## KVPY QUESTION PAPER 2015 <br> Class XI <br> Part-I (One-Mark Questions) <br> [MATHEMATICS]

1. Two distinct polynomials $f(x)$ and $g(x)$ are defined as follows :

$$
f=(x)=x^{2}+a x+2 ; g(x)=x^{2}+2 x+a
$$

If the equation $f(x)=0$ and $g(x)=0$ have a common root then the sum of the roots of the equation $\mathrm{f}(\mathrm{x})+\mathrm{g}(\mathrm{x})=0$ is
(A) $-\frac{1}{2}$
(B) 0
(C) $\frac{1}{2}$
(D) 1

Ans. (C)
Sol. $\mathrm{f}(\alpha)=\mathrm{g}(\alpha) \Rightarrow \alpha=1$ or $\mathrm{a}=-2$
$\Rightarrow \mathrm{a}=2$ or $\mathrm{a}=-3$
Using $\mathrm{a}=-3, \mathrm{f}(\mathrm{x})+\mathrm{g}(\mathrm{x})=0$
$\Rightarrow 2 \mathrm{x}^{2}-\mathrm{x}-1=0$
$\Rightarrow$ sum of roots $=1 / 2$
2. If $n$ is the smallest natural number natural number such that $n+2 n+3 n \ldots \ldots .+99 n$ is a perfect square then the number of digits in $n^{2}$ is
(A) 1
(B) 2
(C) 3
(D) More than 3

Ans. (C)
Sol. Sum $=99 \times 50 \times n=(3)^{2}(5)^{2}(22)(\mathrm{n})=$ perfect square
$\Rightarrow \mathrm{n}_{\text {min }}=22 \Rightarrow \mathrm{n}^{2}=484 \Rightarrow$ number of digits $=3$
3. Let $x, y, z$ be positive reals. Which of the following implies $x=y=z$ ?
(I) $x^{2}+y^{3}+z^{3}=3 x y z$
(II) $x^{3}+y^{2} z+y z^{2}=3 x y z$
(III) $x^{3}+y^{2} z+z^{2} x=3 x y z$
(IV) $(x+y+z)^{3}=27 x y z$
(A) I, IV only
(B) I, II and IV only
(C) I, II and III only
(D) All of them

Ans. (B)
Sol. (I) Using $A M \geq G M$ on $x^{3}, y^{3}, z^{3}$ only possibility is $x=y=z$
(II) Using $\mathrm{AM} \geq \mathrm{GM}$ on $\mathrm{x}^{3}, \mathrm{y}^{2} \mathrm{z}, \mathrm{yz}^{2}$ only possibility is $\mathrm{x}=\mathrm{y}=\mathrm{z}$
(IV) Using AM $\geq$ GM on $x, y, z$ only possibility is $x=y=z$

Hence I, II \& IV are true
4. In the figure given below, a rectangle of perimeter

76 units is divided into 7 congruent rectangles.
What is the perimeter of each of the smaller rectangles ?

(A) 38
(B) 32
(C) 28
(D) 19

Ans. (C)
Sol.

$$
\begin{gathered}
\Rightarrow 6 x+5 y=76 \\
\text { and } 4 x=3 y \\
\Rightarrow x=6, y=8 \\
\Rightarrow 2 x+2 y=28
\end{gathered}
$$


5. The largest non-negative integer k such that $24^{\mathrm{k}}$ divides 13 ! is :
(A) 2
(B) 3
(C) 4
(D) 5

Ans. (B)
Sol. Exponent of 2 in $\lfloor 13$
$=\left[\frac{13}{2}\right]+\left[\frac{13}{2^{2}}\right]+\left[\frac{13}{2^{3}}\right]+\left[\frac{13}{2^{4}}\right]+\ldots . .=10$
Exponent of 3 in $\lfloor 13$
$=\left[\frac{13}{3}\right]+\left[\frac{13}{3^{2}}\right]+\left[\frac{13}{3^{3}}\right]+\ldots .=5$
$\underline{13}=2^{10} \cdot 3^{5} \times 5^{2} \times 7 \times 11 \times 13$
$=(24)^{3}\left(2 \cdot 3^{2} \cdot 5^{2} \cdot 7 \cdot 11 \cdot 13\right)$
So $K_{\max }=3$
6. In a triangle $A B C$, points $X$ and $Y$ are on $A B$ on $A C$, respectively such that $X Y$ is parallel to $B C$, Which of the two following equalities alywas hold ? (Here $[\mathrm{PQR}]$ denotes the area of triangle PQR )
(I) $[\mathrm{BCX}=[\mathrm{BCY}]$
(II) $[\mathrm{ACX}] \cdot[\mathrm{ABY}]=[\mathrm{AXY}] \cdot[\mathrm{ABC}]$
(A) Neither (I) nor (II)
(B) (I) Only
(C) (II) only
(D) Both (I) and (II)

Ans. (D)
Sol. (I) $[\mathrm{BCX}]=[\mathrm{BCY}]$ is true as base \& height same for both triangles
(II) Check $[\mathrm{ACX}][\mathrm{ABY}]=[\mathrm{AXY}][\mathrm{ABC}]$
$\Rightarrow$ Check $\frac{[\mathrm{ACX}]}{[\mathrm{AXY}]}=\frac{[\mathrm{ABC}]}{[\mathrm{ABY}]}$

$\Rightarrow \frac{[\mathrm{AXY}]+[\mathrm{XCY}]}{[\mathrm{AXY}]}=\frac{[\mathrm{ABY}]+[\mathrm{BYC}]}{[\mathrm{ABY}]}$
$\Rightarrow \frac{[\mathrm{XYC}]}{[\mathrm{AXY}]}=\frac{[\mathrm{BYC}]}{[\mathrm{ABY}]}$ is true Hence I \& II both true
7. Let $P$ be an interior point of a triangle $A B C$. Let $Q$ and $R$ be the reflections of $P$ in $A B$ and $A C$, respectively. If $\mathrm{Q}, \mathrm{A}, \mathrm{R}$ are collinear then $\angle \mathrm{A}$ equals
(A) $30^{\circ}$
(B) $60^{\circ}$
(C) $90^{\circ}$
(D) $120^{\circ}$

Ans. (C)

Sol.

$2 \alpha+2 \beta=180^{\circ} \Rightarrow \alpha+\beta=90^{\circ} \Rightarrow \angle \mathrm{A}=90^{\circ}$
8. Let ABCD be a square of side length $1, \mathrm{I}^{-}$a circle passing through B and C , and touching AD . The radius of $\mathrm{I}^{-}$is :-
(A) $\frac{3}{8}$
(B) $\frac{1}{2}$
(C) $\frac{1}{\sqrt{2}}$
(D) $\frac{5}{8}$

Ans. (D)

Sol.

$(1-\mathrm{R})^{2}+(1 / 2)^{2}=\mathrm{R}^{2} \Rightarrow \mathrm{R}=\frac{5}{8}$
9. Let ABCD be a square of side length 1. Let $\mathrm{P}, \mathrm{Q}, \mathrm{R}, \mathrm{S}$ be points in the interiors of the sides $\mathrm{AD}, \mathrm{BC}$,
$A B, C D$, respectively, such that $P Q$ and $R S$ intersect at right angles. If $P Q=\frac{3 \sqrt{3}}{4}$ then $R S$ equals :-
(A) $\frac{2}{\sqrt{3}}$
(B) $\frac{3 \sqrt{3}}{4}$
(C) $\frac{\sqrt{2}+1}{2}$
(D) $4-2 \sqrt{2}$

Ans. (B)
Sol.
In $\triangle \mathrm{PQM}, \mathrm{PQ} \sin \theta=1$
In $\Delta \mathrm{RSN}, \mathrm{RS} \sin \theta=1$
$\Rightarrow \mathrm{PQ}=\mathrm{RS}=\frac{3 \sqrt{3}}{4}$

10. In the figure given below, if the areas of the two regions are equals then which of the following is true ?

(A) $x=y$
(B) $x=2 y$
(C) $2 x=y$
(D) $x=3 y$

Ans. (B)
Sol. From given figure $A_{1}=2 x y+\frac{1}{2}(2 y+y) x$,
$A_{2}=(2 x+y)(2 y)-3 y^{2}$
$\because A_{1}=A_{2} \Rightarrow 2 y=x$
11. A man standing on a railway platform noticed that a train took 21 seconds to cross the platform (this means the time elapsed from the moment the engine enters the platform till the last compartment leaves the platform) which is 88 metres long, and that it took 9 seconds to pass him. Assuming that train was moving with uniform speed, what is the length of the train in meters ?
(A) 55
(B) 60
(C) 66
(D) 72

Ans. (C)
Sol. Let length of train be ' $\ell$ ' and speed be 'v'

$$
\therefore \frac{88+\ell}{\mathrm{v}}=21 \quad \& \frac{\ell}{\mathrm{v}}=9 \Rightarrow \frac{88}{\mathrm{v}}+9=21 \quad \Rightarrow \mathrm{v}=\frac{88}{12} \quad \& \ell=66
$$

12. The least positive integer $n$ for which $\sqrt[3]{\mathrm{n}+1}-\sqrt[3]{\mathrm{n}}<\frac{1}{12}$ is
(A) 6
(B) 7
(C) 8
(D) 9

Ans. (C)
Sol. $(\mathrm{n}+1)^{1 / 3}-(\mathrm{n})^{1 / 3}<\frac{1}{12}$

$$
\begin{array}{ll}
\Rightarrow \mathrm{n}^{\frac{1}{3}}\left(\left(1+\frac{1}{\mathrm{n}}\right)^{\frac{1}{3}}-1\right)<\frac{1}{12} & \Rightarrow \mathrm{n}^{\frac{1}{3}}\left(\left(1+\frac{1}{3 n}-\delta\right)-1\right)<\frac{1}{12}, \delta>0 \\
\Rightarrow \mathrm{n}^{\frac{1}{3}} \frac{(1-3 \mathrm{n} \delta)}{3 \mathrm{n}}<\frac{1}{12} \Rightarrow \mathrm{n}^{2 / 3}>4(1-3 n \delta) & \Rightarrow \mathrm{n}>8(1-3 n \delta)^{3 / 2} \Rightarrow \mathrm{n}_{\text {min }}=8
\end{array}
$$

13. Let $\mathrm{n}>1$ be an integer. Which of the following sets of numbers necessarily contains a multiple of 3 ?
(A) $\mathrm{n}^{19}-1, \mathrm{n}^{19}+1$
(B) $\mathrm{n}^{19}, \mathrm{n}^{38}-1$
(C) $\mathrm{n}^{38}, \mathrm{n}^{38}+1$
(D) $\mathrm{n}^{38}, \mathrm{n}^{19}-1$

Ans. (B)
Sol. numbers will be of type $3 \lambda, 3 \lambda+1,3 \lambda-1$
If $\mathrm{n}=3 \lambda \Rightarrow \mathrm{n}^{19} \& \mathrm{n}^{38}$ are multiples of 3
If $\mathrm{n}=3 \lambda+1 \Rightarrow \mathrm{n}^{19}-1 \& \mathrm{n}^{38}-1$ are multiples of 3
If $\mathrm{n}=3 \lambda-1 \Rightarrow \mathrm{n}^{19}+1 \& \mathrm{n}^{38}-1$ are multiples of 3
$\Rightarrow \mathrm{n}^{19} \& \mathrm{n}^{38}-1$ necessarily contain multiple of 3
14. The number of distinct primes dividing $12!+13!+14$ ! is
(A) 5
(B) 6
(C) 7
(D) 8

Ans. (A)
Sol. $\left\lfloor 12(1+13+(14)(13))=\left(\lfloor 12)(14)^{2} \Rightarrow 2,3,5,7,11\right.\right.$ divide this
So 5 distinct prime divisors
15. How many ways are there to arrange the letters of the word EDUCATION so that all the following three conditions hold ?

- The vowels occur in the same order (EUAIO);
- The consonants occur in the same order (DCTN);
- No two consonants are next to each other.
(A) 15
(B) 24
(C) 72
(D) 120

Ans. (A)
Sol. Vowels can be arranged in one way, due to which there will be 6 gaps, out of which we need to choose 4 So ${ }^{6} \mathrm{C}_{4}=15$

## PHYSICS

16. In an experiment, mass of an object is measured by applying a known force on it, and then measuring its acceleration. If, in the experiment, the measured values of applied force and the measured acceleration are $\mathrm{F}=10.0 \pm 0.2 \mathrm{~N}$ and $\mathrm{a}=1.00 \pm 0.01 \mathrm{~m} / \mathrm{s}^{2}$, respectively, the mass of the object is :-
(A) 10.0 Kg
(B) $10.0 \pm 0.1 \mathrm{Kg}$
(C) $10.0 \pm 0.3 \mathrm{Kg}$
(D) $10.0 \pm 0.4 \mathrm{Kg}$

Sol. Ans. (C)
Sol. $\mathrm{m}=\frac{\mathrm{F}}{\mathrm{a}} ; \quad\left(\frac{\Delta \mathrm{m}}{\mathrm{m}}\right)_{\max }=\frac{\Delta \mathrm{F}}{\mathrm{F}}+\frac{\Delta \mathrm{a}}{\mathrm{a}} \quad=\frac{0.2}{10}+\frac{0.01}{1}=0.03 \quad \therefore \mathrm{~m}=(10.0 \pm 0.3) \mathrm{kg}$
17. A hollow tilted cylindrical vessel of negligible mass rest on a horizontal plane as shown. The diameter of the base is a and the side of the cylinder makes an angle $\theta$ with the horizontal. Water is then slowly poured into the cylinder. The cylinder topples over when the water reaches a certain height h , given by :-

(A) $\mathrm{h}=2 \mathrm{a} \tan \theta$
(B) $\mathrm{h}=\mathrm{a} \tan ^{2} \theta$
(B) $\mathrm{h}=\mathrm{a} \tan \theta$
(D) $\mathrm{h}=\frac{\mathrm{a}}{2} \tan \theta$

Ans. (C)
Sol.

$$
\tan \theta=\frac{\mathrm{y}}{\mathrm{x}}=\frac{\frac{\mathrm{h}}{2}}{\frac{\mathrm{a}}{2}}
$$


$\mathrm{h}=\mathrm{a} \tan \theta$
18. An object at rest at the origin begins to move in the $+x$ direction with a uniform acceleration of $1 \mathrm{~m} /$ $s^{2}$ for 4 s and then it continues moving with a uniform velocity of $4 \mathrm{~m} / \mathrm{s}$ in the same direction. The $\mathrm{x}-\mathrm{t}$ graph for object's motion will be :-
(A)

(B)

(C)

(D)


Ans. (B)
Sol. Initially, velocity will increase, so will be the slope of $x-t$ curve, then velocity will become constant and slope of $x-t$ curve will also become constant.
19. If the axis of rotation of the earth were extended into space then it would pass close to
(A) the moon
(B) the sun
(C) the pole star
(D) the centre of mass of all the planets in the solar system

## Ans. (C)

Sol. A pole star is a visible star, which lies approximately directly overhead when viewed from earth's north pole or south pole. In practice the term pole star usually refers to polars, which is the current northern pole star, also known as north star. The south celestial pole lacks a bright star like
 polarise to mark its position.
20. Methane is a greenhouse gas because
(A) it absobs longer wavelengths of the electromagnetic spectrum while transmitting shorter wavelengths.
(B) it absorbs shorter wavelengths of the electromagnetic spectrum while transmitting longer wavelengths.
(C) it absorbs all wavelengths of the electromagnetic spectrum
(D) it transmits all wavelengths of the electromagnetic spectrum

Ans. (A)
Sol. Green house gases act much like the roof of a green house that trap heat on earth. The process happens in two steps. First green house gases let the visible and uv light (shorter wavelength) in sunlight to pass through earth's atmosphere unimpeded. When light strikes the earth's surface and is refelcted back to atmosphere as infrared energy (longer wavelength), green house gases absorb this heat.
21. A parachutist with total weight 75 kg drops vertically onto a sandy ground with a speed of $2 \mathrm{~ms}^{-1}$ and comes to a halt over a distance of 0.25 m . The average force from the ground on her is close to :-
(A) 600 N
(B) 1200 N
(C) 1350 N
(D) 1950 N

Ans. (C)
Sol. $\mathrm{a}_{\mathrm{av}}=\frac{4}{0.5}=8 \mathrm{~m} / \mathrm{s}^{2}$
$\left(\mathrm{F}_{\mathrm{av}}\right)_{\text {ground }}-\mathrm{mg}=\mathrm{ma}$
$\left(\mathrm{F}_{\mathrm{av}}\right)_{\text {ground }}=(75)[18]=1350 \mathrm{~N}$
22. The beta particles of a radioactive metal originate from
(A) the free electrons in the metal
(B) the orbiting electrons of the metal atoms
(C) the photons released from the nucleus
(D) the nucleus of the metal atoms

Ans. (D)
Sol. When neutron gets converted into a proton, inside a nucleus, $\beta$-particles are emitted.

23. An opitcal device is constructed by fixing three identical convex lenses of focal lengths 10 cm each inside a hollow tube at equal spacing of 30 cm each. One end of the device is placed 10 cm away from a point source. How much does the images shift when the device is moved away from the source by another 10 cm ?
(A) 0
(B) 5 cm
(C) 15 cm
(D) 45 cm

Ans. (A)

Sol.


In second case when object is at 20 cm from first lens, image will still be at its original position because of principle of reversibility.
24. An isosceles glass prism with base angles $40^{\circ}$ is clamped over a tray of water in a position such that the base is just dipped in water. A ray of light incident normally on the inclined face suffers total internal reflection at the base. If the refractive index of water is 1.33 then the condition imposed on the refractive index $\mu$ of the glass is :-
(A) $\mu<2.07$
(B) $\mu>2.07$
(C) $\mu<1.74$
(D) $\mu>1.74$

Ans. (B)
Sol. $40^{\circ}>\theta_{\mathrm{C}}$
$\sin 40^{\circ}>\frac{\mu_{w}}{\mu_{g}}$
$\mu_{\mathrm{g}}>\frac{\mu_{\mathrm{w}}}{\sin 40^{\circ}} ; \quad \mu_{\mathrm{g}}>\frac{1.33}{\frac{3}{5}}$

$\mu_{\mathrm{g}}>2.07$
25. A point source of light is moving at a rate of $2 \mathrm{~cm}-\mathrm{s}^{-1}$ towards a thin convex lens of focal length 10 cm along its optical axis. When the source is 15 cm away from the lens the image is moving at
(A) $4 \mathrm{~cm}-\mathrm{s}^{-1}$ towards the lens
(B) $8 \mathrm{~cm}-\mathrm{s}^{-1}$ towards the lens
(C) $4 \mathrm{~cm}-\mathrm{s}^{-1}$ away from the lens
(D) $8 \mathrm{~cm}-\mathrm{s}^{-1}$ away from the lens

Ans. (D)
Sol. $\frac{1}{\mathrm{~V}}-\frac{1}{-15}=\frac{1}{10} \quad \frac{1}{\mathrm{~V}}-\frac{2}{60}=\frac{1}{30}$
$\mathrm{m}=\frac{30}{-15}=-2 \quad \mathrm{~V}_{\mathrm{J} / \ell}=\mathrm{m}^{2} \mathrm{~V}_{0 / \ell}$

$$
=(4)(2)
$$

$$
=8 \mathrm{~cm} / \mathrm{s}
$$

$\therefore \quad(\mathrm{D})$
26. A light bulb of resistance $R=16 \Omega$ is attached in series with an infinite network with identical resistance $r$ as shown below. A 10 V battery drives current in the circuit. What should be the value of r such that the bulb dissipates about 1 W of power

(A) $14.8 \Omega$
(B) $29.6 \Omega$
(C) $7.4 \Omega$
(B) $3.7 \Omega$

Ans. (A)

Sol.


Let $r_{P Q}=r_{\text {eq }}$
then $\quad r_{e q}=r+\frac{r_{e q} r}{r_{e q}+r}$
Also $\mathrm{P}=\mathrm{i}^{2} \mathrm{R} \Rightarrow 1=\mathrm{i}^{2}(16)$
$\mathrm{i}=\frac{1}{4} \mathrm{~A} ; \quad \frac{1}{4}=\frac{10}{\mathrm{R}+\mathrm{r}_{\mathrm{eq}}}$
$r_{\text {eq }}=40-16=24$
$\Rightarrow \quad \mathrm{r}=14.8 \Omega$
27. A ball is launched from the top of Mt. Everest which is at elevation of 9000 m . The ball moves in circular orbit around earth. Acceleration due to gravity near the earth's surface is g . The magnitude of the ball's acceleration while in orbit is
(A) close to $\mathrm{g} / 2$
(B) zero
(C) much greater than g
(D) nearly equal to g

Ans. (D)
Sol. $\frac{\mathrm{mv}^{2}}{\mathrm{r}}=\left(\frac{\mathrm{GMem}}{\mathrm{r}^{2}}\right)$
$\frac{\mathrm{V}^{2}}{\mathrm{r}} \simeq \frac{\mathrm{GMe}}{\mathrm{R}_{\mathrm{e}}^{2}}\left\langle\mathrm{r} \simeq \mathrm{R}_{\mathrm{e}}\right\rangle$
$\frac{v^{2}}{r} \simeq g$
28. A planet is orbiting the sun in an elliptical orbit. Let $U$ denote the potential energy and $K$ denote the kinetic energy of the planet at an arbitrary point on the orbit. Choose the correct statement.
(A) $\mathrm{K}<|\mathrm{U}|$ always
(B) $\mathrm{K}>|\mathrm{U}|$ always
(C) $\mathrm{K}=|\mathrm{U}|$ always
(D) $\mathrm{K}=|\mathrm{U}|$ for two positions of the planet in the orbit

Ans. (A)
Sol. For bounded orbits
$|\mathrm{U}|>\mathrm{K}$
29. One mole of ideal gas undergoes a linear process as shown in figure below. Its temperature expressed as a function of volume V is

(A) $\frac{\mathrm{P}_{0} \mathrm{~V}_{0}}{\mathrm{R}}$
(B) $\frac{\mathrm{P}_{0} \mathrm{~V}}{\mathrm{R}}$
(C) $\frac{\mathrm{P}_{0} \mathrm{~V}}{\mathrm{R}}\left(1-\frac{\mathrm{V}}{\mathrm{V}_{0}}\right)$
(D) $\frac{\mathrm{P}_{0} \mathrm{~V}_{0}}{\mathrm{R}}\left(1-\left(\frac{\mathrm{V}}{\mathrm{V}_{0}}\right)^{2}\right)$

Ans. (C)
Sol. $\mathrm{P}=\mathrm{P}_{0}-\frac{\mathrm{P}_{0}}{\mathrm{~V}_{0}}$

$T=\frac{P V}{n R}$
$T=\left(P_{0}-\frac{P_{0}}{V_{0}} V\right) V \frac{1}{n R}$
$\mathrm{T}=\frac{\mathrm{P}_{0} \mathrm{~V}}{\mathrm{nR}}\left(1-\frac{\mathrm{V}}{\mathrm{V}_{0}}\right)$
$\mathrm{n}=1$
30. The international station is maintained in a nearly circular orbit with a mean altitude of 330 km and a maximum of 410 km . An astronaut is floating in the space station's cabin. The acceleration of astronaut as measured from the earth is
(A) zero
(B) nearly zero and directed towards the earth
(C) nearly $g$ and directed along the line of travel of the station
(D) nearly $g$ and directed towards the earth

Ans. (D)
Sol. $\frac{\mathrm{V}^{2}}{\mathrm{R}} \simeq \mathrm{g}$

$$
\text { as } \mathrm{g}^{\prime}=\frac{\mathrm{g}}{\left(1+\frac{\mathrm{h}}{\mathrm{R}_{\mathrm{e}}}\right)^{2}}
$$

$h \ll R_{e}$

## CHEMISTRY

31. The percentage of nitrogen by mass in ammonium sulphate is closest to (atomic masses $\mathrm{H}=1, \mathrm{~N}=14, \mathrm{O}=16, \mathrm{~S}=32$ ):-
(A) $21 \%$
(B) $24 \%$
(C) $36 \%$
(D) $16 \%$

Ans. (A)
Sol. $\left(\mathrm{NH}_{4}\right)_{2} \mathrm{SO}_{4}$

Mass of Nitrogen $=28 \mathrm{amu}$

$$
\text { Molecular mass }=132 \mathrm{amu}
$$

$$
\% \mathrm{~N}=\frac{28}{132} \times 100=21 \%
$$

32. Mendeleev's periodic law states that the properties of elements are a periodic function of their :-
(A) reactivity of elements
(B) atomic size
(C) atomic mass
(D) electronic configuration

Ans. (C)
Sol. By definition
33. Maximum number of electrons that can be accommodated in the subshell with azimuthal quantum number $1=4$, is:-
(A) 10
(B) 8
(C) 16
(D) 18

Ans. (D)
Sol. Maximum no. of electrons accornodated
in a subshell $=2[2 \ell+1]=2[2 \times 4+1]=18$
34. The correct order of acidity of the following compounds is :-



2

(A) $1>2>3$
(B) $1>3>2$
(C) $3>1>2$
(D) $3>2>1$

Ans. (C)

Sol.

(Acidic strength order)
$-\mathrm{I},-\mathrm{M}$ effect
$-\mathrm{NO}_{2}$ (E.W.G.) increases acidic strength.
$-\mathrm{OCH}_{3}$ (E.D.G.) $(-\mathrm{I}<+\mathrm{M})$ decreases acidic strength.
35. Reaction of 2-butene with acidic $\mathrm{KMnO}_{4}$ gives:-
(A) $\mathrm{CH}_{3} \mathrm{CHO}$
(B) HCOOH
(C) $\mathrm{CH}_{3} \mathrm{CH}_{2} \mathrm{OH}$
(D) $\mathrm{CH}_{3} \mathrm{COOH}$

Ans. (D)
Sol. $\mathrm{CH}_{3}-\mathrm{CH}=\mathrm{CH}-\mathrm{CH}_{3} \xrightarrow[\mathrm{KMnO}_{4}]{\text { Acidic }} \mathrm{CH}_{3} \mathrm{CO}_{2} \mathrm{H}(2 \mathrm{eq})$
2-Butene $\begin{gathered}\text { strong oxidising } \\ \text { reagent }\end{gathered}$
36. The gas released when baking soda is mixed with vinegar is :-
(A) CO
(B) $\mathrm{CO}_{2}$
(C) $\mathrm{CH}_{4}$
(D) $\mathrm{O}_{2}$

Ans. (B)

Sol.


So, gas released is $\mathrm{CO}_{2}$.
37. The element which readily form an ionic bond has the electronic configuration :-
(A) $1 \mathrm{~s}^{2} 2 \mathrm{~s}^{2} 2 \mathrm{p}^{3}$
(B) $1 \mathrm{~s}^{2} 2 \mathrm{~s}^{2} 2 \mathrm{P}^{1}$
(C) $1 \mathrm{~s}^{2} 2 \mathrm{~s}^{2} 2 \mathrm{p}^{2}$
(D) $1 \mathrm{~s}^{2} \mathrm{~s}^{2} 2 \mathrm{p}^{6} 3 \mathrm{~s}^{1}$

Ans. (D)
Sol. It is the electronic configuration of Na and forms ionic bond readily campared to orthers given
38. The major products of the following reaction

$$
\mathrm{ZnS}(\mathrm{~s})+\mathrm{O}_{2}(\mathrm{~g}) \xrightarrow{\text { heat }}
$$

are
(A) ZnO and $\mathrm{SO}_{2}$
(B) $\mathrm{ZnSO}_{4}$ and $\mathrm{SO}_{3}$
(C) $\mathrm{ZnSO}_{4}$ and $\mathrm{SO}_{2}$
(D) Zn and $\mathrm{SO}_{2}$

Ans. (A)
Sol. $\mathrm{ZnS}(\mathrm{s})+\frac{3}{2} \mathrm{O}_{2}(\mathrm{~g}) \rightarrow \mathrm{ZnO}+\mathrm{SO}_{2}$ (Major)
39. If Avogadro's number is $\mathrm{A}_{0}$, the number of sulphur atoms present in 200 mL of $1 \mathrm{~N}_{2} \mathrm{SO}_{4}$ is :-
(A) $\mathrm{A}_{0} / 5$
(B) $\mathrm{A}_{0} / 2$
(C) $\mathrm{A}_{0} / 10$
(D) $\mathrm{A}_{0}$

Ans. (C)
Sol. Molarity $=\frac{\text { Normality }}{\prime n ' \text { factor }}$

$$
\begin{aligned}
& \text { For } \mathrm{H}_{2} \mathrm{SO}_{4} ; \\
& \text { 'n' factor }=2 \\
& \text { molarity }=\frac{1}{2}
\end{aligned}
$$

No. of moles of $\mathrm{H}_{2} \mathrm{SO}_{4}$

$$
=\text { Molarity } \times \text { Vol. (in lt.) }=\frac{1}{2} \times \frac{200}{100}=\frac{1}{10}
$$

No. of molecules of $\mathrm{H}_{2} \mathrm{SO}_{4}=\frac{1}{10} \times \mathrm{A}_{0}$

No. of sulphur atom $=\frac{1}{10} \times \mathrm{A}_{0}$
40. The functional group present in a molecule having the formula $\mathrm{C}_{12} \mathrm{O}_{9}$ is :-
(A) carboxylic acid
(B) anhydride
(C) aldehyde
(D) alcohol

Ans. (B)
Sol. $\quad \mathrm{C}_{12} \mathrm{O}_{9} \Rightarrow$ One type of carbon suboxide
Which is example of cyclictrianhydride side. The structure is

41. A sweet smelling compound formed by reacting acetic acid with ethanol in the presence of hydrochloric acid is :-
(A) $\mathrm{CH}_{3} \mathrm{COOC}_{2} \mathrm{H}_{5}$
(B) $\mathrm{C}_{2} \mathrm{H}_{5} \mathrm{COOH}$
(C) $\mathrm{C}_{2} \mathrm{H}_{5} \mathrm{COOCH}_{3}$
(D) $\mathrm{CH}_{3} \mathrm{OH}$

Ans. (A)
Sol.


Ethyl acetate
(Sweet smelling compound)
42. Among $\mathrm{Mg}, \mathrm{Cu}, \mathrm{Fe}, \mathrm{Zn}$, the metal that does not produce hydrogen gas in reaction with hydrochloric acid is:-
(A) Cu
(B) Zn
(C) Mg
(D) Fe

Ans. (A)
Sol. Because Cu is above H in the reactivity series
43. The maximum number of isomeric ethers with the molecular formula $\mathrm{C}_{4} \mathrm{H}_{10} \mathrm{O}$ is:-
(A) 2
(B) 3
(C) 4
(D) 5

Ans. (B)
Sol. The maximum number of isomeric ethers with the molecular formula $\mathrm{C}_{4} \mathrm{H}_{10} \mathrm{O}$ is 3 . They are given below.
(i) $\mathrm{H}_{3} \mathrm{C}-\mathrm{CH}_{2}-\mathrm{O}-\mathrm{CH}_{2}-\mathrm{CH}_{3}$ Ethoxyethane
(ii) $\mathrm{H}_{3} \mathrm{C}-\mathrm{O}-\mathrm{CH}_{2}-\mathrm{CH}_{2}-\mathrm{CH}_{3}$

1-methoxy propane
(iii)


2-methoxy propane
44. The number of electrons required to reduce chromium completely in $\mathrm{Cr}_{2} \mathrm{O}_{7}^{2-}$ to $\mathrm{Cr}^{3+}$ in acidic medium, is:-
(A) 5
(B) 3
(C) 6
(D) 2

Ans. (C)
Sol. $6 \mathrm{e}^{-}+\mathrm{Cr}_{2} \mathrm{O}_{7}^{-2}+14 \mathrm{H}^{\oplus} \rightarrow 2 \mathrm{Cr}^{3+}+7 \mathrm{H}_{2} \mathrm{O}$
45. At constant pressure, the volume of fixed mass of a gas varies as a function of temperature as shown in the graph


The volume of the gas at $300{ }^{\circ} \mathrm{C}$ is large than at $0^{\circ} \mathrm{C}$ by a factor of
(A) 3
(B) 4
(C) 1
(D) 2

Ans. (D)
Sol. From graph

## BIOLOGY

46. Excess slat inhibits bacterial growth in pickles by :-
(A) endosmosis
(B) exosmosis
(C) oxidation
(D) denaturation

## Ans. B

47. Restriction endonucleases are enzymes that are used by biotechnologists to :-
(A) cut DNA at specific base sequences
(B) join fragments of DNA
(C) digest DNA from the 3' end
(D) digest DNA from the 5 ' end

Ans. (A)
48. Enzyme X extracted from the digestive system hydrolyses peptide bonds. Which of the following are probable candidates to be enzyme X :-
(A) Amylase
(B) Lipase
(C) Trypsin
(D) Maltase

Ans. (C)
49. A person with blood group AB has :-
(A) antigen A and B on RBCs and both anti-A and anti-B antibodies in plasma
(B) antigen A and B on RBCs but neither anti-A nor anti- B antibodies in plasma
(C) no antigen on RBCs but both anti-A and anti-B antibodies present in plasma
(D) antigen A on RBCs and anti-B antibodies in plasma

Ans. (B)
50. Glycolysis is the breakdown of glucose to pyruvic acid. How many molecules of pyruvic acid are formed from one molecule of glucose :-
(A) 1
(B) 2
(C) 3
(D) 4

Ans. (B)
51. The process of transfer of electrons from glucose to molecular oxygen in bacteria and mitochondria is known as :-
(A) TCA cycle
(B) Oxidative phosphorylation
(C) Fermentation
(D) Glycolysis

Ans. (B)
52. Which one of the following cell types is part of innate immunity :-
(A) Skin epithelial cells (B) cells
(C) T lymphocytes
(D) Liver cells

Ans. (A)
53. Deficiency of which one of the following vitamins can cause impaired blood clotting :-
(A) Vitamin B
(B) Vitamin C
(C) Vitamin D
(D) Vitamin K

Ans. (D)
54. Which one of the following is detrimental to soil fertility :-
(A) Saprophytic bacteria
(B) Nitrosomes
(C) Nitrobacter
(D) Pseudomonas

Ans. (D)
55. In which one of the following phyla is the body segmented :-
(A) Porifera
(B) Platyhelminthes
(C) Annelida
(D) Echinodermata

Ans. (C)
56. Widal test is prescribed to diagnose :-
(A) Typhoid
(B) Pneumonia
(C) Malaria
(D) Filaria

Ans. (A)
57. Which, among grass, goat, tiger and vulture, in a food chain, will have the the maximum concentration of harmful chemicals in its body due to contamination of pesticides in the soil :-
(A) Grass since it grows in the contaminated soil
(B) Goat since it eats the grass
(C) Tiger since it feeds on the goat which feeds on the grass
(D) Vulture since it eats the tiger, which in turn eats the goat, which eats the grass

Ans. (D)
58. Considering the average molecular mass of a base to be 500 Da , what is the molecular mass of a double stranded DNA of 10 base pairs :-
(A) 500 Da
(B) 5 kDa
(C) 10 kDa
(D) 1 kDa

Ans. (C)
59. Which of the following pairs are both polysaccharides :-
(A) Cellulose and glycogen
(B) Starch and glucose
(C) Cellulose and fructose
(D) Ribose and sucrose

Ans. (A)
60. Whic one of the following is a modified leaf :-
(A) Sweet potato
(B) Ginger
(C) Onion
(D) Carrot

Ans. (C)

## Part-II

## (Two-Mark Questions) <br> MATHEMATICS

61. A triangular corner is cut from a rectangular piece of paper and the resulting pentagon has sides 5, $6,8,9,12$ in some order. The ratio of the area of the pentagon to the area of the rectangle is
(A) $\frac{11}{18}$
(B) $\frac{13}{18}$
(C) $\frac{15}{18}$
(D) $\frac{17}{18}$

Ans. (D)
Sol. $\frac{\operatorname{area}(\mathrm{BCDEF})}{\operatorname{area}(\mathrm{ACDE})}$
$=\frac{(12)(9)-\frac{1}{2}(3)(4)}{(12)(9)}=\frac{17}{18}$

62. For a real number $x$, let $[x]$ denote the largest integer less than or equal to $x$, and let $\{x\}=x-[x]$. The number of solutions $x$ to the equation $[x]\{x\}=5$ with $0 \leq x \leq 2015$ is
(A) 0
(B) 3
(C) 2008
(D) 2009

Ans. (D)

Sol. $[x]\{x\}=5, x \in[0,2015]$,
$\{x\}=\frac{5}{[x]} \&\{x\} \in[0,1)$
$\therefore[\mathrm{x}]=6,7,8, \ldots .2015, \therefore 2009$ solutions
63. Let $A B C D$ be a trapezium with $A D$ parallel to $B C$. Assume there is a point $M$ in the interior of the segment BC such that $\mathrm{AB}=\mathrm{AM}$ and $\mathrm{DC}=\mathrm{DM}$. Then the ratio of the area of the trapezium to the area of triangle AMD.
(A) 2
(B) 3
(C) 4
(D) not determinable from the data

Ans. (B)
Sol.


Let $\mathrm{AB}=\mathrm{AM}=\mathrm{z}$, height $=\ell$
$\mathrm{DC}=\mathrm{DM}=\mathrm{x}$
$A D=y$
$\Rightarrow \mathrm{BC}=2 \mathrm{y}$
$p+q=y$
$\frac{\text { Area } \mathrm{ABCD}}{\text { Area AMD }}=\frac{\left(\frac{1}{2}\right)(3 \mathrm{y})(\ell)}{\left(\frac{1}{2}\right)(\mathrm{y})(\ell)}=3$
64. Given are three cylindrical buckets $X, Y, Z$ whose circular bases are of radii $1,2,3$ units respectively. Initially water is filled in these buckets upto the same height. Some water is then transferred from Z to X so that they both have the same volume of water. Is then transferred between X and Y so that they both have the same volume of water. If $h_{Y}, h_{z}$ denote the heights of water at this stage in the buckets
$Y, Z$, respectively, then the ratio $\frac{h_{Y}}{h_{Z}}$ equals
(A) $\frac{4}{9}$
(B) 1
(C) $\frac{9}{4}$
(D) $\frac{81}{40}$

Ans. (D)
Sol. Let initial height in all buckets be H
Let height in z be $\mathrm{h}_{\mathrm{z}}$
$\Rightarrow$ Volume transferred $=9 \pi\left(\mathrm{H}-\mathrm{h}_{\mathrm{z}}\right)$
New volume in $\mathrm{x}=\pi \mathrm{H}+9 \pi\left(\mathrm{H}-\mathrm{h}_{\mathrm{z}}\right)$
$=10 \pi \mathrm{H}-9 \pi \mathrm{~h}_{\mathrm{z}}$
$\therefore 10 \pi \mathrm{H}-9 \pi \mathrm{~h}_{\mathrm{z}}=9 \pi \mathrm{H}_{\mathrm{z}} \quad \Rightarrow \frac{\mathrm{H}}{\mathrm{h}_{\mathrm{z}}}=\frac{9}{5}$

Now after second transfer, let height in X be $\mathrm{h}_{\mathrm{x}}$
$\Rightarrow$ volume transferred $=10 \pi \mathrm{H}-9 \pi \mathrm{~h}_{\mathrm{z}}-\pi \mathrm{h}_{\mathrm{x}} \quad \Rightarrow$ New volume in $\mathrm{Y}=4 \pi \mathrm{H}+10 \pi \mathrm{H}-9 \pi \mathrm{~h}_{\mathrm{z}}-\pi \mathrm{h}_{\mathrm{x}}$ $=14 \pi \mathrm{H}-9 \pi \mathrm{~h}_{\mathrm{z}}-\pi \mathrm{h}_{\mathrm{x}}$
$\Rightarrow$ Volume in $\mathrm{X}=$ Volume in $\mathrm{Y} \quad \Rightarrow \pi \mathrm{h}_{\mathrm{x}}=14 \pi \mathrm{~h}-9 \pi \mathrm{~h}_{\mathrm{z}}-\pi \mathrm{h}_{\mathrm{x}}$
$\Rightarrow \frac{\mathrm{h}_{\mathrm{x}}}{\mathrm{h}_{\mathrm{z}}}=\frac{14 \mathrm{H}}{\mathrm{h}_{\mathrm{z}}}-9-\frac{\mathrm{h}_{\mathrm{x}}}{\mathrm{h}_{\mathrm{z}}} \Rightarrow \frac{\mathrm{h}_{\mathrm{x}}}{\mathrm{h}_{\mathrm{z}}}=\frac{81}{10}$, Now let height in Y be $\mathrm{h}_{\mathrm{y}}$
$\Rightarrow \mathrm{h}_{\mathrm{y}}=\frac{\text { volume in } \mathrm{Y}}{4 \pi} \Rightarrow \mathrm{~h}_{\mathrm{y}}=\frac{14 \pi \mathrm{~h}-9 \pi \mathrm{~h}_{\mathrm{z}}-\pi \mathrm{h}_{\mathrm{x}}}{4 \pi} \Rightarrow \frac{\mathrm{~h}_{\mathrm{y}}}{\mathrm{h}_{\mathrm{z}}}=\frac{14}{4} \cdot \frac{\mathrm{H}}{\mathrm{h}_{\mathrm{z}}}-\frac{9}{4}-\frac{1}{4} \cdot \frac{4 \mathrm{~h}_{\mathrm{x}}}{\mathrm{h}_{\mathrm{z}}}$
$\frac{\mathrm{h}_{\mathrm{y}}}{\mathrm{h}_{\mathrm{z}}}=\frac{14}{4} \cdot \frac{9}{5}-\frac{9}{4}-\frac{1}{4} \cdot \frac{81}{10}=\frac{81}{40}$
65. The average incomes of the people in two villages are P and Q , respectively. Assume that $\mathrm{P} \neq \mathrm{Q}$. A person moves from the first village to the second village. The new average incomes are $\mathrm{P}^{\prime}$ and $\mathrm{Q}^{\prime}$, respectively. Which of the following is not possible ?
(A) $\mathrm{P}^{\prime}>\mathrm{P}$ and $\mathrm{Q}^{\prime}>\mathrm{Q}$
(B) $\mathrm{P}^{\prime}>\mathrm{P}$ and $\mathrm{Q}^{\prime}<\mathrm{Q}$
(C) $\mathrm{P}^{\prime}=\mathrm{P}$ and $\mathrm{Q}^{\prime}=\mathrm{Q}$
(D) $\mathrm{P}^{\prime}<\mathrm{P}$ and $\mathrm{Q}^{\prime}<\mathrm{Q}$

Ans. (C))
Sol. Let number of people in two villages be a \& b respectively

| Average <br> income | No. <br> of <br> People | Total <br> income | Total <br> income <br> after <br> movement | New <br> Population | New <br> average <br> income |
| :---: | :---: | :---: | :---: | :---: | :---: |
| P | Q | $\mathrm{P} . \mathrm{a}$ | $\mathrm{Pa}-\lambda$ | $\mathrm{a}-1$ | $\mathrm{P}^{\prime}=\frac{\mathrm{Pa}-\lambda}{\mathrm{a}-1}$ |
| Q | b | Qb | $\mathrm{Qb}+\lambda$ | $\mathrm{b}+1$ | $\mathrm{Q}^{\prime}=\frac{\mathrm{Qb}+\lambda}{\mathrm{b}+1}$ |

if $\mathrm{P}^{\prime}=\mathrm{P} \Rightarrow \frac{\mathrm{Pa}-\lambda}{\mathrm{a}-1}=\mathrm{P} \Rightarrow \lambda=\mathrm{P}$
and also $\mathrm{Q}^{\prime}=\mathrm{Q} \Rightarrow \frac{\mathrm{Qb}+\lambda}{\mathrm{b}+1}=\mathrm{Q}$
$\Rightarrow \lambda=\mathrm{Q} \Rightarrow \mathrm{P}=\mathrm{Q}$ but $\mathrm{P} \neq \mathrm{Q}$
Hence C option not possible

## PHYSICS

66. A girl sees through a circular glass slab (refractive index 1.5) of thickness 20 mm and diameter 60 cm to the bottom of a swimming pool. Refreactive index of water is 1.33 . The bottom surface of the slab is in contact with the water surface.


The depth of swimming pool is 6 m . The area of bottom of swimming pool that can be seen through the slab is approximately
(A) $100 \mathrm{~m}^{2}$
(B) $160 \mathrm{~m}^{2}$
(C) $190 \mathrm{~m}^{2}$
(D) $220 \mathrm{~m}^{2}$

Ans. (B)

Sol.

$1 \sin 90=\frac{4}{3} \sin r \Rightarrow \tan r=\frac{3}{\sqrt{7}} ; \quad$ Area $=\pi\left[\frac{3}{\sqrt{7}}(6)+\frac{0.6}{2}\right]^{2}$
(=) $158.5 \mathrm{~m}^{2} \simeq 160 \mathrm{~m}^{2}$
67. 1 Kg of ice at $-20^{\circ} \mathrm{C}$ is mixed with 2 Kg of water at $90^{\circ} \mathrm{C}$. Assuming that there is no loss of energy to the environment, what will be the final temperature of the mixture ? (Assume latent heat of ice $=334.4 \mathrm{KJ} / \mathrm{Kg}$, specific heat of water and ice are $4.18 \mathrm{~kJ} /(\mathrm{kg} . \mathrm{K})$ and $2.09 \mathrm{~kJ} /(\mathrm{kg} . \mathrm{K})$, respectively.)
(A) $30^{\circ} \mathrm{C}$
(B) $0^{\circ} \mathrm{C}$
(C) $80^{\circ} \mathrm{C}$
(D) $45^{\circ} \mathrm{C}$

Ans. (A)
Sol. (1) $(2.09)(0+20)+(1)(334.4)+(1)(4.18)(T)$

$$
=(2)(4.18)(90-\mathrm{T})
$$

$\mathrm{T}=30^{\circ} \mathrm{C}$
68. A rigid body in the shape of a " V " has two equal arms made of uniform rods. What must the angle between the two rods be so that when the body is suspended from one end, the other arm is horizontal?
(A) $\cos ^{-1}\left(\frac{1}{3}\right)$
(B) $\cos ^{-1}\left(\frac{1}{2}\right)$
(C) $\cos ^{-1}\left(\frac{1}{4}\right)$
(D) $\cos ^{-1}\left(\frac{1}{6}\right)$

Ans. (A)

Sol.


Centre of mass must be vertically below point P .

$$
\mathrm{m}\left(\frac{\ell}{2}-\ell \cos \theta\right)=\mathrm{m} \frac{\ell}{2} \cos \theta
$$

$$
\frac{3}{2} \ell \cos \theta=\frac{\ell}{2} \Rightarrow \cos =\frac{1}{3}
$$

69. A point object is placed 20 cm left of a convex lens of focal length $f=5 \mathrm{~cm}$ (see the figure). The lens is made to oscillate with small amplitude A along the horizontal axis. The image of the object will also oscillate along the axis with
(A) amplitude $A / 9$, out of phase with the oscillations of the lens.
(B) amplitude $A / 3$, out of phase with the oscillations of the lens
(C) amplitude $A / 3$, in phase with the oscillations of the lens
(D) amplitude $\mathrm{A} / 9$, in phase with the oscillations of the lens


Ans. (A)

Sol. $\mathrm{u}=-20 \mathrm{~cm}$

$$
\mathrm{v}=\frac{20}{3} \mathrm{CM}
$$

$\mathrm{X}_{\mathrm{I} / \ell}=\mathrm{m}^{2} \mathrm{X}_{\mathrm{o} / \ell}$
$\mathrm{A}^{1}=\frac{1}{9} \mathrm{~A}$
If lens moves rightward image moves leftward.
70. Stoke's law states that the viscous drag force F experienced by a sphere of radius a, moving with a speed $v$ through a fluid with coefficient of viscosity $\eta$, is given by $F=6 \pi \eta a v$
If this fluid is flowing through a cylindrical pipe of radius r , length $l$ and a pressure difference of P across its two ends, then the volume of water V which flows through the pipe in time t can be written as

$$
\frac{\mathrm{v}}{\mathrm{t}}=\mathrm{k}\left(\frac{\mathrm{p}}{\ell}\right)^{\mathrm{a}} \eta^{\mathrm{b}} \mathrm{r}^{\mathrm{c}}
$$

where k is a dimensionless constant. Correct values of $\mathrm{a}, \mathrm{b}$ and c are
(A) $\mathrm{a}=1, \mathrm{~b}=-1, \mathrm{c}=4$
(B) $\mathrm{a}=-1, \mathrm{~b}=1, \mathrm{c}=4$
(C) $\mathrm{a}=2, \mathrm{~b}=-2, \mathrm{c}=3$
(D) $\mathrm{a}=1, \mathrm{~b}=-2, \mathrm{c}=-4$

Ans. (A)
Sol. $\quad \frac{V}{t}=k\left(\frac{P}{\ell}\right)^{a}(\eta)^{b}(r)^{c}$
$\left[\mathrm{L}^{3} \mathrm{~T}^{-1}\right]=\left[\mathrm{ML}^{-2} \mathrm{~T}^{-2}\right]^{\mathrm{a}}\left[\mathrm{ML}^{-1} \mathrm{~T}^{-1}\right]^{\mathrm{b}}[\mathrm{L}]^{\mathrm{c}}$
$-2 \mathrm{a}-\mathrm{b}+\mathrm{C}=3$
$a+b=0$
$-2 \mathrm{a}-\mathrm{b}=-1$
$\Rightarrow \mathrm{a}=1, \mathrm{~b}=-1, \mathrm{C}=4$

## CHEMISTRY

71. When 262 g of xenon (atomic mass $=131$ ) reacted completely with 152 g of fluorine (atomic mass $=19$ ), a mixture of $\mathrm{XeF}_{2}$ and $\mathrm{XeF}_{6}$ was produced. The molar ratio $\mathrm{XeF}_{2}: \mathrm{XeF}_{6}$ is :-
(A) $1: 2$
(B) $1: 4$
(C) $1: 1$
(D) $1: 3$

Ans. (C))
Sol. Moles of $\mathrm{Xe}=\frac{262}{131}=2$ moles
Moles of F atoms $=\frac{152}{19}=8$ moles
Let $x$ moles of $\mathrm{XeF}_{2}$ and $y$ moles of $\mathrm{XeF}_{6}$ are formed then
By applying P.O.A.C. on Xe ;

$$
X+Y=2
$$

By applying P.O.A.C. on F

$$
\begin{equation*}
2 x+6 y=8 \tag{2}
\end{equation*}
$$

By Solving (1) \& (2)

$$
x=1 ; y=1
$$

72. Reaction of ethanol with conc. sulphuric acid at $170^{\circ} \mathrm{C}$ produces a gas which is then treated with bromine in carbon tetrachloride. The major product obtained in this reaction is :-
(A) 1,2-dibromoethane (B) ethylene glycol
(C) bromoethane
(D) ethyl sulphate

Ans. (A)

Sol


1,2 dibromoethane

73. When 22.4 $\mathrm{L}^{\text {of }} \mathrm{C}_{4} \mathrm{H}_{8}$ at STP is burnt completely, $89.6 \mathrm{~L}^{\text {of }} \mathrm{CO}_{2}$ gas at STP and 72 g of water are produced. The volume of the oxygen gas at STP consumed in the reaction is closest to :-
(A) 89.6 L
(B) 112 L
(C) 134.4 L
(D) 22.4 L

Ans. (C))
Sol. $\mathrm{C}_{4} \mathrm{H}_{8(\mathrm{~g})}+6 \mathrm{O}_{2(\mathrm{~g})} \rightarrow 4 \mathrm{CO}_{2(\mathrm{~g})}+4 \mathrm{H}_{2} \mathrm{O}_{(\ell)}$
moles of $\mathrm{C}_{4} \mathrm{H}_{8}=\frac{22.4}{22.4}=1$ mole
moles of $\mathrm{O}_{2}$ required $=6$ moles
volume of $\mathrm{O}_{2}$ required $=6 \times 22.4=134.4 \mathrm{lt}$
74. The amount of Ag (atomic mass =108) deposited at the cathode when a current of 0.5 amp is passed through a solution of $\mathrm{AgNO}_{3}$ for 1 hour is closes to :-
(A) 2 g
(B) 5 g
(C) 108 g
(D) 11 g

Ans. (A)
Sol. No. of equivalent of $\operatorname{Ag}$ deposited $=$ No. of faraday $=\frac{0.5 \times 60 \times 60}{96500}=\frac{18}{965}$

Wt. of 'Ag' deposited $=\frac{18}{965} \times 108 \simeq 2 \mathrm{gm}$
75. The major product of the reaction is :-



I


II


III


IV
(A) I
(B) II
(C) III
(D) IV

Ans. (A)

Sol.


Mechanism


## BIOLOGY

76. Genomic DNA is digested with Alu I, a restriction enzyme which is a four base-pair cutter. What is the frequency with which it will cut the DNA assuming a random distribution of bases in the genome:-
(A) $1 / 4$
(B) $1 / 24$
(C) $1 / 256$
(D) $1 / 1296$

Ans. (C)
77. I rice is cooked in a pressure cooker on the Siachen glacier, at sea beach and on Deccan plain, which of the following is correct about the time taken for cooking rice :-
(A) Gets cooked faster on the Siachen glacier
(B) Gets cooked faster at sea beach
(C) Gets cooked faster on Deccan plain
(D) Gets cooked at the same time at all the three places

Ans. (B)
78. A few rabbits are introduced in an un-inhabited island with plenty of food. If these rabbits breed in the absence of any disease, natural calamity and predation, which one of the following graphs best represents their population growth :-
(A)

(B)

(C)

(D)


Ans. (B)
79. What is the advantage of storing glucose as glycogen in animals instead of as monomeric glucose:-
(A) Energy obtained from glycogen is more than that from the corresponding glucose monomers
(B) Glucose present as monomers within the cells exerts more osmotic pressure than a single glycogen molecule, resulting in loss of water from the cells.
(C) Glucose present as monomers within the cell exerts more osmotic pressure than a single glycogen molecule, resulting in excess water within the cells.
(D) Glycogen gives more rigidity to the cells.

Ans. (C)
80. A line is draw from the exterior of an animal cell to the centre of the nucleus, crossing through one mitochondrion. What is the minimum number of membrane bilayers that the line will cross :-
(A) 4
(B) 3
(C) 8
(D) 6

Ans. (B)

