Date: 24/01/2021

Max. Marks: 100   # SOLUTIONS   **Time allowed: 120 mins**

MATHEMATICS

1. If the algebraic expression $(3x^2 + px + 3)$ be always positive, then

(a) $-6 < p < 6$ (b) $p < -6$ (c) $p > 6$ (d) no such p exists

Ans. *(a)*

Sol. For algebraic expression to be positive i.e. $3x^2 + px + 3 > 0$, so $D < 0$; $b^2 - 4ac < 0$

$\Rightarrow p^2 - 4 \times 3 \times 3 < 0$

$\Rightarrow p^2 - 36 < 0$

$\Rightarrow (P - 6)(p + 6) < 0$

$\Rightarrow -6 < p < 6$

2. The sum of the roots of $ax^2 + bx + c = 0$ $(a \neq 0)$ is equal to the sum of the squares of the roots of the equation. Then

(a) $2ab = ac + be$ (b) $b^2 = ab + 2ac$ (c) $2ac = ab + b^2$ (d) $ab = 2ac + b^2$

Ans. *(c)*

Sol. $ax^2 + bx + c = 0$

Let α, β are the roots

& $\alpha + \beta = \alpha^2 + \beta^2$ (A.T.Q)

$\Rightarrow (\alpha + \beta) = (\alpha + \beta)^2 - 2\alpha\beta$

$\Rightarrow \dfrac{-b}{a} = \left(\dfrac{-b}{a}\right)^2 - \dfrac{2c}{a}$

$\Rightarrow \dfrac{-b}{a} = \dfrac{b^2}{a^2} - \dfrac{2c}{a}$

$\Rightarrow \dfrac{-b}{a} = \dfrac{b^2 - 2ac}{a^2}$

$\Rightarrow -ab = b^2 - 2ac$

$\Rightarrow b^2 + ab = 2ac$

3. The solution set for the equation $3^{2x^2} - 2.3^{x^2+x+2} + 3^{2(x+2)} = 0$ is

(a) $\{-1, 2\}$ (b) $\{0, 2\}$ (c) $\{0, -1\}$ (d) $\{2, 4\}$

Ans. *(a)*

Sol. $3^{2x^2} - 2.3^{x^2+x+2} + 3^{2(x+2)} = 0$

$\Rightarrow \left(3^{x^2}\right)^2 - 2.3^{x^2}.3^{x+2} + \left(3^{(x+2)}\right)^2 = 0$

$\Rightarrow [3^{x^2} - 3^{x+2}]^2 = 0$

$\Rightarrow 3^{x^2} = 3^{x+2}$

$\Rightarrow x^2 = x + 2$ (By comparing the powers)

$\Rightarrow x^2 - x - 2 = 0$

$\Rightarrow x^2 - 2x + x - 2 = 0$

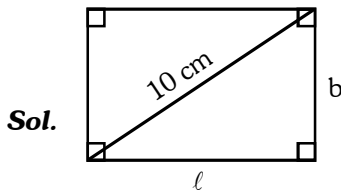$\Rightarrow x(x - 2) + 1 (x - 2) = 0 \Rightarrow (x - 2) (x + 1) = 0$

$\Rightarrow x = 2, -1$

$\Rightarrow x \in \{-1, 2\}$

4. It is printed on a paper that "The length of a diagonal of a rectangle is 10 cm and its area is 62.5 sq. cm". Then which one of the following statements is true?

(a) The perimeter of the rectangle is 30 cm.   (b) The sum of the length and breadth is 20 cm.

(c) The difference of the length and breadth is 5 cm.   (d) No such rectangle can exist.

Ans. *(d)*

Sol.

$\Rightarrow$ Diagonal $= \sqrt{\ell^2 + b^2} = 10$ cm

Area $= 62.5$ cm^2

$\Rightarrow \ell^2 + b^2 = 10^2$ ...(i)

$\Rightarrow \ell b = 62.5$

or, $2\ell b = 125$ ...(ii)

But, A.M $\geq$ G.M.

$\Rightarrow \dfrac{\ell^2 + b^2}{2} \geq \sqrt{\ell^2 b^2}$

$\Rightarrow \ell^2 + b^2 \geq 2\ell b$

$\Rightarrow 100 \geq 125$ (Not possible)

so rectangle is not possible for this data.

5. The ratio of the lengths of the corresponding sides of two similar triangles are in the ratio of 4 : 9. Then the ratio of their areas is

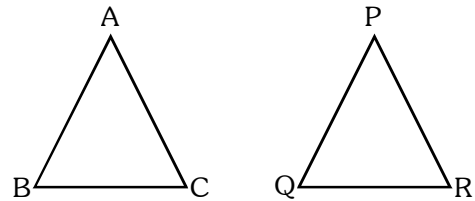(a) 16 : 81   (b) 81 : 16   (c) 4 : 9   (d) 9 : 4

Ans. *(a)*

Sol. Let, $\dfrac{AB}{PQ} = \dfrac{4}{9}$

As, $\triangle ABC \sim \triangle PQR$

So, $\dfrac{ar.\triangle ABC}{ar.\triangle PQR} = \left(\dfrac{AB}{PQ}\right)^2$

$\Rightarrow \dfrac{ar.\triangle ABC}{ar.\triangle PQR} = \left(\dfrac{4}{9}\right)^2 = \dfrac{16}{81}$

6. Father says to his son: "On the date of birth of yours, I was twice older than you are now." Then which one of the following statements is true?

(a) The present ages of the father and his son are 30 years and 10 years respectively.

(b) The present ages of the father and his son are 48 years and 12 years respectively.

(c) Nothing can be said about their ages.

(d) The ratio of the present ages of the father to the son is 3 : 1.

Ans. *(d)*

Sol. Let present age of father be 'x' yrs

Let present age of son be 'y' yrs

when son was born then age of father = (x – y) yrs

A.T.Q.

x – y = 2y

$\Rightarrow$ x = 3y

or $\dfrac{x}{y} = \dfrac{3}{1} = \dfrac{\text{father's present age}}{\text{son's present age}}$

7. Taking at least one from the numbers 1,2,3, how many different sets can be formed?

(a) 8   (b) 7   (c) 3   (d) 3^3

Ans. *(b)*

Sol. By Taking atleast one of the number from 1, 2, 3,

$\Rightarrow$ Total sets = $2^3 - 1$

= 8 – 1 = 7

8. $(18)^{23}$ is divided by remainder 17 to give the remainder

(a) 11   (b) 9   (c) 5   (d) 1

Ans. *(d)*

Sol. $(18^{23}) \div 17 = \dfrac{(17+1)^{23}}{17}$

So, when we open the braket then all term except last term divisible by 17 i.e. $\dfrac{17k+1}{17} \Rightarrow R = 1$

9. If $m^2 - 4m + 1 = 0$, then the value of $\left(m^3 + \dfrac{1}{m^3} \right)$

(a) 52   (b) 48   (c) 64   (d) 68

Ans. *(a)*

Sol. $m^2 + 1 = 4m$

$\Rightarrow \ m + \dfrac{1}{m} = 4$

$\Rightarrow$ So, $m^3 + \dfrac{1}{m^3} = \left(m + \dfrac{1}{m} \right)^3 - 3 \left(m + \dfrac{1}{m} \right)$

$= (4)^3 - 3 \times 4$

$= 64 - 12$

$= 52$

10. For $3^{x+y} = 81, 81^{x-y} = 3$, we get

(a) no solution   (b) $x + \dfrac{21}{2}, y = \dfrac{21}{2}$ (c) $x = 2, y = \dfrac{2}{3}$ (d) $x = \dfrac{17}{8}, y = \dfrac{15}{8}$

Ans. *(d)*

Sol. $3^{x+y} = 3^4$ and

$3^{4(x-y)} = 3^1$

By comparing the powers

$\Rightarrow \ x + y = 4$ ...(i) &

$4 (x - y) = 1$ ...(ii)

$x - y = \dfrac{1}{4}$

from (i) and (ii)

so, $x = \dfrac{17}{8}$ and $y = \dfrac{15}{8}$

11. 125 identical cubes are cut from a big cube and all the smaller cubes are arranged in a row to form a long cuboid. What is the percentage of increase in total surface area of the cuboid over the total surface area of the cube?
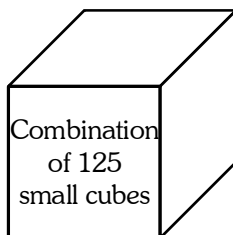
(a) $234\dfrac{2}{3}\%$ (b) $235\dfrac{1}{3}\%$ (c) $134\dfrac{2}{3}\%$ (d) None of these
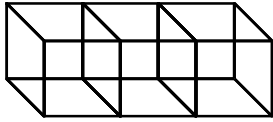
Ans. *(a)*

Sol.

Combination of 125 small cubes

So volume of larger cube = volume of 125 cubes

$a^3 = 125 b^3$

$\Rightarrow$ a = 5b

$\Rightarrow$ S.A. of larger cube = $6a^2 = 6(5b)^2 = 150 b^2$

.....................125 cubes

S.A of 125 smaller cubes forming a cuboid = $2 [125b \times b + 125b \times b + b \times b]$

$= 502b^2$

$\Rightarrow$ % increase in S.A.

$$= \frac{502b^2 - 6(5b)^2}{6(5b)^2} \times 100$$

$$= \frac{352b^2}{150b^2} \times 100$$

$$= \frac{704}{3} = 234\frac{2}{3}\%$$

12. A bag contains 4 Red and 3 Black balls and a second bag contains 2 Red and 4 Black balls. After choosing a bag at random, a ball is also drawn at random. The probability that the ball is Red is

(a) $\frac{23}{42}$ (b) $\frac{17}{42}$ (c) $\frac{19}{42}$ (d) $\frac{16}{39}$

Ans. **(c)**

Sol. Probability of red ball = $\frac{1}{2} \times \frac{4}{7} + \frac{1}{2} \times \frac{2}{6}$

$$= \frac{4}{14} + \frac{2}{12}$$

$$= \frac{2}{7} + \frac{1}{6}$$

$$= \frac{12+7}{42} = \frac{19}{42}$$

13. If [n] denotes the greatest integer $\leq$ n and (n) denotes the smallest integer $\geq$ n ; n being a real number, then

$\left(1\frac{1}{5}\right) \times \left[1\frac{1}{5}\right] - \left(2 - \frac{1}{5}\right) \div \left[1\frac{1}{5}\right] + (1.5)$ is

(a) 1.5   (b) 2   (c) 2.5   (d) 3.5

Ans. **(b)**

Sol. $\left(\frac{6}{5}\right)\left[\frac{6}{5}\right] - \left(\frac{9}{5}\right) \div \left[\frac{6}{5}\right] + (1.5)$

$= 2 \times 1 - 2 \div 1 + 2$

$= 2$

14. The value of $\dfrac{3}{1^2.2^2} + \dfrac{5}{2^2.3^2} + \cdots + \dfrac{19}{9^2.10^2}$ is

(a) $\dfrac{99}{100}$ 　　　 (b) $\dfrac{1}{100}$ 　　　 (c) $\dfrac{101}{100}$ 　　　 (d) 1

Ans. *(a)*

Sol. $\dfrac{3}{1.4} + \dfrac{5}{4.9} + \dfrac{7}{9.16} + \cdots + \dfrac{19}{81.100}$

$$= \left(1 - \dfrac{1}{4}\right) + \left(\dfrac{1}{4} - \dfrac{1}{9}\right) + \left(\dfrac{1}{9} - \dfrac{1}{16}\right) \cdots + \left(\dfrac{1}{81} - \dfrac{1}{100}\right)$$

$$= 1 - \dfrac{1}{100} = \dfrac{99}{100}$$

15. In a frequency distribution, Mean = 9.1 and $\sum f_i x_i = 132 + 5k$, $\sum f_i = 20$, then k is

(a) 4 　　　 (b) 6 　　　 (c) 10 　　　 (d) 9

Ans. *(c)*
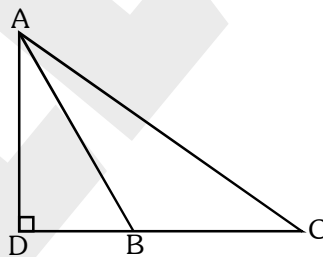
Sol. Mean $= \dfrac{\Sigma f_i x_i}{\Sigma f_i}$

$\Rightarrow 9.1 = \dfrac{132 + 5k}{20}$

$\Rightarrow 182 = 132 + 5k$

$\Rightarrow 5k = 50$

$\therefore k = 10$

16. ABC is a traingle in which $\angle ABC > 90°$ and $AD \perp CB$ produced. Then

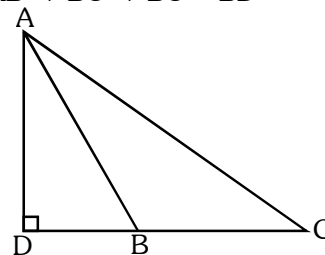(a) $AB^2 = AC^2 + BC^2 + BC \times BD$ 　　　 (b) $AB^2 = AC^2 + BC^2 + 2BC \times BD$
(c) $AC^2 = AB^2 + BC^2 + 2BC \times BD$ 　　　 (d) $AC^2 = AB^2 + BC^2 + BC \times BD$

Ans. *(c)*

Sol. $AC^2 = AD^2 + CD^2$ 　　　 ...(i)
$AB^2 = AD^2 + BD^2$ 　　　 ...(ii)
Also, from (1)
$\Rightarrow AC^2 = AD^2 + (BD + BC)^2$
$\Rightarrow AC^2 = AD^2 + BD^2 + BC^2 + 2BD \times BC$
$\Rightarrow AC^2 = AB^2 + BC^2 + 2B \times BD$

17. Given : $0° < \theta < 90°$. then, if $\sin\theta + \cos\theta = x$, which one of the following is correct?

(a) $x < 1$ (b) $x > 1.5$ (c) $1 \le x \le \sqrt{2}$ (d) $1 < x \le \sqrt{2}$

Ans. *(d)*

Sol. $\sin\theta + \cos\theta = x$

$$\sqrt{2}\left(\frac{1}{\sqrt{2}}\sin\theta + \frac{1}{\sqrt{2}}\cos\theta\right) = x$$

$$\Rightarrow \ \sqrt{2}\ \sin\left(\theta + \frac{\pi}{4}\right) = x$$

As, $0 < \theta < 90°$

$\Rightarrow \ 1 < x \le \sqrt{2}$

18. If $\sin\theta + \cos\phi = 2$ and $0° \le \theta, \phi \le 90°$, then $2\theta + 2000.\phi =$

(a) $180°$ (b) $90°$ (c) $2180°$ (d) Can not be found out

Ans. *(a)*

Sol. $\sin\theta + \cos\phi = 2$, this is possible iff

$\Rightarrow \ \sin\theta = 1, \ \& \ \cos\phi = 1$

It means $\theta = 90° \ \& \ \phi = 0°$

$\therefore \ 2\theta + 2000\phi = 2 \times 90° + 2000 \times 0 = 180°$

19. $\sec\theta + \tan\theta = a + \sqrt{b}$ $a, b \in Q$ and $\sqrt{b} \in Q$ and $\sec\theta$ is rational, then

(a) $\overline{b}^2 = 1 + a$ (b) $a^2 = 1 + \overline{b}$ (c) $\overline{b}^2 = 1 - a$ (d) $a^2 = 1 - \overline{b}$

Ans. *(b)*

Sol. As, $\sec\theta + \tan\theta = a + \sqrt{b}$

A.T.Q. by comparing rational and irrational terms.

$\sec\theta = a$ (As, $\sec\theta$ is rational)

and $\tan\theta = \sqrt{b}$ (As, $\sqrt{b}$ is irrational)

Now, $\sec^2\theta = 1 + \tan^2\theta$

$\Rightarrow \ a^2 = 1 + (\sqrt{b})^2$

$\Rightarrow \ a^2 = 1 + \overline{b}$

20. The ratio of in which $9x - 3y - 14 = 0$ divides the join of $(2, -4)$ and $(3, 7)$ is

(a) $2 : 1$ (b) $1 : 2$ (c) $2 : 3$ (d) $3 : 2$

Ans. *(a)*

Sol. Let the ratio is $k : 1$, apply section formula,

$$x = \frac{3k+2}{k+1}; \quad y = \left(\frac{7k-4}{k+1}\right)$$

As, $9x = 3y + 14$
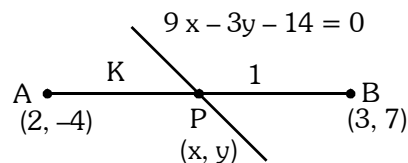
so, $9\left(\dfrac{3k+2}{k+1}\right) = 3\left(\dfrac{7k-4}{k+1}\right) + 14$

$\Rightarrow \ 27k + 18 = 21k - 12 + 14k + 14$

$\Rightarrow \ 16 = 8k$

$\Rightarrow \ k = 2$

$\therefore \ \dfrac{k}{1} = \dfrac{2}{1}$

A $\bullet$ (2, –4) ———K———— P (x, y) ————1———— $\bullet$ B (3, 7)

$9x - 3y - 14 = 0$

PHYSICS

21. The mass, linear momentum and kinetic energy of a body are m, p and E respectively, then

(a) $p = \sqrt{2mE}$　　　(b) $E = \sqrt{2mp}$　　　(c) $p = \sqrt{2E}$　　　(d) $E = \sqrt{2p}$

Ans. *(a)*

Sol. Explanation

$$K = \frac{1}{2}mv^2$$

$$K = \frac{1}{2}mv^2 \times \frac{m}{m}$$

$$K = \frac{m^2v^2}{2m} \qquad [\because P = mv]$$

$$K = \frac{P^2}{2m}$$

$$2mK = P^2$$

$$\sqrt{2mk} = P$$

22. A stone is allowed to fall freely downwards initially at rest from the top of a tower. The time taken by the stone to reach the bottom of the tower is 4 seconds. What is the height of the tower? Take, acceleration due to gravity = 32 ft/s^2

(a) 64 ft.　　　(b) 32 ft.　　　(c) 48 ft.　　　(d) 256 ft.

Ans. *(d)*

Sol. $u = 0$, $t = 4s$, $a = g = 32\dfrac{ft}{s^2}$

By using 2nd equation of motion

$$s = ut + \frac{1}{2}at^2$$

$$s = 0 \times 4 + \frac{1}{2} \times 32 \times (4)^2$$

$$s = \frac{32 \times 16}{2} = 256\ ft$$

$$s = 256\ ft$$

23. The coefficient of linear expansion of a solid is x and the coefficient of volume expansion of the solid is y, then

(a) $x = \dfrac{y}{3}$　　　(b) $y = \dfrac{x}{3}$　　　(c) $x = \dfrac{y}{2}$　　　(d) $y = \dfrac{x}{2}$

Ans. *(a)*

Sol. $V = L^3 \Rightarrow \dfrac{\Delta V}{V} = \dfrac{3\Delta L}{L} \Rightarrow y = 3x \Rightarrow x = \dfrac{y}{3}$

24. In case of refraction of light from a medium to air the critical angle is found to be 45°. What is the refractive index of the medium with respect to air? .

(a) $\sqrt{2}$ (b) $\sqrt{3}$ (c) 2 (d) 3

Ans. *(a)*

Sol. $\mu = \dfrac{1}{\sin i_c} = \dfrac{1}{\sin 45°} = \dfrac{1}{1/\sqrt{2}}$

$\mu = \sqrt{2}$

[μ = refractive index of the medium with respect to air]

25. Which of the following pair have same unit?

(a) Heat and Specific heat

(b) Thermal capacity and Water equivalent

(c) Specific heat and Thermal capacity

(d) Heat and Work

Ans. *(d)*

Sol. Unit of heat and work is same

26. Which of the following is an electromagnetic wave?

(a) α-ray (b) β-ray (c) γ-ray (d) cathode ray

Ans. *(c)*

Sol. Gamma ray (γ ray) is an eletronagatic wave.

27. In case of a convex lens, what is the minimum distance between an object and its real image?

(a) 2.5 times of focal length (b) 2 times of focal length

(c) 4 times of focal length (d) equal to focal length

Ans. *(c)*

Sol. The minimum distance between a real object and its real image formed by convex lens is 4f.

28. What will be the power consumed by a 50Ω wire if it is kept across a potential difference of 200 V?

(a) 0.8 kW (b) 80 kW (c) 400 W (d) 8 kW

Ans. *(a)*

Sol. Power consumed, $P = \dfrac{V^2}{R}$

$= \dfrac{(200)^2}{50} = \dfrac{40000}{50}$

$P = 800w = 0.8$ kW

29. I cm ot main scale of a vernier callipers is divided into 10 divisions. The least count of the callipers is 0.005 cm, then what is the number of divisions in the vernier scale?

(a) 10   (b) 20   (c) 25   (d) 50

Ans. *(b)*

Sol. Each division on MSR $= \dfrac{1}{10} = 0.1$ cm

Let N be the number of division that must present on vernier scale so that each division on MSR corresponds to the maximum value that vernier scale can measure.

$N \times 0.005$ cm $= 0.1$ cm

$N = \dfrac{0.1}{0.005} = 20$

$N = 20$ divisions

30. If an x- ray tube is operated at 20kV, what is the cut-off wave length? (Take, Planks constant h $= 6.62 \times 10^{-34}$ J.S)

(a) 0.89 Å   (b) 0.75 Å   (c) 0.62 Å   (d) 0.31 Å

Ans. *(c)*

Sol. Valtage of × Ray tube, V $= 20$ kV

$= 20 \times 10^3$ V

Plank's constant, h $= 6.62 \times 10^{-34}$ Js

speed of light, C $= 3 \times 10^8$ m/s

Minimum wavelength, $\lambda_{min} = \dfrac{hc}{ev}$

$= \dfrac{6.62 \times 10^{-34} \times 3 \times 10^8}{1.6 \times 10^{-19} \times 20 \times 10^3}$

$\lambda_{min} = 0.62 Å$

31. An ideal gas is found to obey the equation $p^2 V = $ constant along with the ideal gas equation (here, p = pressure and V= volume). If initial temperature and volume are T_0 and V_0 respectively and it expands to a volume $3V_0$, then what is the final temperature?

(a) $\sqrt{3}T_0$ (b) $\sqrt{2}T_0$ (c) $\dfrac{T_0}{\sqrt{3}}$ (d) $\dfrac{T_0}{\sqrt{2}}$

Ans. *(a)*

Sol. PV = nRT   ...(1)

PV = constant   ...(2)

Given that

P^2 V = constant   ...(3)

From equation (1)

$P = \dfrac{nRT}{V}$

$P^2 = \left(\dfrac{nRT}{V}\right)^2$

From equation (3)

$$\left(\frac{nRT}{V}\right)^2 V = \text{constant}$$

$$\frac{T^2}{V} = \text{constant}$$

$$\frac{T_1^2}{V_1} = \frac{T_2^2}{V_2}$$

$$T_2^2 = \frac{T_1^2 V_2}{V_1} \quad \begin{cases} V_2 = 3V_0 \\ T_1 = T_0 \end{cases}$$

$$T_2^2 = \frac{3V_0 T_0^2}{V_0}$$

$$T_2^2 = 3T_0^2$$

$$T_2 = T_0 \sqrt{3} = \sqrt{3}T_0$$

32. Specific heat (S) of a metal at low temperature varies according to $S = aT^3$, where 'a' is a constant and T is a absolute temperature. The amount of heat energy needed to raise the temperature of unit mass of the metal from T = 1K to T = 2K is

(a) 3a (b) $\dfrac{15a}{4}$ (c) $\dfrac{2a}{3}$ (d) $\dfrac{13a}{4}$

Ans. *(b)*

Sol. $dQ = mSdT$

then $Q = \int mSdT$

since, $S = aT^3$, where 'a' is a consatant

$Q = \int m\,(aT^3).dT$

$Q = ma \int_1^2 T^3 dT$

$Q = ma\left[\dfrac{T^4}{4}\right]_1^2$

$Q = ma\left[\dfrac{(2)^4}{4} - \dfrac{(1)^4}{4}\right]$

For units mass

$Q = a\left[\dfrac{16}{4} - \dfrac{1}{4}\right]$

$Q = \dfrac{15a}{4}$

33. An object of weight W and density ρ is submerged wholly in a liquid of density σ, its apparent weight will be

(a) $(\rho - \sigma)$ (b) $(\rho - \sigma)/W$ (c) $W\left(1 - \dfrac{\sigma}{\rho}\right)$ (d) $\left(1 - \dfrac{\rho}{\sigma}\right)$

Ans. *(c)*

Sol. $W_{air} = W$

Bouyant force , $F_B = \rho_\ell V_d\, g$

$F_B = \sigma V_d g$ ...(1)

Apparent weight = weight – bouyant force

$W_a = W - \sigma V_d g$

$W_a = W - \dfrac{\sigma W}{\rho g} \times g$
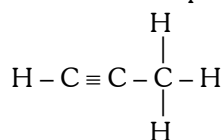
$W_a = W\left[1 - \dfrac{\sigma}{\rho}\right]$

CHEMISTRY

34. The ratio of σ and π bonds in propyne is

(a) $1 : 3$ (b) $3 : 1$ (c) $2 : 3$ (d) $3 : 2$

Ans. *(b)*

Sol. The structure of propyne is

$$H - C \equiv C - \overset{\overset{\displaystyle H}{|}}{\underset{\underset{\displaystyle H}{|}}{C}} - H$$

There are 6 σ bonds and 2π bonds. Hence ratio of σ and π bonds in propyne is $6 : 2$ or $3 : 1$

35. The element having the lowest first ionization energy is

(a) He   (b) Cl   (c) F   (d) I

Ans. *(d)*

Sol. As we move down a group, size increases and ionization energy decreases. Hence I has lowest first ionisation energy.

36. If the four tubes of a car are filled to the same pressure with N_2, O_2, H_2 and Ne gas separately then which will fill the tube first?

(a) N_2 (b) O_2 (c) H_2 (d) Ne

Ans. *(c)*

Sol. As rate of diffusion is inversely proportional to square root of molecular mass of gas. Hence H_2 will have the highest rate of diffusion.

37. At a given temperature what will be the percentage increase in pressure for a 5% decrease in the volume of the gas

(a) 5%   (b) 5.26   (c) 6.26%   (d) 10.26%

Ans. *(b)*

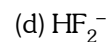***Sol.*** At a given temperature

$P_1 V_1 = P_2 V_2$,

$P_1 = P,\ P_2 = ?$

$V_1 = V,\ V_2 = 0.95\, V$

Hence, $P \times V = P_2 \times 0.95\, V$

$P_2 = 1.0526\, P$

Hence there will be 5.26% increase in pressure of the gas.

38. $O_2^=$ is isoelectronic with

(a) H_2 (b) N_2 (c) F_2 (d) HF_2^-

Ans. *(c)*

Sol. The number of electrons in $O_2^=$ is 18

Hence F_2 having 18 electrons will be isoelectronic with $O_2^=$

39. Which of the following forms a homologous series?

(a) Ethane, Ethylene, Acetylene   (b) Ethane, Propane, Butanone

(c) Methanol, Ethanol, Propanoic acid   (d) Butane, 2-Methyl Butane, 2, 3, dimethyl Butane.

Ans. *(d)*

Sol. Butane – C_4H_{10}

2-Methyl Butane – C_5H_{12}

2, 3-dimethyl butane – C_6H_{14}

As all the three structures differ by $–CH_2$, they form a homologous series.

40. The gas that gives a black precipitate with aqueous $Pb(NO_3)$ solutuion and a white precipitate with aqueous $ZnCl_2$ solution is

(a) CO_2 (b) NO_2 (c) NH_3 (d) H_2S

Ans. *(d)*

Sol. $Pb(NO_3)_{2_{(aq)}} + H_2S_{(g)} \rightarrow \underset{(Black)}{PbS} \downarrow + 2NO_{3_{(aq)}}$

$ZnCl_{2_{(aq)}} + H_2S_{(g)} \rightarrow \underset{(white)}{ZnS_{(s)}} + 2HCl_{(aq)}$

41. The organic product that is obtained by absorbing Ethylene into concentrated H_2SO_4 and subsequently boiling the mixture with water is

(a) an aldehyde   (b) an amide   (c) a ketone   (d) an alcohol

Ans. *(d)*

Sol. Ethene + conc. $H_2SO_4 \longrightarrow$ Ethyl hydrogensulphate $\xrightarrow{\text{boiling with water}}$ Ethyl alcohol.

42. Equal volumes of two solutions of pH = 4 and pH = 10 are mixed. pH of the resultant solution will be

(a) 6   (b) 7   (c) 8   (d) 9

Ans. *(b)*

Sol. First solution pH = 4.
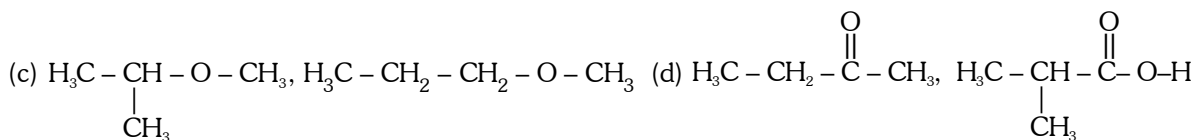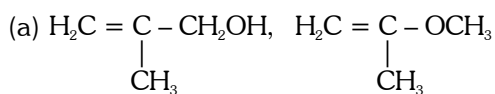
$[H^+] = 10^{-4}M$

Second solution, pH = 10

$[H^+] = 10^{-10}$

pH + POH = 14,   pOH = 4

$[OH^-] = 10^{-4} M$

Hence they will exactly neutralise each other and pH of the resulting solution will be 7.

43. Find out the position isomers from the following pairs of compounds

(a) $H_2C = \underset{\underset{CH_3}{|}}{C} - CH_2OH, \quad H_2C = \underset{\underset{CH_3}{|}}{C} - OCH_3$

(b) $H_2C = CH - CH_2COOH, H_2C = CH - COOCH_3$

(c) $H_3C - \underset{\underset{CH_3}{|}}{CH} - O - CH_3, H_3C - CH_2 - CH_2 - O - CH_3$

(d) $H_3C - CH_2 - \overset{\overset{O}{||}}{C} - CH_3, \quad H_3C - \underset{\underset{CH_3}{|}}{CH} - \overset{\overset{O}{||}}{C} - O-H$

Ans. *(c)*

Sol. In both the structure, functional groups are same, only there positions are different. Hence they are positional isomers.

44. Egg albumin in water is a

(a) True solution   (b) Colloid   (c) Suspension   (d) Supersaturated Solution
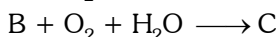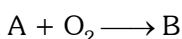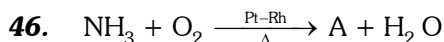
Ans. *(b)*

Sol. Egg albumin in water form a colloid.

45. Lithium is generally used as an electrode in high energy density batteries. This is because

(a) Lithium is the lightest of all metals   (b) Lithium has quite high negative reduction potential

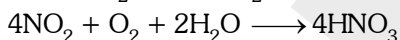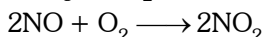(c) Lithium is quite reactive   (d) Lithium does not corrode easily

Ans. *(b)*

Sol. Lithium has high negative reduction potential, which makes it suitable for use in batteries.

46. $NH_3 + O_2 \xrightarrow[\Delta]{Pt-Rh} A + H_2O$

$A + O_2 \longrightarrow B$

$B + O_2 + H_2O \longrightarrow C$

A, B and C respectively are

(a) N_2O, NO_2 and HNO_3 (b) NO, NO_2 and HNO_3 (c) NO_2, NO and HNO_3 (d) N_2O, NO and HNO_3

Ans. *(b)*

Sol. $4NH_3 + 5O_2 \longrightarrow 4NO + 6H_2O$

$2NO + O_2 \longrightarrow 2NO_2$

$4NO_2 + O_2 + 2H_2O \longrightarrow 4HNO_3$
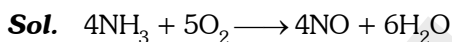
Biology

47. The main plant body of pteridophyte is

(a) Sporophyte   (b) Prothallus   (c) Spore   (d) Gametophyte

Ans. *(a)*

Sol. Main plant body of pteridophyte is sporophyte, as it is diploid plant body that produces spores through meiosis.

48. In human eye, at the blind spot

(a) Only rod cells are present.   (b) Only cone cells are present.

(c) Both rod and cone cells are present.   (d) Neither rod nor cone cells are present.

Ans. *(d)*

Sol. Blind spot of eye lacks receptor cells (rod & cones) because the optic nerves leave the eye ball from here.

49. Percentage of O_2 present in inhaled air in human beings is approximately

(a) 21% (b) 77% (c) 0.04% (d) 3%

Ans. *(a)*

Sol. When we inhale, atmospheric air enters into our lungs which contains 21% oxygen.

50. The disease which usually spreads through cuts and wounds is

(a) Chicken pox (b) Malaria (c) Tuberculosis (d) Tetanus

Ans. *(d)*

Sol. Tetanus is acquired through infection of a cut or wound with the spores of bacterium *Clostridium tetani*.

51. Lysosome stores

(a) ATP (b) Hydrolytic enzymes (c) Carbohydrate (d) Protein

Ans. *(b)*

Sol. Lysosome stores large number of hydrolytic enzymes, which are also known as acid hydrolases.

52. Which muscle separates thoracic and abdominal cavity?

(a) Abdominal muscle (b) Smooth muscle (c) Diaphragm (d) Cardiac muscle

Ans. *(c)*

Sol. Diaphragm is a muscular sheet that separates the thoracic and abdominal cavity in mammals.

53. Which one of the following hormones helps in contraction of uterine muscles during parturition?

(a) Vasopressin (b) Oxytocin (c) Prolactin (d) Relaxin

Ans. *(b)*

Sol. Oxytocin is known as birth hormone that helps in contraction of uterine muscles during parturition.

54. Glomerulus and Bowman's capsule together form

(a) Malpighian tubule (b) Malpighian corpuscle (c) Collecting tubule (d) Renal tubule

Ans. *(b)*

Sol. Glomerulus & Bowman's capsule together form Malpighian corpuscles.

55. Cardiac muscle is

(a) striated and voluntary (b) smooth and voluntary

(c) striated and involuntary (d) smooth and involuntary

Ans. *(c)*

Sol. Cardiac muscles are striated as they have light & dark bands. These muscles are involuntary in nature.

56. In which of the following subphases of meiosis crossing over takes place?

(a) Leptotene (b) Pachytene (c) Zygotene (d) Diplotene

Ans. *(b)*

Sol. Pachytene is the subphase of Meiosis-I during which crossing over takes place between non-sister chromatids of homologous chromosomes.

57. The part of human alimentary canal where no enzyme secretion takes place is

(a) Mouth (b) Oesophagus (c) Stomach (d) Ileum

Ans. *(b)*

Sol. Oesophagus is the part of human alimentary canal where digestive glands are absent, only mucus glands are present.

58. Marine fish when placed in tap water bursts because of

(a) Endosmosis (b) Exomosis (c) Diffusion (d) Plasmolysis

Ans. *(a)*

Sol. Tap water is hypotonic for marine fish so endosmosis occurs, which causes bursting.

59. "Penicillin" obtained from a fungus is an

    (a) Antiseptic   (b) Antiserum   (c) Antibody   (d) Antibiotic

Ans. *(d)*

Sol. Penicillin is an antibiotic, obtained from fungus *Penicillium notatum*.

60. The immunoglobulin which is transported to the foetus through placenta from mother is

    (a) IgG   (b) IgA   (c) IgE   (d) IgM

Ans. *(a)*

Sol. IgG is the only antibody that significantly crosses the human placenta.

<div align="center">SST</div>

61. France was named as "a museum of economic errors" by

    (a) Rousseau   (b) Adam Smith   (c) Montesquieu   (d) Quesnay

Ans. *(b)*

Sol. France was named as "a museum of economic errors" by Adam Smith

62. Who was known as the "Tsar the Liberator"?

    (a) Tsar Nicholas I   (b) Tsar Nicholas II   (c) Tsar Alexander I   (d) Tsar Alexander II

Ans. *(d)*

Sol. Tsar Alexander II was known as the " Tsar the Liberator".

63. The day 24th October, 1929 was marked as 'Black Thursday' in U.S.A. because

    (a) Terrorist Attack   (b) Natural Calamity

    (c) The Great Economic Depression   (d) Change of Political Background

Ans. *(c)*

Sol. The day 24th October, 1929 was marked as 'Black Thursday' in USA because of the Great Economic Depression.

64. The father of British Socialism

    (a) Louis Blanc   (b) Karl Marx   (c) Robert Owen   (d) Saint Simon

Ans. *(c)*

Sol. The father of British socialism was Robert Owen

65. Jagannath Singh Dhol was the leader of

    (a) Kol Rebellion   (b) Santhal Rebellion   (c) Munda Rebellion   (d) Chuar Rebellion

Ans. *(d)*

Sol. Jagannath Singh Dhol was the leader of Chuar Rebellion

66. The editor of the 'Samachar Chandrika' was

    (a) Rammohan Roy   (b) Iswar Gupta

    (c) Bhabani Charan Bandyopadhyay   (d) Gangakishore Bhattacharya

Ans. *(c)*

Sol. The editor of the "Samachar Chandrika" was Bhabani Charan Bandyopadhyay

67. Madari Pasi was the leader of

    (a) Santhal Rebellion   (b) Munda Uprising

    (c) Bhil Revolt   (d) Eka Movement

Ans. *(d)*

Sol. Madari Pasi was the leader of Eka movement

68. 'May Day' was celebrated for the first time in India at

    (a) Bombay   (b) Calcutta   (c) Madras   (d) Kanpur

Ans. *(c)*

Sol. " May day" was celebrated for the first time in India at Madras

69. The Mahad Satyagraha was organised by

(a) Dayananda Saraswati

(b) Swami Vivekananda

(c) Sree Narayan Guru

(d) Dr. B. R. Ambedkar

Ans. *(d)*

Sol. ."Mahad Satyagraha" was organised by Dr. B.R Ambedkar

70. The incident of Chauri Choura took place in

(a) 1919 AD　　(b) 1920 AD　　(c) 1922 AD　　(d) 1925 AD

Ans. *(c)*

Sol. The incident of Chauri Choura took place in 1922 AD

71. The first language state was formed in Independent India:

(a) Andhra Pradesh　　(b) West Bengal　　(c) Tamil Nadu　　(d) Gujarat

Ans. *(a)*

Sol. The first language state formed in independent India was Andhra Pradesh.

72. The writer of the book named "Chhere Asha Gram" was

(a) Manikuntala Sen　　(b) Dakshina Ranjan Basu　　(c) Sankha Ghosh　　(d) Selina Hossain

Ans. *(b)*

Sol. The writer of the book named "Chhere Asha Gram" was Dakshina Ranjan Basu.

73. The time difference between Greenwich Mean Time and the Indian Standard Time is

(a) 6 hours　　(b) 5 hours 30 minutes　　(c) 5 hours 15 minutes　　(d) 5 hours

Ans. *(b)*

Sol. The time difference between Greenwich Mean Time and the Indian Standard Time is 5 hours 30 minutes.

74. By nature, the Western Ghat is a/an

(a) Old fold mountain　　(b) Young fold mountain　　(c) Block mountain　　(d) Igneous mountain

Ans. *(d)*

Sol. By nature, the Western Ghat is an Igneous mountain.

75. The process by which, the height of the earth surface increases is

(a) Aggradation　　(b) Degradation　　(c) Weathering　　(d) Denudation

Ans. *(a)*

Sol. The process by which, the height of the earth surface increases is a Aggradation.

76. Deep cracks on the surface of the mountain glacier are called

(a) Nunatak　　(b) Arete　　(c) Crevasse　　(d) Cirque

Ans. *(c)*

Sol. Crevasse is simply a deep crack in a glacier or ice sheet.

77. The climate which is found in the Cape Town of South Africa is

(a) Equatorial climate　　(b) Tropical Monsoon climate　　(c) Mediterranean climate　　(d) Hot Desert climate

Ans. *(c)*

Sol. The climate which is found in the Cape Town of South Africa is Mediterranean climate,with rainy winters and dry summers.

78. New South wales current flows along the _____ of Australia.

(a) northern side　　(b) southern side　　(c) eastern side　　(d) western side

Ans. *(c)*

Sol. The New South Wales current flow along the eastern side of Australia.

79. Which of the following, parallel of latitude, passes through middle of India?

(a) Equator　　(b) Tropic of Capricon　　(c) Prime Meridian　　(d) Tropic of Cancer

Ans. **(d)**

Sol. Tropic of cancer is the latitude which passes through middle of the India.

80. The lake located, in between the deltas of the Godavari river and the Krishna river is

(a) Kolleru　　(b) Pulicat　　(c) Chilka　　(d) Vembnad

Ans. **(a)**

Sol. Kolleru Lake is the largest natural freshwater Lake located between the deltas of Godavari and Krishna rivers

81. Salty sea breeze is needed for

(a) Sugarcane cultivation　　(b) Tea cultivation　　(c) Jute cultivation　　(d) Coffee cultivation

Ans. **(c)**

Sol. Salty sea breeze is needed for jute cultivation.

82. Which of the following industry is called Foot loose Industry?

(a) Iron and Steel Industry　　(b) Engineering Industry

(c) Automobile Industry　　(d) Cotton textile Industry

Ans. **(d)**

Sol. The cotton industry concerns principally on twirling and knitting. Uniquely in the cotton industry, Ginning, the thread, whirling and weaving was controlled and maintained by diverse state and masters. Henceforth it is called the footloose industry.

83. Diamond Quadrilateral project is related to

(a) Air Transport　　(b) Rail Transport　　(c) Road Transport　　(d) Water Trasport

Ans. **(b)**

Sol. The Diamond Quadrilateral is a project of Indian railway to establish a high speed railway network in India

84. The colour used for drawing of contour lines in a topographical map is

(a) Black　　(b) Brown　　(c) Red　　(d) Blue

Ans. **(b)**

Sol. The colour Brown is used to denote most contour lines on a map which are relief features and elevations.

85. A candidate for Bidhan Sabha and Lok Sabha Election must not be less than _____years.

(a) 25　　(b) 26　　(c) 27　　(d) 29

Ans. **(a)**

Sol. The minimum age criteria for the candidate for fighting Vidhan Sabha and Lok Sabha election is 25 years.

86. 'MONEY BILL' is first introduced in the

(a) Lok Sabha　　(b) Rajya Sabha　　(c) Supreme Court　　(d) High Court

Ans. **(a)**

Sol. Money bill first introduced in Lok Sabha because Lok Sabha have more power on it in comparison to Rajya Sabha.

87. The number of judges of International Court of Justice is

(a) 9　　(b) 10　　(c) 15　　(d) 16

Ans. **(c)**

Sol. The total number of judges of International Court of Justice is 15

88. The age of retirement of the judges of the High Court is

(a) 65 years   (b) 60 years   (c) 62 years   (d) 70 years

Ans. *(c)*

Sol. The retirement age of the judge of High Court is 62 years

89. The headquarter of World Health Organization is

(a) London   (b) Manchester   (c) Geneva   (d) Paris

Ans. *(c)*

Sol. The headquarter of the World Health Organization is Geneva.

90. The minimum age for the citizen to exercise their right to vote has been reduced to 18 years from 21 years through the

(a) 42nd Amendment Act   (b) 44th Amendment Act   (c) 61st Amendment Act   (d) 73rd Amendment Act

Ans. *(c)*

Sol. The minimum age for the citizen to exercise their right to vote has been reduced to 18 years from 21 years through the 61st amendment act.

91. The Panch-Sheel Agreement was signed between

(a) India and China   (b) India and Nepal   (c) India and Pakistan   (d) Pakistan and China

Ans. *(a)*

Sol. The Panch-Sheel Agreement was signed between India and China.

92. The World Trade Organization was founded in _____.

(a) 1990   (b) 1995   (c) 2000   (d) 2005

Ans. *(b)*

Sol. The World Trade Organisation was founded in 1995

93. Which of the following is not a function of Commercial Banks?

(a) Collecting deposits from public   (b) Lending loans

(c) Issuing Notes   (d) Working as an agent of Client.

Ans. *(c)*

Sol. Issuing notes is not a function of commercial banks.

94. Stagflation is a situation where

(a) production increases and price level increases.   (b) production decreases and price level increases.

(c) production decreases and price level decreases.   (d) production increases and price level decreases.

Ans. *(b)*

Sol. Stagflation is a situation where production decreases and price level increases

95. Which of the following is a direct tax?

(a) Sales Tax   (b) Income Tax   (c) Entertainment Tax   (d) Service Tax

Ans. *(b)*

Sol. Income tax is a direct tax.

96. In which economy is the policy of Laissez faire adopted?

(a) Capitalist Economy

(b) Socialist Economy

(c) Mixed Economy

(d) Any Economy

Ans. *(a)*

Sol. The policy of Laissez faire is adopted in the Capitalist Economy.

97. Exclusion principle is not applicable in the case of _____

(a) Capital goods   (b) Consumer goods   (c) Public goods   (d) Private goods

Ans. *(c)*

Sol. Exclusion principle is not applicable in the case of public goods.

98. Railway in India are highlighted by which of the following market form?

(a) Perfect competition   (b) Monopolistic competition   (c) Monopoly   (d) Oligopoly

Ans. *(c)*

Sol. Railways in India are highlighted by monopoly form of market

99. Which of the following taxes follows the ability to pay principle?

(a) Wealth Tax   (b) Entertainment Tax   (c) Goods and Services Tax (d) Excise Duty

Ans. *(c)*

Sol. Goods and services tax follows the ability to pay principle.

100. In underdeveloped countries most of the labour force are generally engaged in

(a) Industrial sector   (b) Service sector   (c) Agricultural sector   (d) Banking sector

Ans. *(c)*

Sol. In underdeveloped countries most of the labour force are generally engaged in agricultural sector