 10 L against a constant external pressure of 1bar. The work done in kJ is :

 $\begin{array}{cccc} (1) -9.0 & (2) +10.0 \\ (3) -0.9 & (4) -2.0 \end{array}$ 

# THERMODYNAMICS-02

1. Two blocks of the same metal having same mass and at temperature  $T_1$  and  $T_2$ , respectively. are brought in contact with each other and allowed to attain thermal equilibrium at constant pressure. The change in entropy,  $\Delta S$ , for this process is :

(1) 
$$2C_{P} \ln\left(\frac{T_{1}+T_{2}}{4T_{1}T_{2}}\right)$$
 (2)  $2C_{P} \ln\left[\frac{(T_{1}+T_{2})^{\frac{1}{2}}}{T_{1}T_{2}}\right]$ 

(3) 
$$C_{P} \ln \left[ \frac{(T_{1} + T_{2})^{2}}{4T_{1}T_{2}} \right]$$
 (4)  $2C_{P} \ln \left[ \frac{T_{1} + T_{2}}{2T_{1}T_{2}} \right]$ 

2. For the chemical reaction  $X \xrightarrow{} Y$ , the standard reaction Gibbs energy depends on temperature T (in K) as :

$$\Delta_{\rm r} {\rm G}^{\rm o} \ ({\rm in} \ {\rm kJ} \ {\rm mol}^{-1}) = 120 - \frac{3}{8} {\rm T}$$

The major component of the reaction mixture at T is :

(1) X if T = 315 K
 (2) X if T = 350 K
 (3) Y if T = 300 K
 (4) Y if T = 280 K

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| 3. | The INCORRECT match in the following is<br>(1) $\Delta G^{\circ} < 0$ , K < 1 (2) $\Delta G^{\circ} = 0$ , K = 1<br>(3) $\Delta G^{\circ} > 0$ , K < 1 (4) $\Delta G^{\circ} < 0$ , K > 1<br>A process will be spontaneous at all  | 9.          | The entropy change associated with the conversion of 1 kg of ice at 273 K to water vapours at 383 K is :  |
|----|--|-------------|---|
| 4. | A process will be spontaneous at all<br>temperatures if :-<br>(1) $\Delta H > 0$ and $\Delta S < 0$<br>(2) $\Delta H < 0$ and $\Delta S > 0$<br>(3) $\Delta H > 0$ and $\Delta S > 0$  |             | (Specific heat of water liquid and water vapour<br>are 4.2 kJ K <sup><math>-1</math></sup> kg <sup><math>-1</math></sup> and 2.0 kJ K <sup><math>-1</math></sup> kg <sup><math>-1</math></sup> ; heat<br>of liquid fusion and vapourisation of water are<br>344 kJ kg <sup><math>-1</math></sup> and 2491 kJ kg <sup><math>-1</math></sup> , respectively). |
| 5. | (4) $\Delta H < 0$ and $\Delta S < 0$<br>For the equilibrium,<br>$2H_2O \Longrightarrow H_2O^+ + OH^-$ , the value of $\Delta G^\circ$ at  |             | $(\log 273 = 2.436, \log 373 = 2.572, \log 383 = 2.583)$  |
|    | 298 K is approximately :-  |             | (1) 7.90 kJ kg <sup>-1</sup> K <sup>-1</sup> (2) 2.64 kJ kg <sup>-1</sup> K <sup>-1</sup>   |
|    | (1) $-80 \text{ kJ mol}^{-1}$  |             | (3) 8.49 kJ kg <sup>-1</sup> K <sup>-1</sup> (4) 9.26 kJ kg <sup>-1</sup> K <sup>-1</sup>   |
|    | (2) $-100 \text{ kJ mol}^{-1}$<br>(3) 100 kJ mol}^{-1}   |             | IONIC EQUILIBRIUM   |
| 6. | (4) 80 kJ mol <sup>-1</sup><br>The standard reaction Gibbs energy for a chemical reaction at an absolute temperature T is given by<br>$\Delta_r G^\circ = A - BT$<br>Where A and B are non-zero constants. Which of the following is TRUE about this reaction ?                        | 1.       2. | If $K_{sp}$ of $Ag_2CO_3$ is $8 \times 10^{-12}$ , the molar<br>solubility of $Ag_2CO_3$ in 0.1M AgNO <sub>3</sub> is :<br>(1) $8 \times 10^{-12}$ M (2) $8 \times 10^{-10}$ M<br>(3) $8 \times 10^{-11}$ M (4) $8 \times 10^{-13}$ M<br>25 ml of the given HCl solution requires 30 mL<br>of 0.1 M sodium carbonate solution. What is                      |
|    | (1) Exothermic if $B < 0$  |             | the volume of this HCl solution required to   |
|    | <ul> <li>(2) Exothermic if A &gt; 0 and B &lt; 0</li> <li>(3) Endothermic if A &lt; 0 and B &gt; 0</li> <li>(4) Endothermic if A &gt; 0</li> </ul>   |             | titrate 30 mL of 0.2 M aqueous NaOHsolution?(1) 25 mL(2) 50 mL  |
| 7. | The reaction, MgO(s) + C(s) $\rightarrow$ Mg(S) + CO(g),<br>for which $\Delta_r H^\circ = + 491.1$ kJ mol <sup>-1</sup> and<br>$\Delta_r S^\circ = 198.0$ JK <sup>-1</sup> mol <sup>-1</sup> , is not feasible at<br>298 K. Temperature above which reaction will<br>be feasible is :- | 3.          | (3) 12.5 mL (4) 75 mL<br>A mixture of 100 m mol of $Ca(OH)_2$ and 2g<br>of sodium sulphate was dissolved in water and<br>the volume was made up to 100 mL. The mass<br>of calcium sulphate formed and the<br>concentration of $OH^-$ in resulting solution  |
|    | (1) 1890.0 K (2) 2480.3 K  |             | respectively, are : (Molar mass of $Ca(OH)_{22}$  |
|    | (3) 2040.5 K (4) 2380.5 K  |             | $Na_2SO_4$ and $CaSO_4$ are 74, 143 and   |
| 8. | A process has $\Delta H = 200 \text{ Jmol}^{-1}$ and<br>$\Delta S = 40 \text{ JK}^{-1}\text{mol}^{-1}$ . Out of the values given<br>below, choose the minimum temperature above<br>which the process will be spontaneous :<br>(1) 5 K (2) 4 K (3) 20 K (4) 12 K                        |             | <ul> <li>136 g mol<sup>-1</sup>, respectively; K<sub>sp</sub> of Ca(OH)<sub>2</sub> is</li> <li>5.5 × 10<sup>-6</sup>)</li> <li>(1) 1.9 g, 0.14 mol L<sup>-1</sup></li> <li>(2) 13.6 g, 0.14 mol L<sup>-1</sup></li> <li>(3) 1.9 g, 0.28 mol L<sup>-1</sup></li> <li>(4) 13.6 g, 0.28 mol L<sup>-1</sup></li> </ul>   |

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- 4. The pH of rain water, is approximately :
  - (1) 6.5 (2) 7.5
  - (3) 5.6 (4) 7.0
- 5. 20 mL of 0.1 M  $H_2SO_4$  solution is added to 30 mL of 0.2 M  $NH_4OH$  solution. The pH of the resultant mixture is :

 $[pk_b \text{ of } NH_4OH = 4.7].$ 

- (1) 9.4 (2) 5.0
- (3) 9.0 (4) 5.2
- 6. If solubility product of  $Zr_3(PO_4)_4$  is denoted by  $K_{sp}$  and its molar solubility is denoted by S, then which of the following relation between S and  $K_{sp}$  is correct

(1) 
$$S = \left(\frac{K_{sp}}{929}\right)^{1/9}$$
 (2)  $S = \left(\frac{K_{sp}}{216}\right)^{1/7}$   
(3)  $S = \left(\frac{K_{sp}}{144}\right)^{1/6}$  (4)  $S = \left(\frac{K_{sp}}{6912}\right)^{1/7}$ 

7. In an acid-base titration, 0.1 M HCl solution was added to the NaOH solution of unknown strength. Which of the following correctly shows the change of pH of the titraction mixture in this experiment?



- 8. Consider the following statements
  - (a) The pH of a mixture containing 400 mL of  $0.1 \text{ M H}_2\text{SO}_4$  and 400 mL of 0.1 M NaOH will be approximately 1.3.
  - (b) Ionic product of water is temperature dependent.
  - (c) A monobasic acid with  $K_a = 10^{-5}$  has a pH = 5. The degree of dissociation of this acid is 50%.
  - (d) The Le Chatelier's principle is not applicable to common-ion effect.

the correct statement are :

- (1) (a), (b) and (d) (2) (a), (b) and (c)
- (3) (a) and (b) (4) (b) and (c)

9. The pH of a 0.02M NH<sub>4</sub>Cl solution will be [given  $K_b(NH_4OH)=10^{-5}$  and log2=0.301] (1) 4.65 (2) 5.35

10. What is the molar solubility of  $Al(OH)_3$  in 0.2 M NaOH solution ? Given that, solubility product of  $Al(OH)_3 = 2.4 \times 10^{-24}$  : (1)  $12 \times 10^{-23}$  (2)  $12 \times 10^{-21}$ 

(1) 
$$12 \times 10^{-19}$$
 (2)  $12 \times 10^{-12}$   
(3)  $3 \times 10^{-19}$  (4)  $3 \times 10^{-22}$ 

11. The molar solubility of  $Cd(OH)_2$  is  $1.84 \times 10^{-5}$ M in water. The expected solubility of  $Cd(OH)_2$ in a buffer solution of pH = 12 is : (1)  $6.23 \times 10^{-11}$  M (2)  $1.84 \times 10^{-9}$  M

(3) 
$$\frac{2.49}{1.84} \times 10^{-9}$$
 M (4)  $2.49 \times 10^{-10}$  M

# **REAL GAS**

 The volume of gas A is twice than that of gas B. The compressibility factor of gas A is thrice than that of gas B at same temperature. The pressures of the gases for equal number of moles are :

> (1)  $2P_A = 3P_B$  (2)  $P_A = 3P_B$ (3)  $P_A = 2P_B$  (4)  $3P_A = 2P_B$

 Consider the van der Waals constants, a and b, for the following gases.

| Gas  | Ar  | Ne  | Kr  | Xe  |
|--|-----|-----|-----|-----|
| a/ (atm dm <sup>6</sup> mol <sup>-2</sup> )            | 1.3 | 0.2 | 5.1 | 4.1 |
| b/ (10 <sup>-2</sup> dm <sup>3</sup> mol <sup>-1</sup> | 3.2 | 1.7 | 1.0 | 5.0 |

Which gas is expected to have the highest critical temperature?

| (1) Kr | (2) Ne |
|--------|--------|
|--------|--------|

- (3) Ar (4) Xe
- 3. At a given temperature T, gases Ne, Ar, Xe and Kr are found to deviate from ideal gas behaviour. Their equation of state is given as

$$p = \frac{RT}{V-b}$$
 at T.

Here, b is the van der Waals constant. Which gas will exhibit steepest increase in the plot of Z (compression factor) vs p?

| (1) Ne | (2) Ar |
|--------|--------|
| (3) Xe | (4) Kr |

4. Consider the following table :

| Gas | $a/(k \operatorname{Pa} dm^6 \operatorname{mol}^{-1})$ | $b/(dm^3 mol^{-1})$ |
|-----|--|---------------------|
| А   | 642.32   | 0.05196             |
| В   | 155.21   | 0.04136             |
| С   | 431.91   | 0.05196             |
| D   | 155.21   | 0.4382              |

a and b are vander waals constant. The correct statement about the gases is :

- Gas C will occupy lesser volume than gas A; gas B will be lesser compressible than gas D
- (2) Gas C will occupy more volume than gas A;gas B will be lesser compressible than gas D
- (3) Gas C will occupy more volume than gas A; gas B will be more compressible than gas D
- (4) Gas C will occupy lesser volume than gas A; gas B will be more compressible than gas D

# LIQUID SOLUTION

1. Freezing point of a 4% aqueous solution of X is equal to freezing point of 12% aqueous solution of Y. If molecular weight of X is A, then molecular weight of Y is :-

- (3) 4A (4) 2A
- 2. Molecules of benzoic acid ( $C_6H_5COOH$ ) dimerise in benzene. 'w' g of the acid dissolved in 30 g of benzene shows a depression in freezing point equal to 2K. If the percentage association of the acid to form dimer in the solution is 80, then w is :

(Given that  $K_f = 5 \text{ K kg mol}^{-1}$ , Molar mass of benzoic acid = 122 g mol}^{-1})

| (1) 1.8 g | (2) 2.4 g |
|-----------|-----------|
| (3) 1.0 g | (4) 1.5 g |

- The freezing point of a diluted milk sample is found to be -0.2°C, while it should have been -0.5°C for pure milk. How much water has been added to pure milk to make the diluted sample ?
  - (1) 2 cups of water to 3 cups of pure milk
  - (2) 1 cup of water to 3 cups of pure milk
  - (3) 3 cups of water to 2 cups of pure milk
  - (4) 1 cup of water to 2 cups of pure milk
- 4.  $K_2HgI_4$  is 40% ionised in aqueous solution. The value of its van't Hoff factor (i) is :-

(1) 1.8 (2) 2.2 (3) 2.0 (4) 1.6

- 5. Liquids A and B form an ideal solution in the entire composition range. At 350 K, the vapor pressures of pure A and pure B are  $7 \times 10^3$  Pa and  $12 \times 10^3$  Pa, respectively. The composition of the vapor in equilibrium with a solution containing 40 mole percent of A at this temperature is :
  - (1)  $x_A = 0.37$ ;  $x_B = 0.63$ (2)  $x_A = 0.28$ ;  $x_B = 0.72$ (3)  $x_A = 0.76$ ;  $x_B = 0.24$ (4)  $x_A = 0.4$ ;  $x_B = 0.6$

6. A solution containing 62 g ethylene glycol in 250 g water is cooled to  $-10^{\circ}$ C. If K<sub>f</sub> for water is 1.86 K kg mol<sup>-1</sup>, the amount of water (in g) separated as ice is :

(1) 32 (2) 48 (3) 16 (4) 64

- 7. Which one of the following statements regarding Henry's law is not correct ?
  - (1) The value of  $K_{\rm H}$  increases with increase of temperatrue and  $K_{\rm H}$  is function of the nature of the gas
  - (2) Higher the value of K<sub>H</sub> at a given pressure, higher is the solubility of the gas in the liquids.
  - (3) The partial pressure of the gas in vapour phase is proportional to the mole fraction of the gas in the solution.
  - (4) Different gases have different K<sub>H</sub> (Henry's law constant) values at the same temperature.
- 8. Elevation in the boiling point for 1 molal solution of glucose is 2 K. The depression in the freezing point of 2 molal solutions of glucose in the same solvent is 2 K. The relation between  $K_b$  and  $K_f$  is:

| (1) $K_b = 0.5 K_f$ | (2) $K_b = 2 K_f$ |
|---------------------|-------------------|
| (3) $K_b = 1.5 K_f$ | (4) $K_b = K_f$   |

- 9. The vapour pressures of pure liquids A and B are 400 and 600 mmHg, respectively at 298K. On mixing the two liquids, the sum of their initial volumes is equal to the volume of the final mixture. The mole fraction of liquid B is 0.5 in the mixture. The vapour pressure of the final solution, the mole fraction of components A and B in vapour phase, respectively are-
  - (1) 500 mmHg, 0.5, 0.5
  - (2) 450 mmHg, 0.4, 0.6
  - (3) 450 mmHg, 0.5, 0.5
  - (4) 500 mmHg, 0.4, 0.6

10. For the solution of the gases w, x, y and z in water at 298K, the Henrys law constants ( $K_H$ ) are 0.5, 2, 35 and 40 kbar, respectively. The correct plot for the given data is :-



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11. The osmotic pressure of a dilute solution of an ionic compound XY in water is four times that of a solution of 0.01 M BaCl<sub>2</sub> in water. Assuming complete dissociation of the given ionic compounds in water, the concentration of XY (in mol L<sup>-1</sup>) in solution is :

(1) 
$$6 \times 10^{-2}$$
 (2)  $4 \times 10^{-4}$ 

(3)  $16 \times 10^{-4}$  (4)  $4 \times 10^{-2}$ 

12. Liquid 'M' and liquid 'N' form an ideal solution. The vapour pressures of pure liquids 'M' and 'N' are 450 and 700 mmHg, respectively, at the same temperature. Then correct statement is:  $(x_{\rm M}$  = Mole fraction of 'M' in solution ;  $x_{\rm N}$  = Mole fraction of 'N' in solution ;

 $y_{M}$ = Mole fraction of 'M' in vapour phase ;  $y_{N}$ = Mole fraction of 'N' in vapour phase)

(1) 
$$(x_{\rm M} - y_{\rm M}) < (x_{\rm N} - y_{\rm N})$$
 (2)  $\frac{x_{\rm M}}{x_{\rm N}} < \frac{y_{\rm M}}{y_{\rm N}}$ 

(3) 
$$\frac{x_{M}}{x_{N}} > \frac{y_{M}}{y_{N}}$$
 (4)  $\frac{x_{M}}{x_{N}} = \frac{y_{M}}{y_{N}}$ 

13. Molal depression constant for a solvent is 4.0 kg mol<sup>-1</sup>. The depression in the freezing point of the solvent for 0.03 mol kg<sup>-1</sup> solution of  $K_2SO_4$  is :

(Assume complete dissociation of the electrolyte)

- (3) 0.18 K (4) 0.24 K
- 14. At room temperature, a dilute soluton of urea is prepared by dissolving 0.60 g of urea in 360 g of water. If the vapour pressure of pure water at this temperature is 35 mmHg, lowering of vapour pressure will be (molar mass of urea = 60 g mol<sup>-1</sup>):-
  - (1) 0.027 mmHg
    (2) 0.028 mmHg
    (3) 0.017 mmHg
    (4) 0.031 mmHg

A solution is prepared by dissolving 0.6 g of urea (molar mass = 60 g mol<sup>-1</sup>) and 1.8 g of glucose (molar mass = 180 g mol<sup>-1</sup>) in 100 mL of water at 27°C. The osmotic pressure of the solution is :

$$(R = 0.08206 \text{ L atm } \text{K}^{-1} \text{ mol}^{-1})$$

- (1) 4.92 atm
  (2) 1.64 atm
  (3) 2.46 atm
  (4) 8.2 atm
- **16.** 1 g of non-volatile non-electrolyte solute is dissolved in 100g of two different solvents A and B whose ebullioscopic constants are in the ratio of 1 : 5. The ratio of the elevation in their

boiling points, 
$$\frac{\Delta T_b(A)}{\Delta T_b(B)}$$
, is :  
(1) 5 : 1 (2) 10 : 1  
(3) 1 : 5 (4) 1 : 0.2

### **CHEMICAL EQUILIBRIUM**

1. In a chemical reaction,  $A + 2B \stackrel{K}{\Longrightarrow} 2C + D$ , the initial concentration of B was 1.5 times of the concentration of A, but the equilibrium concentrations of A and B were found to be equal. The equilibrium constant(K) for the aforesaid chemical reaction is :

(3) 1 (4) 
$$\frac{1}{4}$$

$$A(s) \Longrightarrow B(g) + C(g) ; K_{p_1} = x atm^2$$

$$D(s) \rightleftharpoons C(g) + E(g); K_{p_2} = y \operatorname{atm}^2$$

The total pressure when both the solids dissociate simultaneously is :-

(1) (x + y) atm (2)  $x^2 + y^2$  atm (3)  $2(\sqrt{x+y})$  atm (4)  $\sqrt{x+y}$  atm node06\B0B0-BA\Kota\JEE Main\Topicwise Jee(Main)\_Jan and April -2019\Eng\03-PC

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**3.** Consider the reaction,

 $N_2(g) + 3H_2(g) \xrightarrow{} 2NH_3(g)$ 

The equilibrium constant of the above reaction is  $K_P$ . If pure ammonia is left to dissociate, the partial pressure of ammonia at equilibrium is given by (Assume that  $P_{NH_3} \ll P_{total}$  at equilibrium)

(1) 
$$\frac{3^{\frac{3}{2}} K_{P}^{\frac{1}{2}} P^{2}}{4}$$
 (2)  $\frac{3^{\frac{3}{2}} K_{P}^{\frac{1}{2}} P^{2}}{16}$   
(3)  $\frac{K_{P}^{\frac{1}{2}} P^{2}}{16}$  (4)  $\frac{K_{P}^{\frac{1}{2}} P^{2}}{4}$ 

4. Consider the following reversible chemical reactions :

 $A_{2}(g) + Br_{2}(g) \xleftarrow{K_{1}} 2AB(g) \dots (1)$   $6AB(g) \xleftarrow{K_{2}} 3A_{2}(g) + 3B_{2}(g) \dots (2)$ The relation between K<sub>1</sub> and K<sub>2</sub> is : (1) K<sub>2</sub> = K<sub>1</sub><sup>3</sup> (2) K<sub>2</sub> = K<sub>1</sub><sup>-3</sup> (3) K<sub>1</sub>K<sub>2</sub> = 3 (4) K<sub>1</sub>K<sub>2</sub> = 1

(3) 
$$K_1K_2 = 3$$
 (4)  $K_1K_2 = 3$   
5.1g NH SH is introduced in 3.0 L evac

5. 5.1g NH<sub>4</sub>SH is introduced in 3.0 L evacuated flask at 327°C. 30% of the solid NH<sub>4</sub>SH decomposed to NH<sub>3</sub> and H<sub>2</sub>S as gases. The  $K_p$ of the reaction at 327°C is

(R = 0.082 L atm mol<sup>-1</sup>K<sup>-1</sup>, Molar mass of S = 32 g mol<sup>/01</sup>, molar mass of N = 14g mol<sup>-1</sup>)

- (1)  $1 \times 10^{-4} \text{ atm}^2$
- (2)  $4.9 \times 10^{-3} \text{ atm}^2$
- (3)  $0.242 \text{ atm}^2$
- (4)  $0.242 \times 10^{-4} \text{ atm}^2$
- 6. The value of  $K_p/K_C$  for the following reactions at 300K are, respectively :

(At 300K,  $RT = 24.62 \text{ dm}^3 \text{atm mol}^{-1}$ )

$$N_2(g) + O_2(g) \implies 2NO(g)$$

$$N_2O_4(g) \implies 2NO_2(g)$$

 $N_2(g) + 3H_2(g) \implies 2NH_3(g)$ 

- (1) 1, 24.62 dm<sup>3</sup>atm mol<sup>-1</sup>,  $606.0 \text{ dm}^{6} \text{atm}^{2} \text{mol}^{-2}$
- (2) 1, 4.1 × 10<sup>-2</sup> dm<sup>-3</sup>atm<sup>-1</sup> mol<sup>-1</sup>, 606.0 dm<sup>6</sup> atm<sup>2</sup> mol<sup>-2</sup>
- (3) 606.0 dm<sup>6</sup>atm<sup>2</sup>mol<sup>-2</sup>, 1.65 × 10<sup>-3</sup> dm<sup>3</sup>atm<sup>-2</sup> mol<sup>-1</sup>
- (4) 1, 24.62 dm<sup>3</sup>atm mol<sup>-1</sup>, 1.65 × 10<sup>-3</sup> dm<sup>-6</sup>atm<sup>-2</sup> mol<sup>2</sup>
- 7. For the following reactions, equilibrium constants are given :

$$\begin{split} S(s) + O_2(g) &\rightleftharpoons SO_2(g); K_1 = 10^{52} \\ 2S(s) + 3O_2(g) &\rightleftharpoons 2SO_3(g); K_2 = 10^{129} \\ \text{The equilibrium constant for the reaction,} \end{split}$$

$$2SO_2(g) + O_2(g) \rightleftharpoons 2SO_3(g)$$
 is :  
(1)  $10^{181}$  (2)  $10^{154}$ 

$$(3) 10^{25} (4) 10^{77}$$

8.

For the reaction,  $2SO_2(g) + O_2(g) \rightleftharpoons 2SO_3(g),$   $\Delta H = -57.2kJ \text{ mol}^{-1} \text{ and}$  $K_c = 1.7 \times 10^{16}.$ 

Which of the following statement is INCORRECT?

- (1) The equilibrium constant is large suggestive of reaction going to completion and so no catalyst is required.
- (2) The equilibrium will shift in forward direction as the pressure increase.
- (3) The equilibrium constant decreases as the temperature increases.
- (4) The addition of inert gas at constant volume will not affect the equilibrium constant.
- 9. In which one of the following equilibria,  $K_p \neq K_c$ ?

(1) 
$$NO_2(g) + SO_2(g) \rightleftharpoons NO(g) + SO_3(g)$$

- (2) 2 HI(g)  $\rightleftharpoons$  H<sub>2</sub>(g) + I<sub>2</sub>(g)
- (3)  $2NO(g) \rightleftharpoons N_2(g) + O_2(g)$
- (4)  $2C(s) + O_2(g) \rightleftharpoons 2CO(g)$

# **SURFACE CHEMISTRY**

- **1.** Among the following, the false statement is :
  - (1) Latex is a colloidal solution of rubber particles which are positively charged
  - (2) Tyndall effect can be used to distinguish between a colloidal solution and a true solution.
  - (3) It is possible to cause artificial rain by throwing electrified sand carrying charge opposite to the one on clouds from an aeroplane.
  - (4) Lyophilic sol can be coagulated by adding an electrolyte.
- 2. The combination of plots which does not represent isothermal expansion of an ideal gas is:



3.

4.

- S : solid in gas
- (2) C : solid in liquid; M : liquid in liquid ; S : gas in solid
- (3) C : liquid in solid; M : liquid in solid ;S : solid in gas
- (4) C : liquid in solid; M : liquid in liquid ; S : solid in gas

5. Adsorption of a gas follows Freundlich adsorption isotherm. In the given plot, x is the mass of the gas adsorbed on mass m of the x

adsorbent at pressure p.  $\frac{x}{m}$  is proportional to





- 6. Haemoglobin and gold sol are examples of :(1) negatively charged sols
  - (2) positively charged sols]

7.

8.

- (3) negatively and positively charged sols, respectively
- (4) positively and negatively charged sols, respectively

Adsorption of a gas follows Freundlich adsorption isotherm x is the mass of the gas adsorbed on mass m of the adsorbent. The plot

of log  $\frac{x}{m}$  versus log p is shown in the given

graph. 
$$\frac{x}{m}$$
 is proportional to :



(1)  $p^{\frac{3}{2}}$  (2)  $p^3$  (3)  $p^{\frac{2}{3}}$ 

- The aerosol is a kind of colloid in which :
  - (1) gas is dispersed in solid
  - (2) solid is dispersed in gas
  - (3) liquid is dispersed in water
  - (4) gas is dispersed in liquid

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(4)  $p^2$ 

| 9.  | A gas undergoes physical adsorption on a<br>surface and follows the given Freundlich<br>adsorption isotherm equation $\frac{x}{m} = kp^{0.5}$ | 14. | For coagulation<br>which one of the<br>be most effective<br>(1) $AlCl_3$                | of arsenious sulphide sol,<br>following salt solution will<br>(2) NaCl<br>(4) Na PO |  |  |
|-----|---|-----|---|---|--|--|
|     | Adsorption of the gas increases with :  |     | (3) BaCl <sub>2</sub>   | $(4) \operatorname{Na_3PO_4}$   |  |  |
|     | (1) Decrease in p and decrease in T   |     |   | CONCEPI   |  |  |
|     | (2) Increase in p and increase in T   | 1.  | A 10 mg efferves  | cent tablet containing sodium   |  |  |
|     | (3) Increase in p and decrease in T   |     | bicarbonate and o   | oxalic acid releases 0.25 ml of   |  |  |
|     | (4) Decrease in p and increase in T   |     | $CO_2$ at $T = 298.1$   | 15 K and $p = 1$ bar. If molar  |  |  |
| 10. | The correct option among the following is :   |     | volume of CO  | $P_2$ 1s 25.0 L under such  |  |  |
|     | (1) Colloidal particles in lyophobic sols can be precipiated by electrophoresis   |     | condition, what is the percentage of sodium bicarbonate in each tablet ? [Molar mass of |   |  |  |
|     | (2) Brownian motion in colloidal solution is  |     | $NaHCO_3 = 84 g$  | mol <sup>-1</sup> ]   |  |  |
|     | faster the viscosity of the solution is very  |     | (1) 16.8  | (2) 8.4   |  |  |
|     | high.   |     | (3) 0.84  | (4) 33.6  |  |  |
|     | (3) Colloidal medicines are more effective  | 2.  | For the following   | g reaction, the mass of water   |  |  |
|     | because they have small surface area.   |     | produced from 4   | 45 g of $C_{57}H_{110}O_6$ is :   |  |  |
|     | (4) Addition of alum to water makes it unfit for  |     | $2C_{57}H_{110}O_6(s) +$  | $163O_2(g) \rightarrow$   |  |  |
|     | drinking.   |     |   | $114CO_2(g) + 110 H_2O(l)$  |  |  |
| 11. | Peptization is a :  |     | (1) 495 g (2) 4   | 90 g (3) 890 g (4) 445 g  |  |  |
|     | (1) process of converting a colloidal solution  | 3.  | An organic com  | pound is estimated through  |  |  |
|     | into precipitate  |     | 6 moles of CO 4 moles of U O and 1 moles of   |   |  |  |
|     | (2) process of converting precipitate into  |     | 6 moles of $CO_2$ . 4   | moles of $H_2O$ and 1 mole of   |  |  |
|     | (3) process of converting soluble particles to  |     | nitrogen gas. The $(1)$ C $\downarrow$ L N  | $(2) \subset U N$   |  |  |
|     | form colloidal solution   |     | (1) $C_{12}\Pi_8 N$<br>(3) C H N  | (2) $C_{12} \Pi_8 \Pi_2$<br>(4) C H N   |  |  |
|     | (4) process of bringing colloidal molecule into   | 1   | The percentage composition of carbon by mole  |   |  |  |
|     | solution  | т.  | in methane is ·   | shiposition of carbon by more   |  |  |
| 12. | Among the following, the INCORRECT  |     | (1) 80%   | (2) 25%   |  |  |
|     | statement about colloids is :   |     | (3) 75%   | (4) 20%   |  |  |
|     | (1) They can scatter light  | 5.  | For a reaction,   |   |  |  |
|     | (2) They are larger than small molecules and  |     | $N_2(g) + 3H_2(g) + 3H_2(g)$  | $\rightarrow 2NH_3(g);$   |  |  |
|     | (2) The range of diameters of colloidel   |     | identify dihydrog   | gen $(H_2)$ as a limiting reagent   |  |  |
|     | (5) The Tange of diameters of conordar<br>particles is between 1 and 1000 nm  |     | in the following  | reaction mixtures.  |  |  |
|     | (4) The osmotic pressure of a colloidal solution  |     | (1) 14g of N <sub>2</sub> +   | 4g of H <sub>2</sub>  |  |  |
|     | is of higher order than the true solution at  |     | (2) 28g of N <sub>2</sub> +   | $6g \text{ of } H_2$  |  |  |
|     | the same concentration  |     | (3) 56g of $N_2$ + 10g of $H_2$   |   |  |  |
| 13. | 10 mL of 1mM surfactant solution forms a  | -   | (4) 35g of $N_2$ +  | 8g of H <sub>2</sub>  |  |  |
|     | monolayer covering $0.24 \text{ cm}^2$ on a polar   | 6.  | What would be the molality of 20% (mass/  |   |  |  |
|     | substrate. If the polar head is approximated as   |     | mass) aqueous solution of KI?   |   |  |  |
|     | cube, what is its edge length?  |     | (molar mass of H  | $KI = 166 \text{ g mol}^{-1}$   |  |  |
|     | (1) 2.0 pm (2) 2.0 nm   |     | (1) 1.08  | (2) 1.48  |  |  |
|     | (3) 1.0 pm (4) 0.1 nm   |     | (3) 1.51  | (4) 1.35  |  |  |

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- 7. At 300 K and 1 atmospheric pressure, 10 mL of a hydrocarbon required 55 mL of  $O_2$  for complete combustion and 40 mL of  $CO_2$  is formed. The formula of the hydrocarbon is :
  - (1)  $C_4H_8$  (2)  $C_4H_7Cl$
  - (3)  $C_4 H_{10}$  (4)  $C_4 H_6$
- 8. The minimum amount of  $O_2(g)$  consumed per gram of reactant is for the reaction :

(Given atomic mass : Fe = 56, O = 16, Mg = 24, P = 31, C = 12, H = 1)

- (1)  $C_3H_8(g) + 5 O_2(g) \rightarrow 3 CO_2(g) + 4 H_2O(l)$
- (2)  $P_4(s) + 5 O_2(g) \rightarrow P_4O_{10}(s)$
- (3) 4 Fe(s) + 3  $O_2(g) \rightarrow 2 \text{ FeO}_3(s)$

(4) 2 Mg(s) +  $O_2(g) \rightarrow 2$  MgO(s)

- 9. 5 moles of  $AB_2$  weigh  $125 \times 10^{-3}$  kg and 10 moles of  $A_2B_2$  weigh  $300 \times 10^{-3}$  kg. The molar mass of  $A(M_A)$  and molar mass of  $B(M_B)$ in kg mol<sup>-1</sup> are :
  - (1)  $M_A = 50 \times 10^{-3}$  and  $M_B = 25 \times 10^{-3}$ (2)  $M_A = 25 \times 10^{-3}$  and  $M_B = 50 \times 10^{-3}$ (3)  $M_A = 5 \times 10^{-3}$  and  $M_B = 10 \times 10^{-3}$ (4)  $M_A = 10 \times 10^{-3}$  and  $M_B = 5 \times 10^{-3}$
- 10. 25 g of an unknown hydrocarbon upon burning produces 88 g of  $CO_2$  and 9 g of  $H_2O$ . This unknown hydrocarbon contains.
  - (1) 20g of carbon and 5 g of hydrogen
  - (2) 24g of carbon and 1 g of hydrogen
  - (3) 18g of carbon and 7 g of hydrogen
  - (4) 22g of carbon and 3 g of hydrogen

# **IDEAL GAS**

- 0.5 moles of gas A and x moles of gas B exert a pressure of 200 Pa in a container of volume 10 m<sup>3</sup> at 1000 K. Given R is the gas constant in JK<sup>-1</sup> mol<sup>-1</sup>, x is :
  - (1)  $\frac{2R}{4+12}$  (2)  $\frac{2R}{4-R}$
  - (3)  $\frac{4-R}{2R}$  (4)  $\frac{4+R}{2R}$

- 2. An open vessel at 27°C is heated until two fifth of the air (assumed as an ideal gas) in it has escaped from the vessel. Assuming that the volume of the vessel remains constant, the temperature at which the vessel has been heated is :
  - (1) 750°C (2) 500°C (3) 750 K (4) 500 K
- **3.** Points I, II and III in the following plot respectively correspond to

(V<sub>mp</sub> : most probable velocity)



- (1)  $V_{mp}$  of N<sub>2</sub> (300K);  $V_{mp}$  of H<sub>2</sub>(300K);  $V_{mp}$  of O<sub>2</sub>(400K)
- (2) V<sub>mp</sub> of H<sub>2</sub> (300K); V<sub>mp</sub> of N<sub>2</sub>(300K); V<sub>mp</sub> of O<sub>2</sub>(400K)
- (3)  $V_{mp}$  of O\_2 (400K);  $V_{mp}$  of N\_2(300K);  $V_{mp}$  of H\_2(300K)
- (4)  $V_{mp}$  of  $N_2$  (300K);  $V_{mp}$  of  $O_2(400K);$   $V_{mp}$  of  $H_2(300K)$

# **CONCENTRATION TERMS**

- 1. The volume strength of  $1M H_2O_2$  is: (Molar mass of  $H_2O_2 = 34$  g mol<sup>-1</sup>)
- (1) 16.8 (2) 11.35 (3) 22.4 (4) 5.6
  2. 8g of NaOH is dissolved in 18g of H<sub>2</sub>O. Mole fraction of NaOH in solution and molality (in mol kg<sup>-1</sup>) of the solutions respectively are: (1) 0.167, 11.11 (2) 0.2, 22.20 (3) 0.2, 11.11 (4) 0.167,22.20
  3 A solution of sodium sulfate contains 92 g of
- A solution of sodium sulfate contains 92 g of Na<sup>+</sup> ions per kilogram of water. The molality of Na<sup>+</sup> ions in that solution in mol kg<sup>-1</sup> is:
  (1) 16
  (2) 8
  (3) 4
  (4) 12

#### ALLEN

- 4. The amount of sugar  $(C_{12}H_{22}O_{11})$  required to prepare 2 L of its 0.1 M aqueous solution is : (1) 68.4 g (2) 17.1 g (3) 34.2 g (4)136.8 g
- The strength of 11.2 volume solution of  $H_2O_2$ 5. is : [Given that molar mass of  $H = 1 \text{ g mol}^{-1}$ and  $O = 16 \text{ g mol}^{-1}$ ] (1) 13.6% (2) 3.4%(3) 34% (4) 1.7%
- 6. The mole fraction of a solvent in aqueous solution of a solute is 0.8. The molality (in mol kg<sup>-1</sup>) of the aqueous solution is
  - (1)  $13.88 \times 10^{-1}$
  - (2)  $13.88 \times 10^{-2}$
  - (3) 13.88
  - (4)  $13.88 \times 10^{-3}$

# **ELECTROCHEMISTRY**

| 1. | The standard electrode potential | $E^{\ominus}$ | and | its |
|----|----------------------------------|---------------|-----|-----|
|    |                                  |               |     |     |

temeprature coefficient  $\left(\frac{dE^{\odot}}{dT}\right)$  for a cell are 2V and  $-5 \times 10^{-4} V K^{-1}$  at 300 K respectively. The cell reaction is  $Zn(s) + Cu^{2+}(aq) \rightarrow Zn^{2+}(aq) + Cu(s)$ The standard reaction enthalpy  $(\Delta_r H^{\odot})$  at 300 K in kJ mol<sup>-1</sup> is, [Use  $R = 8JK^{-1} \text{ mol}^{-1}$  and  $F = 96,000 \text{ Cmol}^{-1}$ ] (2) - 384.0(1) - 412.8(3) 206.4(4) 192.0  $\wedge^{\circ}_{m}$  for NaCl, HCl and NaA are 126.4, 425.9 and 100.5 S cm<sup>2</sup>mol<sup>-1</sup>, respectively. If the conductivity of 0.001 M HA is  $5 \times 10^{-5}$  S cm<sup>-1</sup>, degree of dissociation of HA is :

| (1) 0.75 | (2) 0.125 |
|----------|-----------|
| (3) 0.25 | (4) 0.50  |

- 3. Consider the following reduction processes :  $Zn^{2+} + 2e^- \rightarrow Zn(s); E^\circ = -0.76 V$  $Ca^{2+} + 2e^- \rightarrow Ca(s); E^\circ = -2.87 V$  $Mg^{2+} + 2e^- \rightarrow Mg(s); E^\circ = -2.36 V$  $Ni^{2+} + 2e^- \rightarrow Ni(s); E^\circ = -0.25 V$ The reducing power of the metals increases in the order :
  - (1) Ca < Zn < Mg < Ni
  - (2) Ni < Zn < Mg < Ca
  - (3) Zn < Mg < Ni < Ca
  - (4) Ca < Mg < Zn < Ni

4. In the cell :

5.

 $Pt(s)|H_2(g, 1bar|HCl(aq)|AgCl(s)|Ag(s)|Pt(s))$ the cell potential is 0.92V when a 10<sup>-6</sup> molal HCl solution is used. The standard electrode potential of (AgCl/Ag,Cl-) electrode is :

$$\left\{ \text{given}, \frac{2.303\text{RT}}{\text{F}} = 0.06\text{Vat}298\text{K} \right\}$$

| (1) 0.20 V | (2) 0.76 V |
|------------|------------|
| (3) 0.40 V | (4) 0.94 V |

The anodic half-cell of lead-acid battery is recharged unsing electricity of 0.05 Faraday. The amount of PbSO<sub>4</sub> electrolyzed in g during the process in :

(Molar mass of  $PbSO_4 = 303 \text{ g mol}^{-1}$ )

(2) 15.2(1) 22.8

- (3)7.6(4) 11.4
- 6. For the cell  $Zn(s) | Zn^{2+}(aq) || M^{x+}(aq) | M(s)$ , different half cells and their standard electrode potentials are given below :

| Au(s) $Ag(s)$ $Fe^{2+}(aq)$ $Fe(s)$           | $M^{x+}(aq/M(s))$        | Au <sup>3+</sup> (aq)/ | Ag <sup>+</sup> (aq)/ | $\mathrm{Fe}^{3+}(\mathrm{aq})/$ | $\mathrm{Fe}^{2+}(\mathrm{aq})/$ |  |
|---|--------------------------|------------------------|-----------------------|----------------------------------|----------------------------------|--|
|   |                          | Au(s)                  | Ag(s)                 | $\mathrm{Fe}^{2+}(\mathrm{aq})$  | Fe(s)                            |  |
| $E^{o}_{M^{x+}/M^{(v)}}$ 1.40 0.80 0.77 -0.44 | $E^{o}_{M^{x+}/M^{(v)}}$ | 1.40                   | 0.80                  | 0.77                             | -0.44                            |  |

If  $E_{Z_n^{2+}/Z_n}^{\circ} = -0.76 V$ , which cathode will give a mximum value of  $E_{cell}^{o}$  per electron transferred?

(1)  $Fe^{3+} / Fe^{2+}$  $(2) Ag^{+} / Ag$ (4) Fe<sup>2+</sup> / Fe  $(3) Au^{3+} / Au$ 

2.

Ε

If the standard electrode potential for a cell is
 2 V at 300 K, the equilibrium constant (K) for
 the reaction

 $Zn(s) + Cu^{2+}(aq) \implies Zn^{2+}(aq) + Cu(s)$ 

at 300 K is approximately.

 $(R = 8 JK^{-1} mol^{-1}, F = 96000 C mol^{-1})$ 

(1)  $e^{160}$  (2)  $e^{320}$ 

- (3)  $e^{-160}$  (4)  $e^{-80}$
- **8.** Given the equilibrium constant :

 $K_{C}$  of the reaction :

Cu(s) + 2Ag<sup>+</sup>(aq) → Cu<sup>2+</sup>(aq) + 2Ag(s) is 10×10<sup>15</sup>, calculate the  $E_{cell}^0$  of this reaction at

298 K

$$\left[2.303 \frac{\text{RT}}{\text{F}} \text{ at } 298 \text{ K} = 0.059 \text{ V}\right]$$

- (1) 0.04736 V
- (2) 0.4736 V
- (3) 0.4736 mV
- (4) 0.04736 mV
- 9. Given that :  $E_{O_2/H_2O}^0 = +1.23V$ ,
  - $E^{0}_{S_{2}O^{2^{-}}_{8}/SO^{2^{-}}_{4}} = +2.05V$

 $E^0_{Br_2/Br^-} = +1.09V$ 

 $E^{0}_{Au^{3+}/Au} = +1.4V$ 

The strongest oxidizing agent is -

(1)  $O_2$  (2)  $Br_2$ (3)  $S_2O_8^{2-}$  (4)  $Au^{3+}$ 

- 10. Calculate the standard cell potential in(V) of the cell in which following reaction takes place :  $Fe^{2+}(aq) + Ag^{+}(aq) \rightarrow Fe^{3+}(aq) + Ag(s)$ Given that  $E^{o}_{Ag^{+}/Ag} = xV$  $E_{Fe^{2+}/Fe}^{o} = yV$  $E^{o}_{Fe^{3+}/Fe} = zV$ (1) x + 2y - 3z(2) x - z(3) x - y(4) x + y - z11. The standard Gibbs energy for the given cell reaction in kJ mol<sup>-1</sup> at 298 K is :  $Zn(s) + Cu^{2+}(aq) \rightarrow Zn^{2+}(aq) + Cu(s),$  $E^{\circ} = 2 V \text{ at } 298 \text{ K}$ (Faraday's constant,  $F = 96000 \text{ C mol}^{-1}$ ) (1) - 384(2) - 192
  - (3) 192 (4) 384
- 12. A solution of  $Ni(NO_3)_2$  is electrolysed between platinum electrodes using 0.1 Faraday electricity. How many mole of Ni will be deposited at the cathode?

**13.** Consider the statements S1 and S2 :

S1 : Conductivity always increases with decrease in the concentration of electrolyte.
S2 : Molar conductivity always incrteases with decrease in the concentration of electrolyte.
The correct option among the following is :

- (1) Both S1 and S2 are correct
- (2) S1 is wrong and S2 is correct
- (3) S1 is correct and S2 is wrong
- (4) Both S1 and S2 are wrong

#### ALLEN

14. Which one of the following graphs between molar conductivity  $(\Lambda_m)$  versus  $\sqrt{C}$  is correct?



15. Given :

 $Co^{3+} + e^- \rightarrow Co^{2+}$ ; E° = + 1.81 V Pb<sup>4+</sup> + 2e<sup>-</sup> → Pb<sup>2+</sup>; E° = + 1.67 V Ce<sup>4+</sup> + e<sup>-</sup> → Ce<sup>3+</sup>; E° = + 1.61 V Bi<sup>3+</sup> + 3e<sup>-</sup> → Bi ; E° = + 0.20 V

Oxidizing power of the species will increase in the order :

- (1)  $Ce^{4+} < Pb^{4+} < Bi^{3+} < Co^{3+}$
- (2)  $Co^{3+} < Pb^{4+} < Ce^{4+} < Bi^{3+}$
- (3)  $Co^{3+} < Ce^{4+} < Bi^{3+} < Pb^{4+}$
- (4)  $Bi^{3+} < Ce^{4+} < Pb^{4+} < Co^{3+}$

- 16. The decreasing order of electrical conductivity of the following aqueous solutions is :
  0.1 M Formic acid (A),
  0.1 M Acetic acid (B)
  0.1 M Benzoic acid (C)
  - (1) C > B > A (2) A > B > C
  - (3) A > C > B (4) C > A > B

# REDOX

1. The hardness of a water sample (in terms of equivalents of  $CaCO_3$ ) containing  $10^{-3}$  M CaSO<sub>4</sub> is :

(molar mass of  $CaSO_4 = 136 \text{ g mol}^{-1}$ )

- (1) 100 ppm
- (2) 50 ppm
- (3) 10 ppm
- (4) 90 ppm
- 50 mL of 0.5 M oxalic acid is needed to neutralize 25 mL of sodium hydroxide solution. The amount of NaOH in 50 mL of the given sodium hydroxide solution is :
  - (1) 4 g (2) 2 g (3) 8 g (4) 1 g
- 3. In the reaction of oxalate with permaganate in acidic medium, the number of electrons involved in producing one molecule of  $CO_2$  is :
  - (1) 10 (2) 2
  - (3) 1 (4) 5
- 4. The chemical nature of hydrogen preoxide is :-
  - (1) Oxidising and reducing agent in acidic medium, but not in basic medium.
  - (2) Oxidising and reducing agent in both acidic and basic medium
  - (3) Reducing agent in basic medium, but not in acidic medium
  - (4) Oxidising agent in acidic medium, but not in basic medium.

- 5. In order to oxidise a mixture one mole of each of  $FeC_2O_4$ ,  $Fe_2(C_2O_4)_3$ ,  $FeSO_4$  and  $Fe_2(SO_4)_3$  in acidic medium, the number of moles of KMnO<sub>4</sub> required is -
  - (1) 3 (2) 2
  - (3) 1 (4) 1.5
- 6. 100 mL of a water sample contains 0.81 g of calcium bicarbonate and 0.73 of magnesium bicarbonate. The hardness of this water sample expressed in terms of equivalents of  $CaCO_3$  is: (molar mass of calcium bicarbonate is 162 g mol<sup>-1</sup> and magnesium bicarbonate is 146 gmol<sup>-1</sup>)
  - (1) 1,000 ppm (2) 10,000 ppm
  - (3) 100 ppm (4) 5,000 ppm
- **7.** An example of a disproportionation reaction is :
  - (1)  $2KMnO_4 \rightarrow K_2MnO_4 + MnO_2 + O_2$
  - (2)  $2MnO_4^-+10I^-+16H^+ \rightarrow 2Mn^{2+}+5I_2+8H_2O$
  - (3)  $2CuBr \rightarrow CuBr_2 + Cu$
  - (4) 2NaBr+  $Cl_2 \rightarrow 2NaCl+Br_2$

# SOLID STATE

- 1. Which premitive unit cell has unequal edge lenghs ( $a \neq b \neq c$ ) and all axial angles different from 90°
  - (1) Tetragonal(2) Hexagonal(3) Monoclinic(4) Triclinic
- 2. A solid having density of  $9 \times 10^3$  kg m<sup>-3</sup> forms face centred cubic crystals of edge length  $200\sqrt{2}$  pm. What is the molar mass of the solid ?

(Avogadro constant  $\cong$  6 × 10<sup>23</sup> mol<sup>-1</sup>,  $\pi \cong$  3)

- (1) 0.0216 kg mol<sup>-1</sup>
- (2) 0.0305 kg mol<sup>-1</sup>
- (3) 0.4320 kg mol<sup>-1</sup>
- (4) 0.0432 kg mol<sup>-1</sup>

3. The radius of the largest sphere which fits properly at the centre of the edge of body centred cubic unit cell is : (Edge length is represented by 'a') :-

| (1) 0.134 a | (2) 0.027 a |
|-------------|-------------|
| (3) 0.067 a | (4) 0.047 a |

**4.** At 100°C, copper (Cu) has FCC unit cell structure with cell edge length of x Å. What is the approximate density of Cu (in g cm<sup>-3</sup>) at this temperature ?

[Atomic Mass of Cu = 63.55u]

(1) 
$$\frac{105}{x^3}$$
 (2)  $\frac{211}{x^3}$   
(3)  $\frac{205}{x^3}$  (4)  $\frac{422}{x^3}$ 

- The statement that is **INCORRECT** about the interstitial compounds is :
  - (1) They have high melting points
  - (2) They are chemically reactive
  - (3) They have metallic conductivity
  - (4) They are very hard

5.

6. Consider the bcc unit cells of the solids 1 and 2 with the position of atoms as shown below. The radius of atom B is twice that of atom A. The unit cell edge length is 50% more in solid 2 than in 1. What is the approximate packing efficiency in solid 2?



2.

4.

7. An element has a face-centred cubic (fcc) structure with a cell edge of a. The distance between the centres of two nearest tetrahedral voids in the lattice is :

(1) 
$$\frac{a}{2}$$
 (2) a

ALLEN

(3)  $\frac{3}{2}a$ (4)  $\sqrt{2}$  a

- 8. The ratio of number of atoms present in a simple cubic, body centered cubic and face centered cubic structure are, respectively :
  - (1) 1 : 2 : 4(2) 8 : 1 : 6(3) 4 : 2 : 1(4) 4 : 2 : 3
- 9. A compound of formula  $A_2B_3$  has the hcp lattice. Which atom forms the hcp lattice and what fraction of tetrahedral voids is occupied by the other atoms :

(1) hcp lattice-A, 
$$\frac{2}{3}$$
 Tetrachedral voids-B

(2) hcp lattice-B, 
$$\frac{1}{3}$$
 Tetrachedral voids-A

- (3) hcp lattice-B,  $\frac{2}{3}$  Tetrachedral voids-A
- (4) hcp lattice-A  $\frac{1}{3}$  Tetrachedral voids-B

### THERMOCHEMISTRY

1. Given :

- (i) C(graphite) +  $O_2(g) \rightarrow CO_2(g)$ ;  $\Delta r H^{\circ} = x k J mol^{-1}$
- (ii) C(graphite) +  $\frac{1}{2}O_2(g) \rightarrow CO_2(g);$

 $\Delta r H^{\circ} = y k J mol^{-1}$ 

(iii) 
$$CO(g) + \frac{1}{2}O_2(g) \rightarrow CO_2(g);$$
  
 $\Delta r H^\circ = z \text{ kJ mol}^{-1}$ 

Based on the above thermochemical equations, find out which one of the following algebraic relationships is correct?

(1) 
$$z = x + y$$
 (2)  $x = y - z$   
(3)  $x = y + z$  (4)  $y = 2z - z$ 

$$x = y + z$$
 (4)  $y = 2z - x$ 

For diatomic ideal gas in a closed system, which of the following plots does not correctly describe the relation between various thermodynamic quantities ?



- The process with negative entropy change is : 3.
  - (1) Dissolution of iodine in water
  - (2) Synthesis of ammonia from  $N_2$  and  $H_2$
  - (3) Dissolution of  $CaSO_4(s)$  to CaO(s) and  $SO_3(g)$
  - (4) Subimation of dry ice
  - Consider the given plot of enthalpy of the following reaction between A and B.

 $A + B \rightarrow C + D$ 

Identify the incorrect statement.



- (1) C is the thermodynamically stable product.
- (2) Formation of A and B from C has highest enthalpy of activation.
- (3) D is kinetically stable product.
- (4) Activation enthalpy to form C is 5kJ mol<sup>-1</sup> less than that to form D.

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- 5. Enthalpy of sublimation of iodine is  $24 \text{ cal } g^{-1} \text{ at } 200^{\circ}\text{C}$ . If specific heat of  $I_2(s)$  and  $I_2(vap)$  are 0.055 and 0.031 cal  $g^{-1}\text{K}^{-1}$  respectively, then enthalpy of sublimation of iodine at 250°C in cal  $g^{-1}$  is :
  - (1) 2.85 (2) 11.4
  - (3) 5.7 (4) 22.8
- 6. The difference between  $\Delta H$  and  $\Delta U (\Delta H \Delta U)$ , when the combustion of one mole of heptane (1) is carried out at a temperature T, is equal to:
  - (1) 3RT (2) –3RT
  - (3) –4RT (4) 4RT

### RADIOACTIVITY

1. A bacterial infection in an internal wound grows as  $N'(t) = N_0 \exp(t)$ , where the time t is in hours. A dose of antibiotic, taken orally, needs 1 hour to reach the wound. Once it reaches there, the bacterial population goes

down as  $\frac{dN}{dt} = -5N^2$ . What will be the plot of  $\frac{N_0}{N}$  vs. t after 1 hour ?



# **ANSWER KEY**

| ATOMIC STRUCTURE |    |    |    |    |    |    |   |   |   |    |
|------------------|----|----|----|----|----|----|---|---|---|----|
| Que.             | 1  | 2  | 3  | 4  | 5  | 6  | 7 | 8 | 9 | 10 |
| Ans.             | 3  | 2  | 4  | 2  | 2  | 1  | 1 | 3 | 4 | 4  |
| Que.             | 11 | 12 | 13 | 14 | 15 | 16 |   |   |   |    |
| Ans.             | 4  | 4  | 4  | 4  | 2  | 2  |   |   |   |    |

| CHEMI | CAL KIN | IETICS |    |    |   |   |   |   |   |    |
|-------|---------|--------|----|----|---|---|---|---|---|----|
| Que.  | 1       | 2      | 3  | 4  | 5 | 6 | 7 | 8 | 9 | 10 |
| Ans.  | 1       | 1      | 1  | 4  | 3 | 1 | 2 | 2 | 3 | 1  |
| Que.  | 11      | 12     | 13 | 14 |   |   |   |   |   |    |
| Ans.  | 1       | 2      | 2  | 4  |   |   |   |   |   |    |
|       |         |        |    |    |   |   |   |   |   |    |

| THERM | ODYNA | MICS-01 | [ |   |   |   |   |   |  |
|-------|-------|---------|---|---|---|---|---|---|--|
| Que.  | 1     | 2       | 3 | 4 | 5 | 6 | 7 | 8 |  |
| Ans.  | 2     | 2       | 3 | 4 | 1 | 3 | 1 | 3 |  |
|       |       |         |   |   |   |   |   |   |  |

| THERM | ODYNA | MIS-02 |   |   |   |   |   |   |   |  |
|-------|-------|--------|---|---|---|---|---|---|---|--|
| Que.  | 1     | 2      | 3 | 4 | 5 | 6 | 7 | 8 | 9 |  |
| Ans.  | 3     | 1      | 1 | 2 | 4 | 4 | 2 | 1 | 4 |  |
|       |       |        |   |   |   |   |   |   |   |  |

| IONIC E | QUILIB | RIUM |   |   |   |   |   |   |   |    |
|---------|--------|------|---|---|---|---|---|---|---|----|
| Que.    | 1      | 2    | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 |
| Ans.    | 2      | 1    | 3 | 3 | 3 | 4 | 1 | 2 | 2 | 4  |
| Que.    | 11     |      |   |   |   |   |   |   |   |    |
| Ans.    | 4      |      |   |   |   |   |   |   |   |    |

| REAL G | AS |   |   |   |  |
|--------|----|---|---|---|--|
| Que.   | 1  | 2 | 3 | 4 |  |
| Ans.   | 1  | 1 | 3 | 3 |  |

| LIQUID | SOLUT | ION |    |    |    |    |   |   |   |    |
|--------|-------|-----|----|----|----|----|---|---|---|----|
| Que.   | 1     | 2   | 3  | 4  | 5  | 6  | 7 | 8 | 9 | 10 |
| Ans.   | 2     | 2   | 3  | 1  | 2  | 4  | 2 | 2 | 4 | 3  |
| Que.   | 11    | 12  | 13 | 14 | 15 | 16 |   |   |   |    |
| Ans.   | 1     | 3   | 2  | 3  | 1  | 3  |   |   |   |    |

| CHEMICAL EQUILIBRIUM |   |   |   |   |   |   |   |   |   |  |  |
|----------------------|---|---|---|---|---|---|---|---|---|--|--|
| Que.                 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 |  |  |
| Ans.                 | 2 | 3 | 2 | 2 | 3 | 4 | 3 | 1 | 4 |  |  |

| SURFA | CE CHE | MISTRY |    |    |   |   |   |   |   |    |
|-------|--------|--------|----|----|---|---|---|---|---|----|
| Que.  | 1      | 2      | 3  | 4  | 5 | 6 | 7 | 8 | 9 | 10 |
| Ans.  | 1      | 3      | 2  | 4  | 4 | 4 | 3 | 2 | 3 | 1  |
| Que.  | 11     | 12     | 13 | 14 |   | • |   |   |   | •  |
| Ans.  | 2      | 4      | 1  | 1  |   |   |   |   |   |    |

| MOLE CONCEPT |   |   |   |   |   |   |   |   |   |    |  |
|--------------|---|---|---|---|---|---|---|---|---|----|--|
| Que.         | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 |  |
| Ans.         | 2 | 1 | 4 | 4 | 3 | 3 | 4 | 3 | 3 | 2  |  |

| IDEAL GAS |   |   |   |  |  |  |  |  |  |  |
|-----------|---|---|---|--|--|--|--|--|--|--|
| Que.      | 1 | 2 | 3 |  |  |  |  |  |  |  |
| Ans.      | 3 | 4 | 4 |  |  |  |  |  |  |  |

| CONCE | NTRATI | ION TER | RMS |   |   |   |  |
|-------|--------|---------|-----|---|---|---|--|
| Que.  | 1      | 2       | 3   | 4 | 5 | 6 |  |
| Ans.  | 2      | 1       | 3   | 1 | 2 | 3 |  |

| ELECTI | ELECTROCHEMISTRY |    |    |    |    |    |   |   |   |    |  |  |  |
|--------|------------------|----|----|----|----|----|---|---|---|----|--|--|--|
| Que.   | 1                | 2  | 3  | 4  | 5  | 6  | 7 | 8 | 9 | 10 |  |  |  |
| Ans.   | 1                | 2  | 2  | 1  | 3  | 2  | 1 | 2 | 3 | 1  |  |  |  |
| Que.   | 11               | 12 | 13 | 14 | 15 | 16 |   |   |   |    |  |  |  |
| Ans.   | 1                | 2  | 2  | 2  | 4  | 3  |   |   |   |    |  |  |  |

| REDOX |   |       |   |   |   |   |   |  |  |
|-------|---|-------|---|---|---|---|---|--|--|
| Que.  | 1 | 2     | 3 | 4 | 5 | 6 | 7 |  |  |
| Ans.  | 1 | Bonus | 3 | 2 | 2 | 2 | 3 |  |  |

| SOLID S | STATE |   |   |   |   |   |   |   |   |  |
|---------|-------|---|---|---|---|---|---|---|---|--|
| Que.    | 1     | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 |  |
| Ans.    | 4     | 2 | 3 | 4 | 2 | 3 | 1 | 1 | 2 |  |

| THERMOCHEMISTRY |   |   |   |   |   |   |  |
|-----------------|---|---|---|---|---|---|--|
| Que.            | 1 | 2 | 3 | 4 | 5 | 6 |  |
| Ans.            | 3 | 2 | 2 | 4 | 4 | 3 |  |

| RADIOACTIVITY |   |  |  |  |  |
|---------------|---|--|--|--|--|
| Que.          | 1 |  |  |  |  |
| Ans.          | 1 |  |  |  |  |

# **JANUARY & APRIL 2019 ATTEMPT (OC)**



**1.** Which of the following compounds is not aromatic ?



- 2. The increasing basicity order of the following compounds is :
  - $\begin{array}{c} & \begin{array}{c} & & & & & & & \\ H_{2}CH_{3} \\ (A) \ CH_{3}CH_{2}NH_{2} \\ (B) \ CH_{3}CH_{2}NH \\ (C) \ \begin{array}{c} & CH_{3} \\ H_{3}C-N-CH_{3} \\ \end{array} \\ (D) \ \begin{array}{c} & CH_{3} \\ Ph-N-H \\ H_{3}C-N-CH_{3} \\ \end{array} \\ (D) \ (C) < (B) < (D) < (C) < (C) \\ (A) < (B) < (C) < (C) \\ (A) < (B) < (C) < (A) \\ \end{array} \\ (E) \ (E) \ (E) < (C) \\ (E) \ (E) < (E) \\ (E) \ (E) \ (E) < (E) \\ (E) \ (E) \ (E) < (E) \\ (E) \ (E) \ (E) \ (E) \\ (E) \ (E) \ (E) \ (E) \\ (E) \ (E) \ (E) \ (E) \ (E) \\ (E) \ (E) \ (E) \ (E) \ (E) \ (E) \\ (E) \ (E)$
- 3. Which amongst the following is the strongest acid ?

| (1) CHI <sub>3</sub>  | (2) CHCI <sub>3</sub> |
|-----------------------|-----------------------|
| (3) CHBr <sub>3</sub> | (4) $CH(CN)_3$        |

4. Arrange the following amines in the decreasing order of basicity:



- 5. The correct decreasing order for acid strength is :-
  - (1)  $NO_2CH_2COOH > NCCH_2COOH > FCH_2COOH > CICH_2COOH$
  - (2)  $FCH_2COOH > NCCH_2COOH > NO_2CHCOOH > CICH_2COOH$
  - (3)  $NO_2CH_2COOH > FCH_2COOH > CNCH_2COOH > CICH_2COOH$

(4) 
$$CNCH_2COOH > O_2NCH_2COOH > FCH_2COOH > CICH_2COOH$$

6. The increasing order of the pKa values of the following compounds is :



7. In the following compound,



the favourable site/s for protonation is/are :-

- (1) (b), (c) and (d)
- (2) (a)

8.

- (3) (a) and (e)
- (4) (a) and (d)
- Which compound(s) out of the following is/are not aromatic ?



**9.** The correct order for acid strength of compounds

CH=CH, CH<sub>3</sub>-C=CH and CH<sub>2</sub>=CH<sub>2</sub>

is as follows :

(1)  $CH \equiv CH > CH_2 = CH_2 > CH_3 - C \equiv CH$ 

- (2) HC = CH > CH<sub>3</sub> –C = CH > CH<sub>2</sub> = CH<sub>2</sub>
- (3)  $CH_3-C \equiv CH > CH_2 = CH_2 > HC \equiv CH$
- (4)  $CH_3$ - $C \equiv CH > CH \equiv CH > CH_2 = CH_2$

**10.** Among the following four aromatic compounds, which one will have the lowest melting point ?



- 11. In the following compounds, the decreasing order of basic strength will be -(1)  $(C_2H_5)_2NH > C_2H_5NH_2 > NH_3$ (2)  $(C_2H_5)_2NH > NH_3 > C_2H_5NH_2$ 
  - (3)  $NH_3 > C_2H_5NH_2 > (C_2H_5)_2NH$
  - (4)  $C_2H_5NH_2 > NH_3 > (C_2H_5)_2NH$
- **12.** An organic compound 'X' showing the following solubility profile is -



- (1) m-Cresol
- (3) o-Toluidine (4) Benzamide

(2) Oleic acid

13. The increasing order of the  $pK_b$  of the following compound is :





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#### **Options :**

- (1) (A) < (C) < (D) < (B)
- (2) (B) < (D) < (A) < (C)
- (3) (C) < (A) < (D) < (B)
- (4) (B) < (D) < (C) < (A)

### **CARBONYL** COMPOUND

**1.** The major product formed in the following reaction is:





(4) <sup>H</sup>

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**2.** The major product of following reaction is :

 $R - C \equiv N \xrightarrow{(1)AlH(i-Bu_2)}{(2)H_2O} ?$ (1) RCHO (2) RCOOH

- (3)  $RCH_2NH_2$  (4)  $RCONH_2$
- **3.** The major product of the following recation is:



**4.** The major product obtained in the following reaction is :











5. Which is the most suitable reagent for the following transformation ?

$$CH_{3}-CH=CH-CH_{2}-CH-CH_{3}-\cdots\rightarrow CH_{3}-CH=CH-CH_{2}CO_{2}H$$
(1) alkaline KMnO<sub>4</sub> (2) I<sub>2</sub>/NaOH

- (3) Tollen's reagent (4)  $CrO_2/CS_2$
- **6.** The major product 'X' formed in the following reaction is :





7. The major poduct of the following reaction is:



8. The major product of the following reaction is :



9. The major product of the following reaction is:



**10.** The major product of the following reaction is:



**11.** In the following reactions, products A and B are :



$$[A] \xrightarrow{H_3O^+} [B]$$





(3) 
$$A = CH_3 + CH_3 = CH_3 + CH_3$$

(4) 
$$A = CH_3 + CH_3 = CH_3 + CH_3$$

- **12.** In the following reaction
  - Aldehyde + AlcoholHClAcetalAldehydeAlcoholHCHO $^{1}BuOH$ CH<sub>3</sub>CHOMeOH

The best combinations is :

- (1) HCHO and MeOH
- (2) HCHO and <sup>t</sup>BuOH

(3) CH<sub>3</sub>CHO and MeOH(4) CH<sub>3</sub>CHO and <sup>t</sup>BuOH

**13.** The major product obtained in the following reaction is

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- 14. In the following reaction carbonyl compound + MeOH  $\xrightarrow{HCl}$  acetal Rate of the reaction is the highest for :
  - (1) Acetone as substrate and methanol in stoichiometric amount
  - (2) Propanal as substrate and methanol in stoichiometric amount.
  - (3) Acetone as substrate and methanol in excess
  - (4) Propanal as substrate and methanol in excess
- **15.** p-Hydroxybenzophenone upon reaction with bromine in carbon tetrachloride gives:



**16.** The major product of the following reaction is :

$$\begin{array}{c} OH\\ CH_{3}CHCH_{2}CH_{2}NH_{2} \xrightarrow{\text{ethyl formate (lequiv.)}\\ \text{triethylamine}} \end{array}$$

$$\begin{array}{c} OH\\ (1) CH_{3}CHCH_{2}CH_{2}NHCHO\\ (2) CH_{3}CH=CH-CH_{2}NH_{2} \end{array}$$

$$\begin{array}{c} OH\\ H\\ (3) CH_{3}CHCH_{2}CH_{2}NH_{2} \end{array}$$

$$\begin{array}{c} OH\\ H\\ (4) CH_{3}-CH-CH=CH_{2} \end{array}$$

17. Major products of the following reaction are :



18. Compound A  $(C_9H_{10}O)$  shows positive iodoform test. Oxidation of A with KMnO<sub>4</sub>/ KOH gives acid B(C<sub>8</sub>H<sub>6</sub>O<sub>4</sub>). Anhydride of B is used for the preparation of phenolphthalein. Compound A is :-





**19.** The major product(s) obtained in the following reaction is/are :



#### CAD

**1.** The major product obtained in the following reaction is :



2. The major product of the following reaction is :



**3.** Which dicarboxylic acid in presence of a dehydrating agent is least reactive to give an anhydride :

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4. The decreasing order of ease of alkaline hydrolysis for the following esters is :



5.

(1) IV > II > III > I
(2) III > II > I > IV
(3) III > II > IV > I
(4) II > III > I > IV
The major product obtained in the following conversion is :-



The major product obtained in the following 6. reaction is :-

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7. The major product of the following reaction is:



8. The increasing order of the reactivity of the following with LiAlH<sub>4</sub> is :



9. The major product of the following reaction is:









10. The major product 'Y' in the following reaction is:-

$$\stackrel{\text{Ph}}{\underset{O}{\longrightarrow}} \stackrel{\text{CH}_{3}}{\underset{(ii)\text{aniline}}{\longrightarrow}} X \xrightarrow{(i)\text{SOCI}_{2}} Y$$



Ph

Ph

# BIOMOLECULE

1. The correct sequence of amino acids present in the tripeptide given below is :



- (1) Leu Ser Thr
- (2) Thr Ser- Leu
- (3) Thr Ser Val
- (4) Val Ser Thr
- 2. Which of the following tests cannot be used for identifying amino acids ?
  - (1) Biuret test (2) Xanthoproteic test
  - (3) Barfoed test (4) Ninhydrin test
- **3.** Among the following compound which one is found in RNA ?



**4.** The correct structure of histidine in a strongly acidic solution (pH=2) is



5. The correct structure of product 'P' in the following reaction is :



- 6. Maltose on treatment with dilute HCI gives : (1) D-Galactose
  - (2) D-Glucose
  - (3) D-Glucose and D-Fructose
  - (4) D-Fructose

8.

7. Fructose and glucose can be distinguished by :

- (1) Fehling's test (2) Barfoed's test
- (3) Benedict's test (4) Seliwanoff's test
- Which of the following statements is not true about sucrose?
  - (1) On hydrolysis, it produces glucose and fructose
  - (2) The glycosidic linkage is present between  $C_1$  of  $\alpha$ -glucose and  $C_1$  of  $\beta$ -fructose
  - (3) It is also named as invert sugar
  - (4) It is a non reducing sugar
- **9.** The peptide that gives positive ceric ammonium nitrate and carbylamine tests is :
  - (1) Lys-Asp (2) Ser-Lys
  - (3) Gln-Asp (4) Asp-Gln

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- **10.** Amylopectin is composed of :
  - (1)  $\alpha$ -D-glucose, C<sub>1</sub>-C<sub>4</sub> and C<sub>1</sub>-C<sub>6</sub> linkages
  - (2)  $\alpha$ -D-glucose,  $C_1$ - $C_4$  and  $C_2$ - $C_6$  linkages (3)  $\beta$  D glucose  $C_1$   $C_2$  and  $C_3$   $C_4$  linkages
  - (3)  $\beta$ -D-glucose, C<sub>1</sub>–C<sub>4</sub> and C<sub>2</sub>–C<sub>6</sub> linkages (4)  $\beta$ -D-Glucose, C<sub>1</sub>–C<sub>4</sub> and C<sub>1</sub>–C<sub>6</sub> linkages
- 11. Number of stereo centers present in linear and cyclic structures of glucose are respectively :
  (1) 4 & 5
  (2) 5 & 5
  (3) 4 & 4
  (4) 5 & 4
- **12.** Which of the following statements is not true about RNA ?
  - (1) It has always double stranded  $\alpha$ -helix structure
  - (2) It usually does not replicate
  - (3) It is present in the nucleus of the cell
  - (4) It controls the synthesis of protein
- **13.** Glucose and Galactose are having identical configuration in all the positions except position.
  - (1) C-3 (2) C-2 (3) C-4 (4) C-5
- 14. Which of the given statements is INCORRECT about glycogen ?
  - (1) It is a straight chain polymer similar to amylose
  - (2) Only  $\alpha$ -linkages are present in the molecule

3.

- (3) It is present in animal cells
- (4) It is present in some yeast and fungi

# HALOGEN DERIVATIVE

1. The major product of the following reaction is:

$$(1) H_{3}C \longrightarrow CH_{2}CH_{3}$$

$$(1) H_{3}C \longrightarrow CH_{2}CH_{3}$$

$$(1) H_{3}C \longrightarrow CH_{2}CH_{3}$$

$$(2) H_{3}CH_{2}C \longrightarrow CH_{2}CH_{3}$$

$$(2) H_{3}CH_{2}C \longrightarrow CH_{2}CH_{3}$$

$$(2) H_{3}CH_{2}C \longrightarrow CH_{2}CH_{3}$$

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$$\begin{array}{c} CO_2CH_2CH_3\\ (3) CH_3C=CHCH_3\\ (4) CH_3CH_2C=CH_2\\ CO_2CH_2CH_3\\ \end{array}$$

2. The increasing order of reactivity of the following compounds towards reaction with alkyl halides directly is :



The major product of the following reactions:



4. The major product in the following reaction is :







5. The major product of the following reaction is:





- 6. Which one of the following alkenes when treated with HCl yields majorly an anti Markovnikov product?
  - (1)  $F_3C CH = CH_2$
  - (2)  $Cl CH = CH_2$
  - (3)  $CH_3O CH = CH_2$

$$(4) H_2 N - CH = CH_2$$

7. The mojor product of the following reaction is :

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 $CH_{3}C \equiv CH \xrightarrow{(i) DCl (1 equiv.)}$ 

8.

- (1) CH<sub>3</sub>CD(Cl)CHD(I)
- (2)  $CH_3CD_2CH(Cl)(I)$
- (3) CH<sub>3</sub>CD(I)CHD(Cl)
- (4) CH<sub>3</sub>C(I)(Cl)CHD<sub>2</sub>
- 9. Increasing order of reactivity of the following compounds for  $S_N 1$  substitution is:



10. Which of the following potential energy (PE) diagrams represents the  $S_N 1$  reaction?





**12.** The major product of the following reaction is :-

$$(1) \begin{array}{c} CH_{3} \\ CH_{3}-C-CH CH_{3} \\ H Br \end{array} \xrightarrow{CH_{3}OH} \\ (1) CH_{3}-C-CH CH_{3} \\ H OCH_{3} \end{array} \xrightarrow{(2) CH_{3}-C-CH} = CH_{2} \\ H OCH_{3} \\ (2) CH_{3}-C-CH CH_{2} \\ H OCH_{3} \\ (3) CH_{3}-C-CH_{2}CH_{3} \\ OCH_{3} \\ (4) CH_{3}-C = CH CH_{3} \\ OCH_{3} \end{array}$$

- **13.** The increasing order of nucleophilicity of the following nucleophiles is :
  - (a)  $CH_3CO_2^{\ominus}$  (b)  $H_2O$ (c)  $CH_3SO_3^{\ominus}$  (d)  $\overset{\ominus}{O}H$ (1) (b) < (c) < (a) < (d)(2) (a) < (d) < (c) < (b) (3) (d) < (a) < (c) < (b)(4) (b) < (c) < (d) < (a)
- **14.** The major product 'Y' in the following reaction is:



**15.** The major product of the following addition reaction is :

$$H_{3}C - CH = CH_{2} \xrightarrow{Cl_{2}/H_{2}O}$$

$$(1) CH_{3} - CH - CH_{2} \qquad (2) H_{3}C - CH - CH_{2}$$

$$(1) CH_{3} - CH - CH_{2} \qquad (2) H_{3}C - CH - CH_{2}$$

$$(3) H_{3}C - \swarrow \qquad (4) H_{3}C - CH_{3}$$

16. An 'Assertion' and a 'Reason' are given below. Choose the correct answer from the following options.

> Assertion (A): Vinyl halides do not undergo nucleophilic substitution easily.

> Reason (R) : Even though the intermediate carbocation is stabilized by loosely held  $\pi$ -electrons, the cleavage is difficult because of strong bonding.

- (1) Both (A) and (R) are wrong statements
- (2) Both (A) and (R) are correct statements and (R) is the correct explanation of (A)
- (3) Both (A) and (R) are correct statements but (R) is not the correct explanation of (A)
- (4) (A) is a correct statement but (R) is a wrong statement.
- 17. Heating of 2-chloro-1-phenylbutane with EtOK/EtOH gives X as the major product. Reaction of X with Hg(OAc)<sub>2</sub>/H<sub>2</sub>O followed by NaBH<sub>4</sub> gives Y as the major product. Y is :





2. Which hydrogen in compound (E) is easily replaceable during bromination reaction in presence of light :

$$CH_{3} - CH_{2} - CH_{\beta} = CH_{2}$$
(E)
(1)  $\beta$  - hydrogen
(2)  $\gamma$  - hydrogen

- (3)  $\delta$  hydrogen (4)  $\alpha$  – hydrogen
- 3. The major product in the following conversion is :

$$CH_{3}O - \underbrace{\bigcirc} - CH = CH - CH_{3} \xrightarrow{HBr(excess)}_{Heat}?$$

$$(1) HO - \underbrace{\bigcirc} - CH_{2} - CH_{-}CH_{3}_{Br}$$

$$(2) HO - \underbrace{\bigcirc} - CH_{-}CH_{2} - CH_{3}_{Br}$$

$$(3) CH_{3}O - \underbrace{\bigcirc} - CH_{2} - CH_{-}CH_{3}_{Br}$$

$$(4) CH_{3}O - \underbrace{\bigcirc} - CH_{-}CH_{2} - CH_{3}_{Br}$$



4.



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5. Consider the following reactions :

$$A \xrightarrow{Ag_2O} ppt$$

$$A \xrightarrow{Hg^{2+}/H^+} B \xrightarrow{NaBH_4} C \xrightarrow{ZnCl_2} Turbidity$$
within  
'A' is :  
(1) CH=CH  
(3) CH\_2=CH\_2
(2) CH\_3-C=CH  
(4) CH\_3-C=C-CH\_3

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- AROMATIC
- 1. The major product of the following reaction is:



2. What will be the major product in the following mononitation reaction ?



**3.** The major product of the following reaction is:



4.

5. The compounds A and B in the following reaction are, respectively:

$$\xrightarrow{\text{HCHO+HCI}} A \xrightarrow{\text{AgCN}} A$$

- (1) A = Benzyl alcohol, B = Benzyl isocyanide
- (2) A = Benzyl alcohol, B = Benzyl cyanide
- (3) A = Benzyl chloride, B = Benzyl cyanide
- (4) A = Benzyl chloride, B = Benzyl isocyanide

(4)

Н

 $O_n N$ 

6. The major product of the following reaction is:



7. The major product of the following reaction is :-



8. Coupling of benzene diazonium chloride with 1-napthol in alkaline medium will give





9. An organic compound neither reacts with neutral ferric chloride solution nor with Fehling solution, It however, reacts with Grignard reagent and gives positive iodoform test. The compound is -



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**10.** The major product of the following reaction is:











**11.** The major product of the following reaction is:



- **12.** Polysubstitution is a major drawback in:
  - (1) Reimer Tiemann reaction
  - (2) Friedel Craft's acylation
  - (3) Friedel Craft's alkylation
  - (4) Acetylation of aniline
- **13.** The organic compound that gives following qualitative analysis is :



**14.** The increasing order of reactivity of the following compounds towards aromatic electrophilic substitution reaction is :



(1) D < B < A < C (2) A < B < C < D(3) D < A < C < B (4) B < C < A < D

**15.** The major product of the following reaction is: OH



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4. The major product of the following reaction is:





2. The correct match between item 'I' and item 'II' is :

| Item 'I'  | Item 'II'   |
|---|---|
| (compound)                                      | (reagent)   |
| (A) Lysine                                      | (P) 1-naphthol  |
| (B) Furfural                                    | (Q) ninhydrin   |
| (C) Benzyl alcohol                              | (R) KMnO <sub>4</sub>   |
| (D) Styrene<br>nitrate                          | (S) Ceric ammonium  |
| (1) (A) $\rightarrow$ (Q), (B) $\rightarrow$ (I | P), (C) $\rightarrow$ (S), (D) $\rightarrow$ (R)  |
| $(2) (A) \rightarrow (Q), (B) \rightarrow (B)$  | $\mathbf{R}), (\mathbf{C}) \rightarrow (\mathbf{S}), (\mathbf{D}) \rightarrow (\mathbf{P})$ |

- $(3) (A) \rightarrow (Q), (B) \rightarrow (P), (C) \rightarrow (R), (D) \rightarrow (S)$  $(4) (A) \rightarrow (R), (B) \rightarrow (P), (C) \rightarrow (Q), (D) \rightarrow (S)$
- 3. The correct match between Item I and Item II is :-

|     | Item I           | Item II |     |  |  |
|-----|------------------|---------|-----|--|--|
| (A) | Ester test       | (P)     | Tyr |  |  |
| (B) | Carbylamine test | (Q)     | Asp |  |  |
| (C) | Phthalein dye    | (R)     | Ser |  |  |
|     | test             |         |     |  |  |
|     |                  | (S)     | Lys |  |  |

- $(1) (A) {\rightarrow} (Q); (B) {\rightarrow} (S); (C) {\rightarrow} (P)$
- $(2) (A) \rightarrow (R); (B) \rightarrow (Q); (C) \rightarrow (P)$
- $(3) (A) \rightarrow (Q); (B) \rightarrow (S); (C) \rightarrow (R)$

 $(4) (A) \rightarrow (R); (B) \rightarrow (S); (C) \rightarrow (Q)$ 

4. Hinsberg's reagent is :

| (1) $C_6H_5SO_2Cl$    | (2) $C_6H_5COCl$        |
|-----------------------|-------------------------|
| (3) SOCl <sub>2</sub> | (4) (COCl) <sub>2</sub> |

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# NOMENCLATURE

**1.** What is the IUPAC name of the following compound ?



- (1) 3-Bromo-1, 2-dimethylbut-1-ene]
- (2) 4-Bromo-3-methylpent-2-ene
- (3) 2-Bromo-3-methylpent-3-ene
- (4) 3-Bromo-3-methyl-1, 2-dimethylprop-1-ene
- 2. The IUPAC name of the following compound is :

- (1) 2-Methyl-3Hydroxypentan-5-oic acid
- (2) 4,4-Dimethyl-3-hydroxy butanoic acid
- (3) 3-Hydroxy-4 -methylpentanoic acid
- (4) 4-Methyl-3-hydroxypentanoic acid
- **3.** The correct IUPAC name of the following compound is :

 $NO_2$ 

- O CHL C
- (1) 5-chloro-4-methyl-1-nitrobenzene
- (2) 2-methyl-5-nitro-1-chlorobenzene
- (3) 3-chloro-4-methyl-1-nitrobenzene
- (4) 2-chloro-1-methyl-4-nitrobenzene
- 4. The IUPAC name of the following compound is :



- (1) 3,5-dimethyl-4-propylhept-6-en-1-yne
- (2) 3-methyl-4-(3-methylprop-1-enyl)-1heptyne
- (3) 3-methyl-4-(1-methylprop-2-ynyl)-1heptene
- (4) 3,5-dimethyl-4-propylhept-1-en-6-yne

### POLYMER

- 1. The two monomers for the synthesis of Nylone 6, 6 are :
  - (1) HOOC(CH<sub>2</sub>)<sub>6</sub>COOH,  $H_2N(CH_2)_6NH_2$

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- (2) HOOC(CH<sub>2</sub>)<sub>4</sub>COOH, H<sub>2</sub>N(CH<sub>2</sub>)<sub>4</sub>NH<sub>2</sub>
- (3) HOOC(CH<sub>2</sub>)<sub>6</sub>COOH,  $H_2N(CH_2)_4NH_2$
- (4) HOOC(CH<sub>2</sub>)<sub>4</sub>COOH, H<sub>2</sub>N(CH<sub>2</sub>)<sub>6</sub>NH<sub>2</sub>
- 2. Major product of the following reaction is :











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**3.** The major product of the following reaction is:











**4.** The homopolymer formed from 4-hydroxybutanoic acid is :-

$$(1) \begin{bmatrix} 0 \\ -C(CH_{2})_{3} - 0 \end{bmatrix}_{n} \quad (2) \begin{bmatrix} 0 \\ -OC(CH_{2})_{3} - 0 \end{bmatrix}_{n}$$
$$(3) \begin{bmatrix} 0 & 0 \\ -C(CH_{2})_{2} - 0 \end{bmatrix}_{n} \quad (4) \begin{bmatrix} 0 & 0 \\ -C(CH_{2})_{2} - 0 \end{bmatrix}_{n}$$

5. The polymer obtained from the following reactions is :

HOOC  

$$NH_{2} \xrightarrow{(i) \text{ NaNO}_{2}/\text{H}_{3}\text{O}^{+}} \xrightarrow{(i) \text{ NaNO}_{2}/\text{H}_{3}\text{O}^{+}} \xrightarrow{(i) \text{ Polymerisation}} \xrightarrow{(i) \text{ Polymerisation}} \xrightarrow{(1) \left[ \begin{array}{c} O \\ -C - (CH_{2})_{4} - N \end{array} \right]_{n}} \xrightarrow{(2) \left[ \begin{array}{c} O \\ -O - (CH_{2})_{4} - C \end{array} \right]_{n}} \xrightarrow{(3) \left[ \begin{array}{c} O \\ -HNC(CH_{2})_{4} - C - N \end{array} \right]_{n}} \xrightarrow{(4) \left[ \begin{array}{c} O \\ -OC(CH_{2})_{4} - O \end{array} \right]_{n}} \xrightarrow{(4) \left[ \begin{array}{c} O \\ -OC(CH_{2})_{4} - O \end{array} \right]_{n}} \xrightarrow{(4) \left[ \begin{array}{c} O \\ -OC(CH_{2})_{4} - O \end{array} \right]_{n}} \xrightarrow{(4) \left[ \begin{array}{c} O \\ -OC(CH_{2})_{4} - O \end{array} \right]_{n}} \xrightarrow{(4) \left[ \begin{array}{c} O \\ -OC(CH_{2})_{4} - O \end{array} \right]_{n}} \xrightarrow{(4) \left[ \begin{array}{c} O \\ -OC(CH_{2})_{4} - O \end{array} \right]_{n}} \xrightarrow{(4) \left[ \begin{array}{c} O \\ -OC(CH_{2})_{4} - O \end{array} \right]_{n}} \xrightarrow{(4) \left[ \begin{array}{c} O \\ -OC(CH_{2})_{4} - O \end{array} \right]_{n}} \xrightarrow{(4) \left[ \begin{array}{c} O \\ -OC(CH_{2})_{4} - O \end{array} \right]_{n}} \xrightarrow{(4) \left[ \begin{array}{c} O \\ -OC(CH_{2})_{4} - O \end{array} \right]_{n}} \xrightarrow{(4) \left[ \begin{array}{c} O \\ -OC(CH_{2})_{4} - O \end{array} \right]_{n}} \xrightarrow{(4) \left[ \begin{array}{c} O \\ -OC(CH_{2})_{4} - O \end{array} \right]_{n}} \xrightarrow{(4) \left[ \begin{array}{c} O \\ -OC(CH_{2})_{4} - O \end{array} \right]_{n}} \xrightarrow{(4) \left[ \begin{array}{c} O \\ -OC(CH_{2})_{4} - O \end{array} \right]_{n}} \xrightarrow{(4) \left[ \begin{array}{c} O \\ -OC(CH_{2})_{4} - O \end{array} \right]_{n}} \xrightarrow{(4) \left[ \begin{array}{c} O \\ -OC(CH_{2})_{4} - O \end{array} \right]_{n}} \xrightarrow{(4) \left[ \begin{array}{c} O \\ -OC(CH_{2})_{4} - O \end{array} \right]_{n}} \xrightarrow{(4) \left[ \begin{array}{c} O \\ -OC(CH_{2})_{4} - O \end{array} \right]_{n}} \xrightarrow{(4) \left[ \begin{array}{c} O \\ -OC(CH_{2})_{4} - O \end{array} \right]_{n}} \xrightarrow{(4) \left[ \begin{array}{c} O \\ -OC(CH_{2})_{4} - O \end{array} \right]_{n}} \xrightarrow{(4) \left[ \begin{array}{c} O \\ -OC(CH_{2})_{4} - O \end{array} \right]_{n}} \xrightarrow{(4) \left[ \begin{array}{c} O \\ -OC(CH_{2})_{4} - O \end{array} \right]_{n}} \xrightarrow{(4) \left[ \begin{array}{c} O \\ -OC(CH_{2})_{4} - O \end{array} \right]_{n}} \xrightarrow{(4) \left[ \begin{array}{c} O \\ -OC(CH_{2})_{4} - O \end{array} \right]_{n}} \xrightarrow{(4) \left[ \begin{array}{c} O \\ -OC(CH_{2})_{4} - O \end{array} \right]_{n}} \xrightarrow{(4) \left[ \begin{array}{c} O \\ -OC(CH_{2})_{4} - O \end{array} \right]_{n}} \xrightarrow{(4) \left[ \begin{array}{c} O \\ -OC(CH_{2})_{4} - O \end{array} \right]_{n}} \xrightarrow{(4) \left[ \begin{array}{c} O \\ -OC(CH_{2})_{4} - O \end{array} \right]_{n}} \xrightarrow{(4) \left[ \begin{array}{c} O \\ -OC(CH_{2})_{4} - O \end{array} \right]_{n}} \xrightarrow{(4) \left[ \begin{array}{c} O \\ -OC(CH_{2})_{4} - O \end{array} \right]_{n}} \xrightarrow{(4) \left[ \begin{array}{c} O \\ -OC(CH_{2})_{4} - O \end{array} \right]_{n}} \xrightarrow{(4) \left[ \begin{array}{c} O \\ -OC(CH_{2})_{4} - O \end{array} \right]_{n}} \xrightarrow{(4) \left[ \begin{array}{c} O \\ -OC(CH_{2})_{4} - O \end{array} \right]_{n}} \xrightarrow{(4) \left[ \begin{array}{c} O \\ -OC(CH_{2})_{4} - O \end{array} \right]_{n}} \xrightarrow{(4) \left[ \begin{array}{c} O \\ -OC(CH_{2})_{4} - O \end{array} \right]_{n}} \xrightarrow{(4) \left[ \begin{array}{c} O \\ -OC(CH_{2})_{4} - O \end{array} \right]_{n}} \xrightarrow{(4) \left[ \begin{array}[c] O \\ -OC(CH$$

- 6. Poly-β-hydroxybutyrate-co-βhydroxyvalerate(PHBV) is a copolymer of \_\_\_\_\_.
  (1) 3-hydroxybutanoic acid and
  - 4-hydroxypentanoic acid
  - (2) 2-hydroxybutanoic acid and3-hydroxypentanoic acid
  - (3) 3-hydroxybutanoic acid and2-hydroxypentanoic acid
  - (4) 3-hydroxybutanoic acid and3-hydroxypentanoic acid
- 7. The structure of Nylon-6 is :



8.

The major product of the following reaction is :



**9.** Which of the following compounds is a constituent of the polymer

$$\begin{bmatrix} O \\ II \\ HN - C - NH - CH_2 \end{bmatrix}_n ?$$

- (1) Formaldehyde (2) Ammonia
- (3) Methylamine (4) N-Methyl urea
- **10.** Which of the following is a condensation polymer ?
  - (1) Buna S (2) Nylon 6, 6
  - (3) Teflon (4) Neoprene
- **11.** The correct match between Item-I and Item-II is:

|     | Item-I                 |       | Item-II   |
|-----|------------------------|-------|---|
| (a) | High density polythene | (I)   | Peroxide catalyst                                 |
| (b) | Polyacrylonitrile      | (II)  | Condensation at<br>high temperature &<br>pressure |
| (c) | Novolac                | (III) | Ziegler-Natta<br>Catalyst                         |
| (d) | Nylon 6                | (IV)  | Acid or base<br>catalyst                          |

(1) (a) $\rightarrow$ (III), (b) $\rightarrow$ (I), (c) $\rightarrow$ (II), (d) $\rightarrow$ (IV)

- (2) (a) $\rightarrow$ (IV), (b) $\rightarrow$ (II), (c) $\rightarrow$ (I), (d) $\rightarrow$ (III)
- (3) (a) $\rightarrow$ (II), (b) $\rightarrow$ (IV), (c) $\rightarrow$ (I), (d) $\rightarrow$ (III)
- $(4) (a) \rightarrow (III), (b) \rightarrow (I), (c) \rightarrow (IV), (d) \rightarrow (II)$
- **12.** Which of the following is a thermosetting polymer?
  - (1) Buna–N (2) PVC
  - (3) Bakelite (4) Nylon 6
- **13.** The correct name of the following polymer is:



- (1) Polyisoprene
- (2) Polytert-butylene
- (3) Polyisobutane
- (4) Polyisobutylene

# CHEMISTRY IN EVERYDAY LIFE

1. The correct match between Item(I) and Item(II) is :

| Item-I            | Item-II         |
|-------------------|-----------------|
| (A) Nortehindrone | (P) Anti-biotic |

- (B)Ofloxacin (Q) Anti-fertility
- (C)Equanil

(R) Hypertension(S) Analgesics

- (1) A-R, B-P, C-S
- (2) A-Q, B-P, C-R
- (3) A-R, B-P, C-R
- (4) A-Q, B-R, C-S
- 2. Noradrenaline is a /an
  - (1) Neurotransmitter (2) Antidepressant
  - (3) Antihistamine (4) Antacid

### PHENOL

1. The product formed in the reaction of cumene with  $O_2$  followed by treatment with dil. HCl are :



#### ALLEN

2. The major product of the following reaction is :









![](_page_44_Figure_7.jpeg)

# AMINE

1. The major product formed in the reaction given below will be :

![](_page_44_Figure_10.jpeg)

- 2. A compound 'X' on treatment with  $Br_2/NaOH$ , provided  $C_3H_9N$ , which gives positive carbylamine test. Compound 'X' is :-
  - (1) CH<sub>3</sub>COCH<sub>2</sub>NHCH<sub>3</sub>
  - (2) CH<sub>3</sub>CH<sub>2</sub>COCH<sub>2</sub>NH<sub>2</sub>
  - (3) CH<sub>3</sub>CH<sub>2</sub>CH<sub>2</sub>CONH<sub>2</sub>
  - (4) CH<sub>3</sub>CON(CH<sub>3</sub>)<sub>2</sub>
- **3.** Which of the following amines can be prepared by Gabriel phthalimide reaction ?
  - (1) Neo-pentylamine (2) n-butylamine
  - (3) triethylamine (4) t-butylamine
- 4. The major product obtained in the following reaction is :

$$\underbrace{(i)CHCl_3/KOH}_{(ii)Pd/C/H_2}$$

(1) 
$$H_{2N}$$
 OH

![](_page_44_Figure_22.jpeg)

![](_page_44_Figure_23.jpeg)

![](_page_44_Figure_24.jpeg)

5. Aniline dissolved in dilute HCl is reacted with sodium nitrite at 0°C. This solution was added dropwise to a solution containing equimolar mixture of aniline and phenol in dil. HCl. The structure of the major product is :

![](_page_45_Figure_2.jpeg)

![](_page_45_Figure_3.jpeg)

![](_page_45_Figure_4.jpeg)

![](_page_45_Figure_5.jpeg)

- 6. Ethylamine  $(C_2H_5NH_2)$  can be obtained from N-ethylphthalimide on treatment with :
  - (1)  $NaBH_4$  (2)  $CaH_2$
  - (3)  $H_2O$  (4)  $NH_2NH_2$
- 7. Benzene diazonium chloride on reaction with aniline in the presence of dilute hydrochloric acid gives :

![](_page_45_Figure_10.jpeg)

# **ORGANO METALIC**

ALLEN

1. Which of the following compounds reacts with ethylmagnesium bromide and also decolourizes bromine water solution :-

![](_page_45_Figure_13.jpeg)

#### ALLEN

- 2. The major product of the following reaction is :
  - $CH_3CH = CHCO_2CH_3 \xrightarrow{\text{LiAlH}_4}$
  - (1) CH<sub>3</sub>CH<sub>2</sub>CH<sub>2</sub>CHO
  - (2)  $CH_3CH = CHCH_2OH$
  - (3) CH<sub>3</sub>CH<sub>2</sub>CH<sub>2</sub>CO<sub>2</sub>CH<sub>3</sub>
  - (4) CH<sub>3</sub>CH<sub>2</sub>CH<sub>2</sub>CH<sub>2</sub>OH
- **3.** The major products A and B for the following reactions are, respectively:

![](_page_46_Figure_9.jpeg)

![](_page_46_Figure_10.jpeg)

![](_page_46_Figure_11.jpeg)

![](_page_46_Figure_12.jpeg)

![](_page_46_Figure_13.jpeg)

- **4.** Which of the following is NOT a correct method of the preparation of benzylamine from cyanobenzene ?
  - (1) (i) HCl/H<sub>2</sub>O (ii) NaBH<sub>4</sub>
  - (2) (i)  $\text{LiAIH}_4$  (ii)  $\text{H}_3\text{O}^+$
  - (3) (i) SnCl<sub>2</sub>+HCl(gas) (ii) NaBH<sub>4</sub>
  - (4) H<sub>2</sub>/Ni

# **ALCOHOL & ETHER**

**1.** The major product of the following reaction is :

![](_page_46_Figure_21.jpeg)

![](_page_46_Figure_22.jpeg)

![](_page_46_Figure_23.jpeg)

2. The major product obtained in the given reaction is :-

![](_page_46_Figure_25.jpeg)

![](_page_46_Figure_26.jpeg)

(2) 
$$H_3C$$
  $CH_2$   $CH_2$   $CH = CH_2$ 

![](_page_46_Figure_28.jpeg)

![](_page_46_Figure_29.jpeg)

Ε

|   |  | M |
|---|--|---|
| A |  |   |

# **ANSWER KEY**

| GOC    |         |        |            |       |    |    |    |    |    |    |
|--------|---------|--------|------------|-------|----|----|----|----|----|----|
| Que.   | 1       | 2      | 3          | 4     | 5  | 6  | 7  | 8  | 9  | 10 |
| Ans.   | 3       | 1      | 4          | 4     | 1  | 4  | 1  | 2  | 2  | 1  |
| Que.   | 11      | 12     | 13         |       |    |    |    |    |    |    |
| Ans.   | 1       | 1      | 2          |       |    |    |    |    |    |    |
| CARBO  | NYL CO  | MPOUNI | )          |       |    |    |    |    |    |    |
| Que.   | 1       | 2      | 3          | 4     | 5  | 6  | 7  | 8  | 9  | 10 |
| Ans.   | 1       | 1      | 3          | 4     | 2  | 4  | 1  | 2  | 4  | 3  |
| Que.   | 11      | 12     | 13         | 14    | 15 | 16 | 17 | 18 | 19 |    |
| Ans.   | 4       | 1      | 4          | 4     | 4  | 1  | 4  | 1  | 2  |    |
| CAD    |         |        |            |       |    |    |    |    |    |    |
| Que.   | 1       | 2      | 3          | 4     | 5  | 6  | 7  | 8  | 9  | 10 |
| Ans.   | 3       | 3      | 4          | 2     | 2  | 2  | 2  | 1  | 4  | 1  |
|        |         |        |            |       |    |    |    |    |    |    |
| BIOMOI | LECULE  |        |            |       |    |    |    |    |    |    |
| Que.   | 1       | 2      | 3          | 4     | 5  | 6  | 7  | 8  | 9  | 10 |
| Ans.   | 4       | 3      | 3          | 1     | 1  | 2  | 4  | 2  | 2  | 1  |
| Que.   | 11      | 12     | 13         | 14    |    |    |    |    |    |    |
| Ans.   |         | 1      | 3          | l     |    |    |    |    |    |    |
| HALOG  | EN DERI | VATIVE |            |       |    |    |    |    |    |    |
| Que.   | 1       | 2      | 3          | 4     | 5  | 6  | 7  | 8  | 9  | 10 |
| Ans.   | 3       | 2      | 4          | Bonus | 4  | 1  | 4  | 4  | 3  | 4  |
| Que.   | 11      | 12     | 13         | 14    | 15 | 16 | 17 |    |    |    |
| Ans.   | 3       | 3      | 1          | 3     | 2  | 4  | 4  |    |    |    |
| HYDRO  | CARBON  | N      |            |       |    |    |    |    |    |    |
| Que.   | 1       | 2      | 3          | 4     | 5  |    |    |    |    |    |
| Ans.   | 4       | 2      | 2          | 1     | 2  |    |    |    |    |    |
| AROMA  | TIC     |        |            |       |    |    |    |    |    |    |
| Oue.   | 1       | 2      | <b>-</b> 3 | 4     | 5  | 6  | 7  | 8  | 9  | 10 |
| Ans.   | 2       | 3      | 2          | 4     | 4  | 1  | 2  | 3  | 1  | 3  |
| Que.   | 11      | 12     | 13         | 14    | 15 | 16 | 17 | 18 | -  |    |
| Ans.   | 4       | 3      | 1          | 3     | 3  | 3  | 3  | 4  |    |    |
| ALKAY  | LE HALI | DE     |            |       |    |    |    |    |    |    |
| Oue.   | 1       | 2      | 3          | 4     |    |    |    |    |    |    |
| Ans.   | 4       | 3      | 4          | 1     |    |    |    |    |    |    |
|        |         |        | -          |       |    |    |    |    |    |    |
| GRIGNA | RD REA  | GENN   |            |       |    |    |    |    |    |    |
| Que.   | 1       | 2      |            |       |    |    |    |    |    |    |
| Ans.   | 2       | 1      |            |       |    |    |    |    |    |    |
| POC    |         |        |            |       |    |    |    |    |    |    |
| Que.   | 1       | 2      | 3          | 4     |    |    |    |    |    |    |
| Ans.   | 2       | 1      | 1          | 1     |    |    |    |    |    |    |
| ·      | -       |        |            |       |    |    |    |    |    |    |

|   |  | M |
|---|--|---|
| A |  |   |

| NOMEN  | CLATU   | RE    |         |   |   |   |   |   |   |    |
|--------|---------|-------|---------|---|---|---|---|---|---|----|
| Que.   | 1       | 2     | 3       | 4 |   |   |   |   |   |    |
| Ans.   | 2       | 3     | 4       | 4 |   |   |   |   |   |    |
| DOLVA  | ED      |       |         |   |   |   |   |   |   |    |
|        |         | 2     | 2       | 4 | 5 |   | _ | 0 | 0 | 10 |
| Que.   |         | 2     | 3       | 4 | 5 | 0 | 7 | 8 | 9 | 10 |
| Ans.   | 4       | 4     | 2       | 1 | 2 | 4 | 3 |   |   | 2  |
| Que.   |         | 12    | 13      |   |   |   |   |   |   |    |
| Ans.   | 4       | 3     | 4       |   |   |   |   |   |   |    |
| CHEMIS | STRY IN | EVERY | DAY LIF | 0 |   |   |   |   |   |    |
| Que.   | 1       | 2     |         |   |   |   |   |   |   |    |
| Ans.   | 2       | 1     |         |   |   |   |   |   |   |    |
| PHENO  | ī,      |       |         |   |   |   |   |   |   |    |
| Oue.   | 1       | 2     |         |   |   |   |   |   |   |    |
| Ans.   | 3       | 1     |         |   |   |   |   |   |   |    |
|        | •       | •     |         |   |   |   |   |   |   |    |
| AMINE  |         |       |         |   |   |   |   |   |   |    |
| Que.   | 1       | 2     | 3       | 4 | 5 | 6 | 7 |   |   |    |
| Ans.   | Bonus   | 3     | 2       | 1 | 1 | 4 | 3 |   |   |    |
| ODCAN  |         | TTC   |         |   |   |   |   |   |   |    |
| ORGAN  |         |       |         |   |   |   | _ |   |   |    |
| Que.   |         |       |         |   |   |   |   |   |   |    |
| Ans.   | 4       |       |         |   |   |   |   |   |   |    |
| REDUC  | TION    |       |         |   |   |   |   |   |   |    |
| Que.   | 1       | 2     | 3       | 4 |   |   |   |   |   |    |
| Ans.   | 4       | 2     | 2       | 1 |   |   |   |   |   |    |
|        | •       | •     |         |   |   |   |   |   |   |    |

| ALCOH | OL & ET | 'HER |  |
|-------|---------|------|--|
| Que.  | 1       | 2    |  |
| Ans.  | 1       | 4    |  |
|       |         |      |  |
|       |         |      |  |
|       |         |      |  |
|       |         |      |  |
|       |         |      |  |

# **JANUARY & APRIL 2019 ATTEMPT (IOC)**

# COORDINATION COMPOUND

- The metal d-orbitals that are directly facing the 1. ligands in  $K_3[Co(CN)_6]$  are :
  - (1)  $d_{xz}$ ,  $d_{yz}$  and  $d_{z^2}$
  - (2)  $d_{xy}$ ,  $d_{xz}$  and  $d_{yz}$
  - (3)  $d_{xy}$  and  $d_{x^2-y^2}$
  - (4)  $d_{x^2-v^2}$  and  $d_{z^2}$
- 2.  $Mn_2(CO)_{10}$  is an organometallic compound due to the presence of :
  - (1) Mn Mn bond
  - (2) Mn C bond
  - (3) Mn O bond
  - (4) C O bond
- 3. The pair of metal ions that can give a spin only magnetic moment of 3.9 BM for the complex  $[M(H_2O)_6]Cl_2$ , is :
  - (1)  $Cr^{2+}$  and  $Mn^{2+}$
  - (2) V<sup>2+</sup> and Co<sup>2+</sup>
  - (3) V<sup>2+</sup> and Fe<sup>2+</sup>
  - (4)  $Co^{2+}$  and  $Fe^{2+}$
- 4. The magnetic moment of an octahedral homoleptic Mn(II) complex is 5.9 BM. The suitable ligand for this complex is : (1)  $CN^{-}$ (2) NCS<sup>-</sup>
  - (4) ethylenediamine (3) CO
- 5. The coordination number of Th in  $K_4[Th(C_2O_4]_4(OH_2)_2]$  is :-

 $(C_2 O_4^{2-} = Oxalato)$ (1) 6(2) 10(3) 14

(4) 86. The number of bridging CO ligand (s) and Co-Co bond (s) in  $Co_2(CO)_8$ , respectively are :-(1) 0 and 2(2) 2 and 0

(1) 
$$0$$
 and  $2$  (2)  $2$  and  $0$   
(3)  $4$  and  $0$  (4)  $2$  and  $1$ 

- 7. The total number of isomers for a square planar complex  $[M(F)(Cl)(SCN)(NO_2)]$  is : (4) 4
  - (1) 12(2) 8(3) 16

8. Wilkinson catalyst is :

- (1)  $[(Ph_3P)_3RhCl]$  (Et =  $C_2H_5$ )
- $(2) [Et_3P)_3 IrCl]$
- (3) [Et<sub>3</sub>P)<sub>3</sub>RhCl]
- $(4) [Ph_3P)_3 IrCl]$

- 9. Two complexes  $[Cr(H_2O_6)Cl_3]$  (A) and  $[Cr(NH_3)_6]Cl_3$  (B) are violet and yellow coloured, respectively. The incorrect statement regarding them is :
  - (1)  $\Delta_0$  value of (A) is less than that of (B).
  - (2)  $\Delta_0$  value of (A) and (B) are calculated from the energies of violet and yellow light, respectively
  - (3) Bothe absorb energies corresponding to their complementary colors.
  - (4) Bothe are paramagnetic with three unpaired electrons.
- 10. The highest value of the calculated spin only magnetic moment (in BM) among all the transition metal complexs is :
  - (1) 5.92(2) 3.87
  - (3) 6.93(4) 4.90
- 11. The complex thai has highest crystal field splitting energy ( $\Delta$ ), is :
  - (1)  $K_3[Co(CN)_6]$
  - (2)  $[Co(NH_3)_5(H_2O)]Cl_3$
  - (3)  $K_2[CoCl_4]$
  - (4)  $[Co(NH_3)_5Cl]Cl_2$
- 12. The difference in the number of unpaired electrons of a metal ion in its high-spin and low-spin octahedral complexes is two. The metal ion is :
  - $(1) Fe^{2+}$ (2)  $Co^{2+}$
  - (3) Mn<sup>2+</sup> (4) Ni<sup>2+</sup>
- 13. A reaction of cobalt(III) chloride and ethylenediamine in a 1:2 mole ratio generates two isomeric products A (violet coloured) B (green coloured). A can show optial actively, B is optically inactive. What type of isomers does A and B represent ?
  - (1) Geometrical isomers
  - (2) Ionisation isomers
  - (3) Coordination isomers
  - (4) Linkage isomers

- **14.** The compound used in the treatment of lead poisoning is :
  - (1) EDTA (2) Cis-platin
  - (3) D-penicillamine (4) desferrioxime B
- **15.** The coordination numbers of Co and Al in  $[Co(Cl)(en)_2]Cl$  and  $K_3[Al(C_2O_4)_3]$ , respectively, are :

(en=ethane-1,2-diamine)

- (1) 3 and 3 (2) 6 and 6
- (3) 5 and 6 (4) 5 and 3
- 16. The crystal fied stabilization energy (CFSE) of  $[Fe(H_2O)_6]Cl_2$  and  $K_2[NiCl_4]$ , respectively, are :-
  - (1) –0.4 $\Delta_0$  and –0.8 $\Delta_t$
  - (2) –0.4 $\Delta_0$  and –1.2 $\Delta_t$
  - (3)  $-2.4\Delta_0$  and  $-1.2\Delta_t$
  - (4)  $-0.6\Delta_0$  and  $-0.8\Delta_t$
- **17.** The INCORRECT statement is :
  - (1) the spin-only magnetic moments of  $[Fe(H_2O)_6]^{2+}$  and and  $[Cr(H_2O)_6]^{2+}$  are nearly similar.
  - (2) the spin-only magnetic moment of [Ni(NH<sub>3</sub>)<sub>4</sub>(H<sub>2</sub>O)<sub>2</sub>]<sup>2+</sup> is 2.83BM.
  - (3) the gemstone, ruby, has Cr<sup>3+</sup> ions occupying the octahedral sites of beryl.
  - (4) the color of [CoCl(NH<sub>3</sub>)<sub>5</sub>]<sup>2+</sup> is violet as it absorbs the yellow light.
- **18.** The maximum possible denticities of a ligand given below towards a common transition and inner-transition metal ion, respectively, are :

![](_page_50_Figure_19.jpeg)

**20.** The following ligand is

![](_page_50_Figure_21.jpeg)

- Bidentate
   Hexadentate
   Tetradentate
   Tridentate
- 21. The correct order of the spin-only magnetic moment of metal ions in the following low spin complexes,  $[V(CN)_6]^{4-}$ ,  $[Fe(CN)_6]^{4-}$ ,  $[Ru (NH_3)_6]^{3+}$ , and  $[Cr(NH_3)_6]^{2+}$ , is : (1)  $V^{2+} > Cr^{2+} > Ru^{3+} > Fe^{2+}$ (2)  $V^{2+} > Ru^{3+} > Cr^{2+} > Fe^{2+}$ (3)  $Cr^{2+} > V^{2+} > Ru^{3+} > Fe^{2+}$ (4)  $Cr^{2+} > Ru^{3+} > Fe^{2+} > V^{2+}$
- 22. The calculated spin-only magnetic moments (BM) of the anionic and cationic species of  $[Fe(H_2O)_6]_2$  and  $[Fe(CN)_6]$ , respectively, are :
- (1) 4.9 and 0 (2) 2.84 and 5.92 (3) 0 and 4.9 (4) 0 and 5.92 **23.** The degenerate orbitals of  $[Cr(H_2O)_6]^{3+}$  are :
  - (1)  $d_{yz}$  and  $d_{z^2}$  (2)  $d_{z^2}$  and  $d_{xz}$
  - (3)  $d_{xz}$  and  $d_{yz}$  (4)  $d_{x^2-y^2}$  and  $d_{xy}$
- 24. The one that will show optical activity is : (en = ethane-1,2-diamine)

![](_page_50_Figure_29.jpeg)

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25. The species that can have a trans-isomer is : (en = ethane-1, 2-diamine, ox = oxalate)1. (1) [Pt(en)Cl<sub>2</sub>] (2)  $[Cr(en)_2(ox)]^+$ (3) [Zn(en)Cl<sub>2</sub>] (4)  $[Pt(en)_2Cl_2]^{2+}$ Three complexes, 26. 2.  $[CoCl(NH_3)_5]^{2+}(I),$  $[Co(NH_3)_5H_2O]^{3+}$  (II) and  $[Co(NH_3)_6]^{3+}$  (III) 3. absorb light in the visible region. The correct order of the wavelength of light absorbed by them is : (1) (III) > (I) > (II) (2) (I) > (II) > (III)4. (3) (II) > (I) > (III) (4) (III) > (II) > (I) The complex ion that will lose its crystal field 27. stabilization energy upon oxidation of its metal to +3 state is (Phen =and ignore pairing 5. energy) (1)  $[Fe(phen)_3]^{2+}$ (2)  $[Zn(phen)_3]^{2+}$ 6. (3)  $[Ni(phen)_3]^{2+}$ (4)  $[Co(phen)_3]^{2+}$ Complete removal of both the axial ligands 28. (along the z-axis) from an octahedral complex leads to which of the following splitting patterns? (relative orbital energies not on scale). 7. (1)  $E \begin{bmatrix} d_{x^2-y^2} \\ d_{xy} \\ d_{z^2} \\ d_{xz}, d_{yz} \end{bmatrix}$ 8. (2)  $E \begin{bmatrix} -\frac{1}{z} \\ -\frac{1}{z^2 - y^2} \\ -\frac{1}{z^2 -$ 9. the following is true with respect to  $Li_2^+$  and  $Li_2^-$ ?  $\int_{0}^{z} E \begin{vmatrix} & & & \\$ (3) 10. (4)  $E \left| \begin{array}{c} & & & & \\ & & & & \\ & & & \\ & & & \\ & & & \\ & & & \\ & & & & \\ & & & \\ & & & \\ & & & \\ & & & \\ & & & \\ & & & \\ & & & \\$ 

#### **CHEMICAL BONDING** The element that shows greater ability to form $p\pi$ - $p\pi$ multiple bonds, is : (1) Si (2) Ge (3) Sn (4) CThe element that does NOT show catenation is: (1) Sn (2) Ge (3) Si (4) Pb The chloride that CANNOT get hydrolysed is : (1) $SiCl_4$ (2) $SnCl_4$ (3) $PbCl_4$ (4) $CCl_4$ The relative stability of +1 oxidation state of group 13 elements follows the order :-(1) Al < Ga < Tl < In(2) Tl < In < Ga < Al(3) Al < Ga < In < Tl (4) Ga < Al < In < TlThe hydride that is NOT electron deficient is :-(1) $B_2H_6$ (2) $AlH_3$ (3) $SiH_4$ (4) $GaH_3$ The type of hybridisation and number of lone pair(s) of electrons of Xe in $XeOF_4$ , respectively, are : (1) $sp^3d$ and 1 (2) $sp^3d$ and 2 (3) $sp^{3}d^{2}$ and 1 (4) $sp^{3}d^{2}$ and 2 Two pi and half sigma bonds are present in: $(1) N_2^+$ (2) $N_2$ $(3) O_2^+ (4) O_2$ The pair that contains two P-H bonds in each of the oxoacids is : (1) $H_3PO_2$ nad $H_4P_2O_5$ (2) $H_4P_2O_5$ and $H_4P_2O_6$ (3) H<sub>3</sub>PO<sub>3</sub> and H<sub>3</sub>PO<sub>2</sub> (4) $H_4P_2O_5$ nad $H_3PO_3$ According to molecular orbital theory, which of

- (1) Both are unstable
- (2)  $Li_2^+$  is unstable and  $Li_2^-$  is stable
- (3)  $Li_2^+$  is stable and  $Li_2^-$  is unstable
- (4) Both are stable
- C<sub>60</sub>, an allotrope of carbon contains :
  - (1) 20 hexagons and 12 pentagons.
  - (2) 12 hexagons and 20 pentagons.
  - (3) 18 hexagons and 14 pentagons.
  - (4) 16 hexagons and 16 pentagons.

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| 11. | Aluminium is usually found in +3 oxidation<br>stagte. In contarast, thallium exists in +1 and<br>+3 oxidation states. This is due to :<br>(1) lanthanoid contraction<br>(2) lattice effect<br>(3) diagonal relationship<br>(4) inert pair effect   | 19.<br>20. | The number of pentagons in $C_{60}$ and trigons<br>(triangles) in white phosphorus, respectively,<br>are:<br>(1) 12 and 3 (2) 20 and 4<br>(3) 12 and 4 (4) 20 and 3<br>The ion that has sp <sup>3</sup> d <sup>2</sup> hybridization for the<br>central atom, is :<br>(1) TER 5 (2) UP 15  |
|-----|--|------------|--|
| 12. | <ul> <li>Good reducing nature of H<sub>3</sub>PO<sub>2</sub> attributed to the presence of:</li> <li>(1) One P-OH bond</li> <li>(2) One P-H bond</li> <li>(3) Two P-H bonds</li> <li>(4) Two P-OH bonds</li> </ul>   | 21.        | (1) $[ICI_2]^-$ (2) $[IF_6]$<br>(3) $[ICI_4]^-$ (4) $[BrF_2]^-$<br>The covalent alkaline earth metal halide<br>(X = Cl, Br, I) is :  |
| 13. | In which of the following processes, the bond<br>order has increased and paramagnetic character<br>has changed to diamagnetic ?<br>(1) $N_2 \rightarrow N_2^+$ (2) NO $\rightarrow$ NO <sup>+</sup><br>(3) $O_2 \rightarrow O_2^{2-}$ (4) $O_2 \rightarrow O_2^+$  | 22.        | (1) $CaX_2$ (2) $SrX_2$<br>(3) $BeX_2$ (4) $MgX_2$<br>Among the following molecules / ions,<br>$C_2^{2-}, N_2^{2-}, O_2^{2-}, O_2$   |
| 14. | The number of 2-centre-2-electron and<br>3-centre-2-electron bonds in $B_2H_6$ ,<br>respectively, are :<br>(1) 2 and 4 (2) 2 and 1<br>(3) 2 and 2 (4) 4 and 2  | 23.        | which one is dramagnetic and has the shortest<br>bond length?<br>(1) $C_2^{2-}$ (2) $N_2^{2-}$ (3) $O_2$ (4) $O_2^{2-}$<br>The correct statement about ICl <sub>5</sub> and ICl <sub>4</sub> <sup>-</sup> is   |
| 15. | The C–C bond length is maximum in<br>(1) graphite (2) $C_{70}$<br>(3) diamond (4) $C_{70}$   |            | (1) $ICl_5$ is trigonal bipyramidal and $ICl_4^-$ is tetrahedral.  |
| 16. | The correct sequence of thermal stability of the following carbonates is<br>(1) $BaCO_3 < CaCO_3 < SrCO_3 < MgCO_3$<br>(2) $MgCO_3 < CaCO_3 < SrCO_3 < BaCO_3$<br>(3) $BaCO_3 < SrCO_3 < CaCO_3 < MgCO_3$<br>(4) $MgCO_3 < SrCO_3 < CaCO_3 < BaCO_3$   |            | <ul> <li>(2) ICl<sub>5</sub> is square pyramidal and ICl<sub>4</sub><sup>-</sup> is tetrahedral.</li> <li>(3) ICl<sub>5</sub> is square pyramidal and ICl<sub>4</sub><sup>-</sup> is square planar.</li> </ul>   |
| 17. | <ul> <li>The correct statement among the following is (1) (SiH<sub>3</sub>)<sub>3</sub>N is pyramidal and more basic than (CH<sub>3</sub>)<sub>3</sub>N</li> <li>(2) (SiH<sub>3</sub>)<sub>3</sub>N is planar and more basic than (CH<sub>3</sub>)<sub>3</sub>N</li> <li>(3) (SiH<sub>3</sub>)<sub>3</sub>N is pyramidal and less basic than (CH<sub>3</sub>)<sub>3</sub>N</li> <li>(4) (SiH<sub>3</sub>)<sub>3</sub>N is planar and less basic than</li> </ul>                    | 24.        | (4) Both are isostructural.<br>The correct order of the oxidation states of<br>nitrogen in NO, N <sub>2</sub> O, NO <sub>2</sub> and N <sub>2</sub> O <sub>3</sub> is :<br>(1) NO <sub>2</sub> < N <sub>2</sub> O <sub>3</sub> < NO < N <sub>2</sub> O<br>(2) NO <sub>2</sub> < NO < N <sub>2</sub> O <sub>3</sub> < NO < N <sub>2</sub> O<br>(3) N <sub>2</sub> O < N <sub>2</sub> O <sub>3</sub> < NO < NO <sub>2</sub><br>(4) N <sub>2</sub> O < NO < N <sub>2</sub> O <sub>3</sub> < NO <sub>2</sub> |
| 18. | $(CH_3)_3N$<br>The basic structural unit of feldspar, zeolites,<br>mica, and asbestos is :<br>$(1) (SiO_3)^{2-}$ (2) $SiO_2$   | 25.<br>26. | Among the following, the molecule expected<br>to be stabilized by anion formation is :<br>$C_2$ , $O_2$ , NO, $F_2$<br>(1) NO (2) $C_2$ (3) $F_2$ (4) $O_2$<br>The number of water molecule(s) not   |
|     | (3) $(SiO_4)^{4-}$ (4) $\stackrel{R}{\stackrel{I}{\underset{R}{\overset{I}{\underset{R}{\overset{I}{\underset{R}{\overset{I}{\underset{R}{\overset{I}{\underset{R}{\overset{I}{\underset{R}{\underset{R}{\overset{I}{\underset{R}{\underset{R}{\overset{I}{\underset{R}{\underset{R}{\overset{I}{\underset{R}{\underset{R}{\overset{I}{\underset{R}{\underset{R}{\overset{I}{\underset{R}{\underset{R}{\underset{R}{\underset{R}{\underset{R}{\underset{R}{\underset{R}{\underset$ |            | coordinated to copper ion directly in $CuSO_4.5H_2O$ , is :<br>(1) 4 (2) 3 (3) 1 (4) 2   |

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| 27. | Among the followin                          | g species, the diamagnetic  | 2. | N        | latch the following  | g items        | s in column I with the                        |
|-----|---|---|----|----------|--|----------------|---|
|     | $(1) \Omega_{-}$                            | (2) NO  |    |          |  |                | Colorer H                                     |
|     | (1) $O_2$<br>(3) B                          | $(2) \Pi \mathbf{C} \mathbf{C} \mathbf{C} \mathbf{C} \mathbf{C} \mathbf{C} \mathbf{C} \mathbf{C}$ |    | (i)      | Na <sub>2</sub> CO <sub>3</sub> ·10 H <sub>2</sub> O   | (P)            | Portland cement                               |
| 20  | (5) $\mathbf{D}_2$                          | (+) CO  |    |          |  |                | ingredient                                    |
| 28. | state and vanour pl                         | ymum chioride in the solid  |    | (ii)     | $Mg(HCO_3)_2$  | (Q)            | Castner-Keller                                |
|     | (1) chain and dimer                         | iase, respectively, are .   |    | (iii)    | NaOH   | ( <b>R</b> )   | Solvay process                                |
|     | (1) chain and differ<br>(3) dimeric and dim | eric(4) dimeric and chain   |    | (iv)     | Ca <sub>3</sub> Al <sub>2</sub> O <sub>6</sub>   | $(\mathbf{R})$ | Temporary                                     |
| 29  | HF has highest boili                        | ng point among hydrogen   |    | × ,      |  |                | hardness                                      |
| 27. | halides because it l                        | ng point among nyurogen   |    | (]       | $(i) \rightarrow (C); (ii) $   | B); (ii        | ii) $\rightarrow$ (D); (iv) $\rightarrow$ (A) |
|     | (1) lowest dissociat                        | ion enthalny  |    | (2       | $2) (i) \rightarrow (C); (ii) \rightarrow (C)$   | D); (ii        | ii) $\rightarrow$ (B); (iv) $\rightarrow$ (A) |
|     | (1) lowest dissociat                        | r Weals' interactions   |    | (3       | $(i) \rightarrow (D); (ii) $   | A); (i         | ii) $\rightarrow$ (B); (iv) $\rightarrow$ (C) |
|     | (2) strongest value                         | a waals interactions  |    | (4       | $(i) \rightarrow (B); (ii) \rightarrow (ii$ | C); (ii        | ii) $\rightarrow$ (A); (iv) $\rightarrow$ (D) |
|     | (3) strongest hydrog                        | gen bonding   | 3. | Т        | he metal used for r  | naking         | g X-ray tube window                           |
| •   | (4) lowest ionic cha                        | racter  |    | is       | :  |                |   |
| 30. | The correct stateme                         | ents among I to III are :   |    | (1       | ) Mg (2) Na  | (              | 3) Ca (4) Be                                  |
|     | (I) Valence bond the                        | neory cannot explain the  | 4. | Т        | he alkaline earth  | metal          | nitrate that does not                         |
|     | color exhibite                              | d by transition metal   |    | CI       | ystallise with wa  | ter mo         | olecules, is :                                |
|     | complexes.                                  |   |    | (1       | ) $Sr(NO_3)_2$   | (              | 2) $Mg(NO_3)_2$                               |
|     | (II) Valence bor                            | nd theory can predict   |    | (3       | B) $Ca(NO_3)_2$  | (              | 4) $Ba(NO_3)_2$                               |
|     | quantitatively the                          | ne magnetic properties of   | 5. | Т        | he metal that form   | s nitric       | le by reacting directly                       |
|     | transtition metal                           | complexes.  |    | W        | ith $N_2$ of air, is :   |                |   |
|     | (III) Valence bond                          | theory cannot distinguish   |    | (1       | ) K (2) Cs   | (              | 3) Li (4) Rb                                  |
|     | ligands as weak                             | and strong field ones.  | 6. | S        | odium metal o  | n dis          | solution in liquid                            |
|     | (1) (I) and (II) only                       |   |    | a        | nmonia gives a de  | ep blu         | e solution due to the                         |
|     | (2) (I), (II) and (III)                     |   |    | fo       | ormation of:   |                |   |
|     | (3) (I) and (III) only                      | 1   |    | ()       | ) sodium ion-ami   | monia          | complex                                       |
|     | (4) (II) and (III) on                       | V   |    | (2       | sodium-ammon   | ia cor         | nnley   |
| 31  | The oxoacid of sult                         | bur that does not contain   |    | (-       | ammoniated ele   | ectron         | npiex<br>s                                    |
| 51. | bond between sulph                          | our atoms is :  | 7. | Ň        | lagnisium powde  | r burn         | s in air to give:                             |
|     | (1) $H_2S_4O_4$                             | $(2) H_2S_2O_7$   |    | (1       | ) MgO only   |                | 6   |
|     | (3) $H_2S_2O_3$                             | (4) $H_2S_2O_4$   |    | (2       | 2) MgO and Mg(   | $NO_3)_2$      | ,   |
| 32. | During the change of                        | of $O_2$ to $O_2^-$ , the incoming  |    | (3       | $MgO and Mg_3$   | $N_2$          |   |
|     | electron goes to the                        | orbital :   |    | (4       | ) $Mg(NO_3)_2$ and   | Mg_3l          | N <sub>2</sub>                                |
|     | (1) $\sigma^* {}^2P_z$                      | (2) $\pi {}^{2}P_{v}$   | 8. | А        | hydrated solid X   | on he          | eating initially gives                        |
|     | (3) $\pi^{*2}P_{x}$                         | (4) $\pi {}^{2}P_{x}$   | 1  | a        | monohydrated con   | mpour          | nd Y. Y upon heating                          |
|     | S-BI  | OCK   |    | al       | pove 373K leads  | s to a         | n anhydrous white                             |
| 1   |   |   |    | p<br>(1  | $\sum $ Washing sode $\sum$  | L, resp        | becuvely, are:                                |
| 1.  | A metal on combust                          | ion in excess air forms X,  | 1  | (1<br>(2 | 2) Washing soda :  | and de         | ead burnt plaster.                            |
|     | $\Lambda$ upon hydrolysis w                 | Fun water yields $H_2O_2$ and   | 1  | (3       | B) Baking soda an  | d dea          | d burnt plaster.                              |
|     | $O_2$ along with anoth                      | er product. I ne metal is : $(2) M = (4) L^{2}$   | 1  | (4       | ) Baking soda ar   | id sod         | a ash.  |
|     | (1) $Kb$ (2) $Na$                           | (3) Mg (4) L1   |    |          | 2  |                |   |

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|----------|---|---|-------|--|--|--|--|--|
| 9.       | <ul> <li>The temporary hardness of a water sample is due to compound X. Boiling this sample converts X to compound Y. X and Y, respectively, are : <ul> <li>(1) Ca(HCO<sub>3</sub>)<sub>2</sub> and CaO</li> <li>(2) Mg(HCO<sub>3</sub>)<sub>2</sub> and MgCO<sub>3</sub></li> <li>(3) Mg(HCO<sub>3</sub>)<sub>2</sub> and Mg(OH)<sub>2</sub></li> <li>(4) Ca(HCO<sub>3</sub>)<sub>2</sub> and Ca(OH)<sub>2</sub></li> </ul> </li> <li>The INCORRECT statement is : <ul> <li>(1) Lithium is least reactive with water among the alkali metals.</li> <li>(2) LiCl crystallises from aqueous solution as LiCl.2H<sub>2</sub>O.</li> <li>(3) Lithium is the strongest reducing agent among the alkali metals.</li> <li>(4) LiNO<sub>3</sub> decomposes on heating to give LiNO<sub>2</sub> and O<sub>2</sub>.</li> </ul> </li> </ul> |   |       | <ul> <li>6. The effect of lanthanoid contraction lanthanoid series of elements by an means : <ul> <li>(1) decrease in both atomic and ionic</li> <li>(2) increase in atomic radii and decrease in atomic radii</li> <li>(3) increase in both atomic and ionic</li> <li>(4) decrease in atomic radii and increase in atomic radii and increase in atomic radii</li> </ul> </li> <li>7. The electronegativity of aluminium is to : <ul> <li>(1) Boron</li> <li>(2) Carbon</li> <li>(3) Lithium</li> <li>(4) Berylliun</li> </ul> </li> <li>8. In general, the properties that decrease increase down a group in the period respectively, are : <ul> <li>(1) I to the interval of the period p</li></ul></li></ul> |  |  |  |  |
|          | PERIODIC  | TABLE   |       | (2) electronegativity  | $\gamma$ and atomic radius.  |  |  |  |
| 1.       | The element with Z = 2<br>will be an/a :<br>(1) transition metal<br>(2) inner-transition metal  | 120 (not yet discovered)<br>etal  |       | <ul> <li>(3) atomic radius an</li> <li>(4) electron gain enth</li> </ul>   | d electronegativity.<br>alpy and electronegativity.  |  |  |  |
|          | <ul><li>(2) alkaline earth meta</li><li>(4) alkali metal</li></ul>  | al  | 9.    | of oxygen is –141 k.<br>gain enthalpy is :   | ron gain enthalpy ( $\Delta_{eg}H$ )<br>J/mol, its second electron                                 |  |  |  |
| 2.       | The correct order of a  | tomic radii is :  |       | (1) almost the same  | as that of the first   |  |  |  |
|          | (1) $\text{Ce} > \text{Eu} > \text{Ho} > 1$   | N   |       | (2) negative, but le   | ss negative than the first   |  |  |  |
|          | (2) $N > Ce > Eu > H$   |   |       | (3) a positive value   |  |  |  |  |
|          | (5) Eu > Ce > H0 > .  |   |       | (4) a more negative  | value than the first   |  |  |  |
| 3.       | (4) $\Pi \cup > \Pi > Eu > C$<br>The amphoteric hydro   | oxide is :  | 10.   | The pair that has sir  | nilar atomic radii is :  |  |  |  |
|          | (1) $Ca(OH)_2$  | (2) $Be(OH)_2$  |       | (1) Sc and Ni  | (2) Ti and HF  |  |  |  |
| 4.       | (3) $Sr(OH)_2$<br>The correct order of the Al and S is:<br>(1) $S < C < Al < Cs$<br>(2) $S < C < Cs < Al$<br>(3) $C < S < Cs < Al$<br>(4) $C < S < Al < Cs$   | (4) Mg(OH) <sub>2</sub><br>ne atomic radii of C, Cs,                                | 11.   | <ul> <li>(3) Mo and W</li> <li>In comparison to be</li> <li>(1) lesser nuclear of ionisation enthal</li> <li>(2) lesser nuclear</li> </ul>   | (4) Mn and Re<br>pron, berylium has :<br>charge and greater first<br>py<br>charge and lesser first |  |  |  |
| 5.       | <ul> <li>(1) C &lt; B &lt; Al &lt; Cs</li> <li>The correct option with electronegativity value</li> <li>(1) Ga &lt; Ge</li> <li>(3) P &gt; S</li> </ul>   | th respect to the Pauling<br>es of the elements is :-<br>(2) Si < Al<br>(4) Te > Se |       | <ul> <li>ionisation enthal</li> <li>(3) greater nuclear</li> <li>ionisation enthal</li> <li>(4) greater nuclear</li> <li>ionisation enthal</li> </ul>  | py<br>charge and greater first<br>py<br>charge and lesser first<br>py                              |  |  |  |

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| 12.<br>13. | The group number, number of valence<br>electrons, and valency of an element with<br>atomic number 15, respectively, are<br>(1) 16, 5 and 2 (2) 16, 6 and 3<br>(3) 15, 5 and 3 (4) 15, 6 and 2<br>The highest possible oxidation states of<br>uranium and plutonium, respectively, are :-<br>(1) 6 and 4 (2) 7 and 6   | 2.<br>3.    | The pair that does NOT require calcination is:<br>(1) ZnO and MgO<br>(2) Fe <sub>2</sub> O <sub>3</sub> and CaCO <sub>3</sub> .MgCO <sub>3</sub><br>(3) ZnO and Fe <sub>2</sub> O <sub>3</sub> .xH <sub>2</sub> O<br>(4) ZnCO <sub>3</sub> and CaO<br>Match the ores(Column A) with the metals<br>(column B) :<br>Column A  |
|------------|---|-------------|---|
| 14         | (3) 4 and 6 (4) 6 and 7   |             | Column-A Column-B<br>Ores Metals  |
| 14.        | The noble gas that does NOT occur in the atmosphere is:<br>(1) He (2) Ra (3) Ne (4) Kr<br>The correct order of the first ionization<br>enthalpies is:<br>(1) Mn < Ti < Zn < Ni<br>(2) Ti < Mn < Ni < Zn   |             | (I) Siderite(a) Zinc(II) Kaolinite(b) Copper(III) Malachite(c) Iron(IV) Calamine(d) Aluminium(1) I-b; II-c; III-d; IV-a(2) I-c; II-d; III-a; IV-b(3) I-c; II-d; III-b; IV-a   |
|            | (3) $Zn < Ni < Mn < Ti$<br>(4) $Ti < Mn < Zn < Ni$  |             | (4) I-a; II-b; III-c; IV-d  |
| 16.        | (4) T1 < Mn < Zn < N1<br>The correct order of hydration enthalpies of<br>alkali metal ions is -<br>(1) Li <sup>+</sup> > Na <sup>+</sup> > K <sup>+</sup> > Rb <sup>+</sup> > Cs <sup>+</sup><br>(2) Li <sup>+</sup> > Na <sup>+</sup> > K <sup>+</sup> > Cs <sup>+</sup> > Rb <sup>+</sup>   | 4.<br>5.    | The ore that contains both iron and copper is:(1) malachite(2) dolomite(3) azurite(4) copper pyritesThe correct statement regarding the givenEllingham diagram is:  |
| 17.        | (3) Na <sup>+</sup> > Li <sup>+</sup> > K <sup>+</sup> > Rb <sup>+</sup> > Cs <sup>+</sup><br>(4) Na <sup>+</sup> > Li <sup>+</sup> > K <sup>+</sup> > Cs <sup>+</sup> > Rb <sup>+</sup><br>The IUPAC symbol for the element with<br>atomic number 119 would be :<br>(1) when (2) when (3) when (4) when  |             | 4Cu+02 -> 2Cu20   |
| 18.        | <ul> <li>(1) unit (2) unit (3) une (4) une</li> <li>The size of the iso-electronic species Cl<sup>-</sup>, Ar and Ca<sup>2+</sup> is affected by -</li> <li>(1) Principal quantum number of valence shell</li> <li>(2) Nuclear charge</li> <li>(3) Azimuthal quantum number of valence shell</li> <li>(4) Electron-electron interaction in the outer</li> </ul> | ∆G°(kJ/mol) | -300<br>$-600$ $2Zn^{+}O_{2}^{-}2ZnO$ $2C_{x_{O}}^{-}2C_{O}^{-}2C_$ |
| 19.        | orbitals<br>The element having greatest difference<br>between its first and second ionization<br>energies, is :<br>(1) Ca (2) K (3) Ba (4) Sc   |             | $-1050 \underbrace{4}_{3} \text{Al} + \text{O}_{2} \xrightarrow{7} 3$ $500^{\circ}\text{C}  \text{Temp.}(^{\circ}\text{C})  2000^{\circ}\text{C}$ (1) At 800°C, Cu can be used for the extraction of Zn from ZnO  |
|            | METALLURGY  |             | (2) At 500 C, coke can be used for the extraction $\sqrt{2}$  |
| 1.         | In the Hall-Heroult process, aluminium isformed at the cathode. The cathode is made outof :(1) Platinum(2) Carbon(3) Pure aluminium(4) Copper   |             | ot Zn from ZnO<br>(3) Coke cannot be used for the extraction of<br>Cu from Ca <sub>2</sub> O.<br>(4) At 1400°C, Al can be used for the extraction<br>of Zn from ZnO   |

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| 6.  | The reaction that does NOT define calcination is :-  | 12. | The Mond pro  |
|-----|--|-----|---|
|     | (1) $ZnCO_3 \xrightarrow{\Lambda} ZnO + CO_2$  |     | (1) extraction<br>(2) Purification                    |
|     | (2) $\operatorname{Fe_2O_2} \times \operatorname{H_2O} \xrightarrow{\Delta} \operatorname{Fe_2O_2} + \operatorname{XH_2O}$                                       |     | (3) Purificatio                                       |
|     | (3) CaCO <sub>2</sub> ·MgCO <sub>2</sub> $\xrightarrow{\Delta}$ CaO + MgO + 2 CO <sub>2</sub>  |     | (4) Extraction  |
| 7   | (4) $2 \operatorname{Cu}_2 S + 3 \operatorname{O}_2 \xrightarrow{\Lambda} 2 \operatorname{Cu}_2 O + 2 \operatorname{SO}_2$<br>Hall Herenkie meesen is given by " | 13. | The ore that confluoride is :                         |
| 7.  | (1) $\operatorname{Cr}_2\operatorname{O}_3 + 2\operatorname{Al} \to \operatorname{Al}_2\operatorname{O}_3 + 2\operatorname{Cr}$                                  |     | <ul><li>(1) magnetite</li><li>(3) malachite</li></ul> |
|     | (2) $Cu^{2+}$ (aq.) + $H_2(g) \rightarrow Cu(s) + 2H^+$ (aq)   | 14. | The one that i  |
|     | (3) $ZnO + C \xrightarrow{Coke, 10/3K} Zn + CO$  |     | (1) bauxite   |
| 0   | (4) $2Al_2O_3 + 3C \rightarrow 4Al + 3CO_2$  |     | (3) calamine  |
| ð.  | a person X and this method is related to the   | 15. | Assertion: For  |
|     | process Y of ores. X and Y, respectively, are:   |     | ore is used.  |
|     | (1) fisher woman and concentration   |     | Reason: Haer  |
|     | (2) washer man and reduction   |     | (1) Only the r  |
|     | (3) washer woman and concentration<br>(4) fisher man and reduction   |     | (2) Both the a  |
| 9.  | The correct statement is :   |     | and the rea   |
|     | (1) leaching of bauxite using concentrated   |     | the assertion   |
|     | NaOH solution gives sodium aluminate   |     | (3) Only the a  |
|     | (2) the blistered appearance of copper during  |     | (4) Both the a  |
|     | the metallurgical process is due to the  |     | but the reas  |
|     | evolution of $CO_2$  |     | for the ass   |
|     | (3) pig iron is obtained from cast iron  | 16. | Match the ref   |
|     | (4) the Hall-Heroult process is used for the production of aluminium and iron  |     | metals (Colun   |
| 10  | The correct statement is :   |     | (Defining mot   |
| 10. |  |     | (Reming file)   |
|     | (1) zincite is a carbonate ore   |     | (I) Equation (II) Zone Re                             |
|     | (2) aniline is a froth stabilizer  |     | (II) Mond Pr  |
|     | (3) zone refining process is used for the refining of titanium   |     | (IV) Van Arke   |
|     | (4) sodium evanide cannot be used in the   |     | (1) (1) $-$ (0), (<br>(2) (1) $-$ (b): (              |
|     | metallurgy of silver   |     | (2) (1) (0), (<br>(3) (1) – (c): (                    |
| 11. | With respect to an ore, Ellingham diagram  |     | (4) (I) – (c): (                                      |
|     | helps to predict the feasibility of its -  | 17. | The allov used  |
|     | (1) Vapour phase refining  | -   | is :-   |
|     | <ul><li>(2) Zone retining</li><li>(3) Electrolysis</li></ul>   |     | (1) Mg – Sn   |
|     | (4) Thermal reduction  |     | (3) Mg – Al   |
|     |  |     | $\sim $   |

| • | The Mond process is use  | ed for the             |
|---|--|------------------------|
|   | (1) extraction of Mo   |                        |
|   | (2) Purification of Ni   |                        |
|   | (3) Purification of Zr and   | d Ti                   |
|   | (4) Extraction of Zn   |                        |
| • | The ore that contains the fluoride is :  | metal in the form of   |
|   | (1) magnetite (  | 2) sphalerite          |
|   | (3) malachite (  | 4) cryolite            |
| • | The one that is not a car  | bonate is :            |
|   | (1) bauxite (  | 2) siderite            |
|   | (3) calamine (   | 4) malachite           |
| • | Assertion: For the extract   | ion of iron, haematite |
|   | ore is used.   |                        |
|   | Reason: Haematite is a c   | arbonate ore of iron.  |
|   | (1) Only the reason is co  | prrect.                |
|   | (2) Both the assertion an  | d reason are correct   |
|   | and the reason is the co   | orrect explanation for |
|   | the assertion.   |                        |
|   | (3) Only the assertion is  | correct.               |
|   | (4) Both the assertion an  | d reason are correct,  |
|   | but the reason is not th   | e correct explanation  |
|   | for the assertion.   |                        |
| • | Match the refining methorem metals (Column II).  | ods (Column I) with    |
|   | Column I   | Column II              |
|   | (Refining methods)   | (Metals)               |
|   | (I) Liquation  | (a) Zr                 |
|   | (II) Zone Refining   | (b) Ni                 |
|   | (III) Mond Process   | (c) Sn                 |
|   | (IV) Van Arkel Method  | (d) Ga                 |
|   | (1) $(I) - (b); (II) - (c); (I)$   | II) - (d); (IV) - (a)  |
|   | (2) (1) – (b); (11) – (d); (1<br>(2) (1) – (c) (11) – (d); (1) (1) (1) (1) (1) (1) (1) (1) (1) (1) | (II) - (a); (IV) - (c) |
|   | (3) (1) – (c); (11) – (a); (1  | II) - (b); (IV) - (d)  |
|   | (4) (1) - (c); (11) - (d); (1)   | (II) - (D); (IV) - (a) |

**17.** The alloy used in the construction of aircrafts is :-

| (1) Mg – Sn | (2) Mg – Mn |
|-------------|-------------|
| (3) Mg – Al | (4) Mg – Zn |

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|                 | QUANTUM NUMBER  | 3.       | Diborane $(B_2H_6)$ reacts independently with $O_2$<br>and H O to produce, respectively.   |
|-----------------|---|----------|--|
| 1.              | The total number of isotopes of hydrogen and<br>number of radioactive isotopes among them,<br>respectively, are :<br>(1) 2 and 0 (2) 3 and 2<br>(3) 3 and 1 (4) 2 and 1<br>The isotopes of hydrogen are :   | 4.       | (1) HBO <sub>2</sub> and H <sub>3</sub> BO <sub>3</sub> (2) H <sub>3</sub> BO <sub>3</sub> and B <sub>2</sub> O <sub>3</sub><br>(3) B <sub>2</sub> O <sub>3</sub> and H <sub>3</sub> BO <sub>3</sub> (4) B <sub>2</sub> O <sub>3</sub> and [BH <sub>4</sub> ] <sup>-</sup><br>The one that is extensively used as a<br>piezoelectric material is :<br>(1) Quartz (2) Amorphous silica<br>(3) Mica (4) Tridymite  |
|                 | <ol> <li>(1) Tritium and protium only</li> <li>(2) Deuterium and tritium only</li> <li>(3) Protium and deuterum only</li> <li>(4) Protium deuterium and tritium</li> </ol>  | 5.       | The amorphous form of silica is :(1) quartz(2) kieselguhr(3) cristobalite(4) tridymite   |
| 3.<br>4.        | The $71^{st}$ electron of an element X with an atomic number of 71 enters into the orbital :<br>(1) 4f (2) 6p (3) 6s (4) 5d<br>The quantum number of four electrons are   | 6.       | The correct statements among I to III regarding<br>group 13 element oxides are,<br>(I) Boron trioxide is acidic.   |
| 5.              | given below -<br>I. $n = 4$ , $l = 2$ , $m_l = -2$ , $m_s = -\frac{1}{2}$<br>II. $n = 3$ , $l = 2$ , $m_l = 1$ , $m_s = +\frac{1}{2}$<br>III. $n = 4$ , $l = 1$ , $m_l = 0$ , $m_s = +\frac{1}{2}$<br>IV. $n = 3$ , $l = 1$ , $m_l = 1$ , $m_s = -\frac{1}{2}$<br>The correct order of their increasing energies<br>will be -<br>(1) IV < III < II < I (2) IV < II < III < I<br>(3) I < II < III < IV (4) I < III < II < IV<br>The isoelectronic set of ions is :<br>(1) N <sup>2</sup> - Lite N <sup>2</sup> = -1 O <sup>2</sup> | 7.<br>8. | <ul> <li>(II) Oxides of aluminium and gallium are amphoteric.</li> <li>(III) Oxides of indium and thalliumare basic.</li> <li>(1) (I), (II) and (III) (2) (II) and (III) only</li> <li>(3) (I) and (III) only (4) (I) and (II) only</li> <li>(3) (I) and (III) only (4) (I) and (II) only</li> <li>(1) C &gt; Si &gt; Ge ≈ Sn (2) C &gt; Sn &gt; Si ≈ Ge</li> <li>(3) Ge &gt; Sn &gt; Si &gt; C (4) Si &gt; Sn &gt; C &gt; Ge</li> <li>The synonym for water gas when used in the</li> </ul> |
|                 | (1) $N^{3-}$ , $Li^+$ , $Mg^{2+}$ and $O^{2-}$<br>(2) $Li^+$ , $Na^+$ , $O^{2-}$ and $F^-$<br>(3) $F^-$ , $Li^+$ , $Na^+$ and $Mg^{2+}$<br>(4) $N^{3-}$ , $O^{2-}$ , $F^-$ and $Na^+$<br><b>P-BLOCK</b>   |          | production of methanol is :-<br>(1) natural gas (2) laughing gas<br>(3) syn gas (4) fuel gas<br><b>D-BLOCK</b>   |
| <u>1.</u><br>2. | Among the following reactions of hydrogen<br>with halogens, the one that requires a catalyst<br>is :<br>(1) $H_2 + I_2 \rightarrow 2HI$ (2) $H_2 + F_2 \rightarrow 2HF$<br>(3) $H_2 + Cl_2 \rightarrow 2HCI$ (4) $H_2 + Br_2 \rightarrow 2HBr$<br>Which of the following is not and example of  | 1.<br>2. | The element that usually does not show variable<br>oxidation states is :<br>(1) V (2) Ti (3) Sc (4) Cu<br>$\underline{A} \xrightarrow{4 \text{ KOH, O}_2} 2\underline{B} + 2 \text{ H}_2\text{O}$ (Green)<br>$3 \underline{B} \xrightarrow{4 \text{ HCl}} 2 \underline{C} + \text{ MnO}_2 + 2 \text{ H}_2\text{O}$   |
|                 | <ul> <li>heterogeneous catalytic reaction ?</li> <li>(1) Ostwald's process</li> <li>(2) Haber's process</li> <li>(3) Combustion of coal</li> <li>(4) Hydrogenation of vegetable oils</li> </ul>   |          | (Purple)<br>$2 \xrightarrow{B} \xrightarrow{H_2O, \text{ KI}} 2 \xrightarrow{A} + 2\text{KOH} + \overrightarrow{D}$<br>In the above sequence of reactions,<br>$\overrightarrow{A}$ and $\overrightarrow{D}$ respectively, are :-<br>(1) KIO <sub>3</sub> and MnO <sub>2</sub> (2) KI and K <sub>2</sub> MnO <sub>4</sub><br>(3) MnO <sub>2</sub> and KIO <sub>3</sub> (4) KI and KMnO <sub>4</sub>   |

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3.

4.

| 3. | The transition element that has lowest enthalpy |
|----|---|
|    | of atomisation, is :                            |

(1) Zn (2) Cu (3) V (4) Fc

4. Match the catalysts (Column I) with products (Column II).

| Column I                    | Column II                            |
|-----------------------------|--------------------------------------|
| $(A)V_2O_5$                 | (i) Polyethylene                     |
| (B) $TiCl_4/Al(Me)_3$       | (ii) ethanal                         |
| (C) PdCl <sub>2</sub>       | (iii) H <sub>2</sub> SO <sub>4</sub> |
| (D) Iron Oxide              | (iv) NH <sub>3</sub>                 |
| (1) (A)-(ii); (B)-(iii); (C | C)-(i); (D)-(iv)                     |
| (2) (A)-(iii); (B)-(i); (C  | )-(ii); (D)-(iv)                     |
| (3) (A)-(iii); (B)-(iv); (  | C)-(i); (D)-(ii)                     |
| (4) (A)-(iv); (B)-(iii); (  | C)-(ii); (D)-(i)                     |

- 5. Consider the hydrates ions of Ti<sup>2+</sup>, V<sup>2+</sup>, Ti<sup>3+</sup> and Sc<sup>3+</sup>. The correct order of their spin-only magnetic moments is :
  - (1)  $Sc^{3+} < Ti^{3+} < Ti^{2+} < V^{2+}$
  - (2)  $Ti^{3+} < Ti^{2+} < Sc^{3+} < V^{2+}$
  - (3)  $Sc^{3+} < Ti^{3+} < V^{2+} < Ti^{2+}$
  - (4)  $V^{2+} < Ti^{2+} < Ti^{3+} < Sc^{3+}$

### HYDROGEN & IT'S COMPOUND

- **1.** NaH is an example of :
  - (1) Electron-rich hydride
  - (2) Molecular hydride
  - (3) Saline hydride
  - (4) Metallic hydride
- 2. The correct statements among (a) to (d) regarding H<sub>2</sub> as a fuel are :
  - (a) It produces less pollutant than petrol
  - (b) A cylinder of compressed dihydrogen weighs ~ 30 times more than a petrol tank producing the same amount of energy
  - (c) Dihydrogen is stored in tanks of metal alloys like NaNi<sub>5</sub>
  - (d) On combustion, values of energy released per gram of liquid dihydrogen and LPG are 50 and 142 kJ, respectively
  - (1) b and d only (2) a, b and c only
  - (3) b, c and d only (4) a and c only

The temporary hardness of water is due to :-(1)  $Ca(HCO_3)_2$  (2) NaCl (3)  $Na_2SO_4$  (4)  $CaCl_2$ The chemical nature of hydrogen preoxide is :-

- (1) Oxidising and reducing agent in acidic medium, but not in basic medium.
- (2) Oxidising and reducing agent in both acidic and basic medium
- (3) Reducing agent in basic medium, but not in acidic medium
- (4) Oxidising agent in acidic medium, but not in basic medium.
- 5. The metal that gives hydrogen gas upon treatment with both acid as well as base is :
  (1) zinc
  (2) iron
  - (3) magnesium (4) mercury

# ENVIRONMENTAL CHEMISTRY

|   | 1. | Water samples with BC                   | D values of 4 ppm and      |  |  |  |  |  |  |  |  |  |  |
|---|----|---|----------------------------|--|--|--|--|--|--|--|--|--|--|
|   |    | 18 ppm, respectively,                   | are :                      |  |  |  |  |  |  |  |  |  |  |
|   |    | (1) Highly polluted and Clean           |                            |  |  |  |  |  |  |  |  |  |  |
|   |    | (2) Highly polluted and Highly polluted |                            |  |  |  |  |  |  |  |  |  |  |
|   |    | (3) Clean and Highly                    | polluted                   |  |  |  |  |  |  |  |  |  |  |
| - |    | (4) Clean and Clean                     |                            |  |  |  |  |  |  |  |  |  |  |
|   | 2. | The upper stratosphere                  | consisting of the ozone    |  |  |  |  |  |  |  |  |  |  |
|   |    | layer protects us from                  | the sun's radiation that   |  |  |  |  |  |  |  |  |  |  |
|   |    | falls in the wavelength                 | region of :                |  |  |  |  |  |  |  |  |  |  |
|   |    | (1) 600-750 nm                          | (2) 0.8-1.5 nm             |  |  |  |  |  |  |  |  |  |  |
| ) |    | (3) 400-550 nm                          | (4) 200-315 nm             |  |  |  |  |  |  |  |  |  |  |
| , | 3. | The compound that                       | is NOT a common            |  |  |  |  |  |  |  |  |  |  |
|   |    | component of photoch                    | emical smog is :           |  |  |  |  |  |  |  |  |  |  |
| , |    | (1) O <sub>3</sub>                      | (2) CH <sub>2</sub> =CHCHO |  |  |  |  |  |  |  |  |  |  |
| 1 |    | (3) $CF_2Cl_2$                          | (4) $H_3C-C-OONO_2$        |  |  |  |  |  |  |  |  |  |  |
| Ĺ |    |   | Ö                          |  |  |  |  |  |  |  |  |  |  |
|   | 4. | Taj Mahal is being s                    | lowly disfigured and       |  |  |  |  |  |  |  |  |  |  |
| 1 |    | discoloured. This is pr                 | imarily due to :-          |  |  |  |  |  |  |  |  |  |  |
|   |    | (1) Water pollution                     | (2) Global warming         |  |  |  |  |  |  |  |  |  |  |
| 1 |    | (3) Soil pollution                      | (4) Acid rain              |  |  |  |  |  |  |  |  |  |  |
|   | 5. | The higher concentrat                   | ion of which gas in air    |  |  |  |  |  |  |  |  |  |  |
|   |    | can cause stiffness of                  | flower buds ?              |  |  |  |  |  |  |  |  |  |  |
|   |    | (1) SO <sub>2</sub>                     | (2) NO <sub>2</sub>        |  |  |  |  |  |  |  |  |  |  |
|   |    | (3) $CO_{2}$                            | (4) CO                     |  |  |  |  |  |  |  |  |  |  |

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| 6.<br>7. | Peoxyacetyl nitrate (PAN), an eye irritant is<br>produced by :<br>(1) Acid rain<br>(2) Photochemical smog<br>(3) Classical smog<br>(4) Organic waste<br>The correct set of species responsible for the<br>photochemical smog is :<br>(1) NO, NO, O, and hydrocarbons              | 13.      | The regions of the atmosphere, where clouds<br>form and where we live respectively, are :-<br>(1) Stratosphere and Troposphere<br>(2) Troposphere and Stratosphere<br>(3) Troposphere and Troposphere<br>(4) Stratosphere and Stratosphere<br>The primary pollutant that leads to<br>photochemical smog is :<br>(1) sulphur dioxide (2) acrolein   |
|----------|---|----------|--|
|          | (1) NO, NO <sub>2</sub> , O <sub>3</sub> and hydrocarbons<br>(2) $N_2, O_2, O_3$ and hydrocarbons<br>(3) $N_2, NO_2$ and hydrocarbons   |          | (3) ozone (4) nitrogen oxides SALT ANALYSIS  |
| 8.       | (4) $CO_2$ , $NO_2$ , $SO_2$ and hydrocarbons<br>Air pollution that occurs in sunlight is :<br>(1) oxidising smog (2) acid rain<br>(3) reducing smog (4) fog  | 1.       | Chlorine on reaction with hot and concentrated<br>sodium hydroxide gives :<br>(1) $Cl^-$ and $ClO_2^-$<br>(2) $Cl^-$ and $ClO_3^-$   |
| 9.       | <ul> <li>Assertion : Ozone is destroyed by CFCs in the upper stratosphere</li> <li>Reason : Ozone holes increase the amount of UV radiation reaching the earth.</li> <li>(1) Assertion and reason are correct, but the reason is not the explanation for the assertion</li> </ul> | 2.<br>3. | (3) Cl <sup>-</sup> and ClO <sup>-</sup><br>(4) ClO <sub>3</sub> <sup>-</sup> and ClO <sub>2</sub> <sup>-</sup><br>Iodine reacts with concentrated HNO <sub>3</sub> to yield<br>Y along with other products. The oxidation<br>state of iodine in Y, is :-<br>(1) 5 (2) 3 (3) 1 (4) 7<br>An organic compound 'A' is oxidized with<br>Na <sub>2</sub> O <sub>2</sub> followed by boiling with HNO <sub>2</sub> . The |
|          | <ul> <li>(2) Assertion is false, but the reason is correct</li> <li>(3) Assertion and reason are incorrect,<br/>Assertion and reason are both correct</li> <li>(4) And the reason is the correct explanation<br/>for the assertion</li> </ul>                                     |          | resultant solution is then treated with<br>ammonium molybdate to yield a yellow<br>precipitate.<br>Based on above observation, the element   |
| 10.      | Which is wrong with respect to our<br>responsibility as a human being to protect our<br>environment ?<br>(1) Avoiding the use of floodlighted facilities<br>(2) Restricting the use of vehicles<br>(3) Using plastic bags<br>(4) Setting up compost tin in gardens                | 4.       | present in the given compound is :(1) Sulphur(2) Nitrogen(3) Fluorine(4) PhosphorusWhich one of the following is likely to give aprecipitate with $AgNO_3$ solution ?(1) $(CH_3)_3CC1$ (2) CHCl_3(3) $CH_2=CH-C1$ (4) $CCl_4$  |
| 11.      | Excessive release of $CO_2$ into the atomosphere  | 1        | <b>F-BLOCK</b>   |
|          | results in :<br>(1) polar vortex<br>(2) depletion of ozone<br>(3) formation of smog<br>(4) global warming   | 1.<br>2. | I he lanthanide ion that would show colour is- $(1)$ Sm <sup>3+</sup> $(2)$ La <sup>3+</sup> $(3)$ Lu <sup>3+</sup> $(4)$ Gd <sup>3+</sup> The maximum number of possible oxidationstates of actinoides are shown by   |
| 12.      | <ul> <li>(4) global warming</li> <li>The layer of atmosphere between 10 km to</li> <li>50 km above the sea level is called as :</li> <li>(1) troposphere (2) mesosphere</li> <li>(3) stratosphere (4) thermosphere</li> </ul>   |          | <ul> <li>(1) berkelium (Bk) and californium (Cf)</li> <li>(2) nobelium (No) and lawrencium (Lr)</li> <li>(3) actinium (Ac) and thorium (Th)</li> <li>(4) neptunium (Np) and plutonium (Pu)</li> </ul>  |

# **ANSWER KEY**

| COORD | COORDINATION COMPOUND |       |    |    |    |    |    |    |    |    |  |  |  |
|-------|-----------------------|-------|----|----|----|----|----|----|----|----|--|--|--|
| Que.  | 1                     | 2     | 3  | 4  | 5  | 6  | 7  | 8  | 9  | 10 |  |  |  |
| Ans.  | 4                     | 2     | 2  | 2  | 2  | 4  | 1  | 1  | 2  | 1  |  |  |  |
| Que.  | 11                    | 12    | 13 | 14 | 15 | 16 | 17 | 18 | 19 | 20 |  |  |  |
| Ans.  | 1                     | 2     | 1  | 1  | 3  | 1  | 3  | 1  | 2  | 3  |  |  |  |
| Que.  | 21                    | 22    | 23 | 24 | 25 | 26 | 27 | 28 |    |    |  |  |  |
| Ans.  | 1                     | Bonus | 3  | 3  | 4  | 2  | 1  | 1  |    |    |  |  |  |

### CHEMICAL BONDING

| Que. | 1  | 2  | 3  | 4  | 5  | 6  | 7  | 8  | 9  | 10 |
|------|----|----|----|----|----|----|----|----|----|----|
| Ans. | 4  | 4  | 4  | 3  | 3  | 3  | 1  | 1  | 4  | 1  |
| Que. | 11 | 12 | 13 | 14 | 15 | 16 | 17 | 18 | 19 | 20 |
| Ans. | 4  | 3  | 2  | 4  | 3  | 2  | 4  | 3  | 3  | 3  |
| Que. | 21 | 22 | 23 | 24 | 25 | 26 | 27 | 28 | 29 | 30 |
| Ans. | 3  | 1  | 3  | 4  | 2  | 3  | 4  | 1  | 3  | 3  |
| Que. | 31 | 32 |    |    |    |    |    |    |    |    |
| Ans. | 2  | 3  |    |    |    |    |    |    |    |    |

| S-BLOC | K |   |   |   |   |   |   |   |   |    |
|--------|---|---|---|---|---|---|---|---|---|----|
| Que.   | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 |
| Ans.   | 1 | 2 | 4 | 4 | 3 | 4 | 3 | 1 | 3 | 4  |

| PERIOD | IC TAB | LE |    |       |    |    |    |    |    |    |
|--------|--------|----|----|-------|----|----|----|----|----|----|
| Que.   | 1      | 2  | 3  | 4     | 5  | 6  | 7  | 8  | 9  | 10 |
| Ans.   | 3      | 3  | 2  | 4     | 1  | 1  | 4  | 2  | 3  | 3  |
| Que.   | 11     | 12 | 13 | 14    | 15 | 16 | 17 | 18 | 19 |    |
| Ans.   | 1      | 3  | 4  | Bonus | 2  | 1  | 4  | 2  | 2  |    |

| METAL | LURGY |    |    |    |    |    |    |   |   |    |
|-------|-------|----|----|----|----|----|----|---|---|----|
| Que.  | 1     | 2  | 3  | 4  | 5  | 6  | 7  | 8 | 9 | 10 |
| Ans.  | 2     | 1  | 3  | 4  | 4  | 4  | 4  | 3 | 1 | 2  |
| Que.  | 11    | 12 | 13 | 14 | 15 | 16 | 17 |   |   |    |
| Ans.  | 4     | 2  | 4  | 1  | 3  | 4  | 3  |   |   |    |

| QUANT | UM NUN | ABER |   |   |   |  |
|-------|--------|------|---|---|---|--|
| Que.  | 1      | 2    | 3 | 4 | 5 |  |
| Ans.  | 3      | 4    | 1 | 2 | 4 |  |

| <b>P-BLOC</b> | K |   |   |   |   |   |   |   |  |
|---------------|---|---|---|---|---|---|---|---|--|
| Que.          | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 |  |
| Ans.          | 1 | 3 | 3 | 1 | 2 | 1 | 1 | 3 |  |

| D-BLOC | CK |   |   |   |   |  |
|--------|----|---|---|---|---|--|
| Que.   | 1  | 2 | 3 | 4 | 5 |  |
| Ans.   | 3  | 3 | 2 | 2 | 1 |  |

| HYDRO | HYDROGEN & ITS COMPOUND |   |   |   |   |  |  |  |  |  |  |
|-------|-------------------------|---|---|---|---|--|--|--|--|--|--|
| Que.  | 1                       | 2 | 3 | 4 | 5 |  |  |  |  |  |  |
| Ans.  | 3                       | 2 | 1 | 2 | 1 |  |  |  |  |  |  |

| ENVIRONMENTAL CHEMISTRY |    |    |    |    |   |   |   |   |   |    |
|-------------------------|----|----|----|----|---|---|---|---|---|----|
| Que.                    | 1  | 2  | 3  | 4  | 5 | 6 | 7 | 8 | 9 | 10 |
| Ans.                    | 3  | 4  | 3  | 4  | 1 | 2 | 1 | 1 | 1 | 3  |
| Que.                    | 11 | 12 | 13 | 14 |   |   |   |   |   |    |
| Ans.                    | 4  | 3  | 3  | 4  |   |   |   |   |   |    |

| SALT ANALYSIS |   |   |   |   |  |  |  |  |
|---------------|---|---|---|---|--|--|--|--|
| Que.          | 1 | 2 | 3 | 4 |  |  |  |  |
| Ans.          | 2 | 1 | 4 | 1 |  |  |  |  |

| <b>F-BLOC</b> | K |   |  |
|---------------|---|---|--|
| Que.          | 1 | 2 |  |
| Ans.          | 1 | 4 |  |