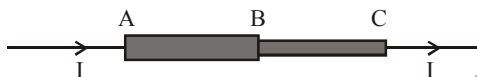


SOLUTIONS

1. Rod AB of radius $2r$ is joined with rod BC of radius r . They are of same material and are of same length. The combination carries a current I . Choose the correct statement.



- (a) $V_{AB} = 4V_{BC}$ (b) Current per unit in AB and BC are equal
(c) Resistance of AB is greater than of BC (d) $V_{BC} = 4V_{AB}$

Ans. (d)

Sol.
$$\frac{V_{AB}}{V_{BC}} = \frac{IR_{AB}}{IR_{BC}} = \frac{I\rho\ell/\pi(2r)^2}{I\rho\ell/\pi r^2} = \frac{1}{4}$$

or $V_{BC} = 4V_{AB}$

2. The statement "a is not less than 4" is correctly represented by

- (a) $a < 4$ (b) $a > 4$ (c) $a \geq 4$ (d) $a \leq 4$

Ans. (c)

Sol. "a is not less than 4"

\Rightarrow a is greater or equal to 4

$\Rightarrow a \geq 4$

So option (c) is correct

3. A chemist mixes two ideal liquids A and B to form a homogeneous mixture. The densities of the liquids are 2.0 g/mL for A and 3 g/mL for B. When she drops a small object into the mixture, she finds that the object becomes suspended in the liquid that is it neither sinks to the bottom nor does it float on the surface. If the mixture is made of 40% A and 60% B, by volume, what is the density of the object?

- (a) 2.60 g/mL (b) 2.50 g/mL (c) 2.40 g/mL (d) 1.50 g/mL

Ans. (a)

Sol. density of mixture = density of object

$$= \frac{V_A\rho_A + V_B\rho_B}{V_A + V_B} = \frac{0.4 \times 2.0 + 0.6 \times 3}{1}$$

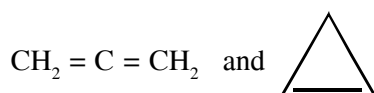
$$= 0.8 + 1.8 = 2.6 \text{ g/mL}$$

4. How many different compounds can have the formula C_3H_4 ?

- (a) One (b) Two (c) Three (d) Four

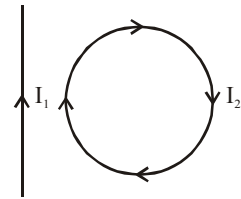
Ans. (c) Three

Sol. Structures are : $CH_3 - C \equiv CH$



5. In the figure shown, the current carrying loop is fixed, where as current carrying straight conductor is free to move. Then straight wire will (ignore gravity)

- (a) remain stationary
- (b) move towards the loop
- (c) move away from the loop
- (d) rotate about the axis perpendicular to plane of paper



Ans. (b)

Sol. Due to current carrying loop, magnetic field on straight wire will be in outward direction so a force towards right will be exerted on this wire.

6. Two friends A and B watched a car from the top of their buildings. Angle of depression for A was 10° more than angle of depression for B, then

- (a) A's apartment is taller than B's apartment
- (b) B's apartment is taller than A's apartment
- (c) A's apartment and B's apartment have same height
- (d) We cannot compare the heights of the two apartments

Ans. (d)

Sol. Let 'H₁' and 'H₂' i.e. the height of two buildings, then

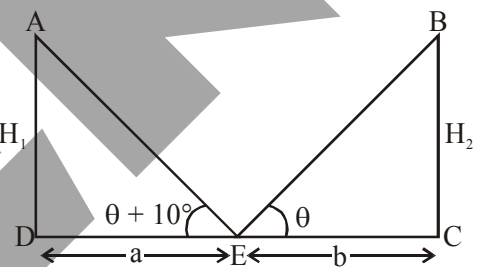
$$\tan \theta = \frac{H_2}{b}, \tan (\theta + 10^\circ) = \frac{H_1}{a}$$

$$\Rightarrow H_2 = b \tan \theta,$$

$$H_1 = a \tan(\theta + 10^\circ)$$

Now, we can compare the height of two building only when a and b are known.

so option (d) is correct



7. How many times would a red blood cell pass through the heart during one complete cycle?

- (a) Once
- (b) Twice
- (c) 4 times
- (d) 72 times

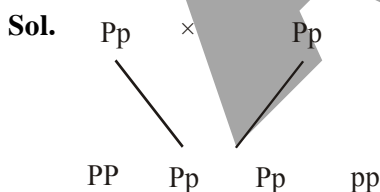
Ans. (b)

Sol. In double circulation, blood passes twice through.

8. A gene has two alleles P(dominant) and p(recessive). The homozygous recessive combination leads to death in the embryo stage. If two individuals with genotype Pp are mated, out of the offspring that survive to adulthood, what is the probability of the genotype to be Pp?

- (a) 0.75
- (b) 0.33
- (c) 0.5
- (d) 0.67

Ans. (d)



As mentioned in question homozygous recessive will die. So pp will die then Pp will be $\frac{2}{3} = 0.67$.

9. A convex mirror of focal length f produces an image of size equal to $\frac{1}{n}$ times the size of the object. Then the object distance is

- (a) nf (b) $\frac{f}{n}$ (c) $(n + 1)f$ (d) $(n - 1)f$

Ans. (d)

Sol. $\frac{v}{u} = \frac{1}{n}, \quad v = \frac{u}{n}$

Writing mirror formula,

$$\frac{1}{v} + \frac{1}{u} = \frac{1}{f}$$

$$\frac{n}{u} - \frac{1}{u} = \frac{1}{f}$$

$$\text{or, } \frac{1}{u} (n - 1) = \frac{1}{f}$$

$$\therefore u = (n - 1)f$$

10. Total surface area of a sphere S with radius $\sqrt{2} + \sqrt{3}$ cm is

- (a) $400\pi(5 + 2\sqrt{6})$ sq mm (b) $\pi(\sqrt{2} + \sqrt{3})^2$ sq cm
(c) $2\pi(\sqrt{2} + \sqrt{3})^2$ sq cm (d) $40\pi(5 + 2\sqrt{6})$ sq mm

Ans. (a)

Sol. $r = \sqrt{2} + \sqrt{3}$

$$\begin{aligned} \text{S.A of sphere} &= 4\pi (\sqrt{2} + \sqrt{3})^2 \\ &= 4\pi (5 + 2\sqrt{6}) \text{ cm}^2 \\ &= 400 \pi (5 + 2\sqrt{6}) \text{ mm}^2 \end{aligned}$$

So option (a) is correct.

11. There are many elements in the periodic table that are named after the country, where they were first made or obtained. For example, the Latin name for copper was coined by the Romans because their chief source of copper was from the Island of Cyprus. However, there is one country in the world which was named after an element (the Latin name). A long time ago, it was believed that this country had mountains full of a valuable element, however all expeditions to find these mountains failed. But the name stuck on. The element in question is used for many applications today, and many of its compounds are used as catalysts. The ions of this metal have very good anti-microbial property and finds application in water purification. The element is

- (a) Sodium (b) Gold (c) Silver (d) Francium

Ans. (c) Silver

Sol. Argentina is named after silver "Argentum"

12. All of these species have the same number of valence electrons as nitrate ion, except

- (a) Carbonate ion (b) Bicarbonate ion
(c) NF_3 (d) SO_3

Ans. (c) NF_3

Sol. No. of valence e⁻s in nitrate ion is

$$\text{NO}_3^- = 24.$$

(a) CO_3^{2-} : Valence e⁻ = 24

(b) HCO_3^- : Valence e⁻ = 24

(c) NF_3 : Valence e⁻ = 26

(d) SO_3 : Valence e⁻ = 24

13. The angle between the hour arm and the minute arm of a clock at 2:10 a.m. is

- (a) Zero (b) 4° (c) 5° (d) 6°

Ans. (c)

Sol. Angle between hour hand and minute hand is given by $\frac{|11M - 60H|}{2}$

Where M = minute and H = Hour

So, angle between hour hand and minute hand of 2 : 10 AM is $\frac{|11 \times 10 - 2 \times 60|}{2} = 5^\circ$

Option is (c) correct

14. A craft teacher reshapes the wax from a cylinder of candle with section diameter 6 cm and the height 6cm into a sphere. The radius of this sphere will be

- (a) $r = 6\sqrt{3/2}$ cm (b) $r = 6$ cm
(c) $r = 3\sqrt[3]{3/2}$ cm (d) $r = 6\sqrt[3]{2}$ cm

Ans. (c)

Sol. Volume of wax in cylindrical shape = volume of wax in spherical shape

$$= \pi r^2 h = \frac{4}{3} \pi R^3$$

$$= \frac{22}{7} \times (3)^2 \times 6 = \frac{4}{3} \pi R^3$$

$$\Rightarrow R^3 = \frac{3^2 \times 6 \times 3}{4}$$

$$\Rightarrow R = 3\sqrt[3]{\frac{3}{2}} \text{ cm}$$

Option (c) is correct

15. Plants absorb nitrates from the soil, which are most essential to produce

- (a) Proteins (b) Carbohydrates
(c) Fats (d) Cell wall

Ans. (a)

Sol. Plant absorb nitrates from the soil which is essential to produce protein.

16. The dry mass (mass excluding water) of a seed in the process of germination

- (a) increases over time until the first leaves appear
- (b) decreases over time until the first leaves appear
- (c) stays constant until the first leaves appear
- (d) first increases and then decreases until the first leaves appear.

Ans. (b)

Sol. During the time of germination the dry mass of seed will decrease, because it will do respiration.

17. A point object O is kept at origin. When a concave mirror M_1 placed at $x = 6$ cm, image is formed at infinity. When M_1 is replaced by another concave mirror M_2 at same position, image is formed at $x = 30$ cm, then ratio of the focal length of M_1 to that of M_2 is

- (a) $\frac{3}{4}$
- (b) $\frac{4}{3}$
- (c) 5
- (d) $\frac{1}{5}$

Ans. (a)

Sol. Since image is formed at ∞

$$f_{M_1} = -6$$

For M_2 ,

$$\frac{1}{(30-6)} - \frac{1}{6} = \frac{1}{f_{M_2}}$$

or $\frac{1}{24} - \frac{1}{6} = \frac{1}{f_{M_2}}$

$$\frac{1-4}{24} = \frac{1}{f_{M_2}}$$

$$\Rightarrow f_{M_2} = -8 \text{ cm}$$

$$\therefore \frac{f_{M_1}}{f_{M_2}} = \frac{6}{8} = \frac{3}{4}$$

18. The number $3^8(3^{10} + 6^5) + 2^3(2^{12} + 6^7)$ is

- (a) A perfect square and a perfect cube
- (b) Neither a perfect square nor a perfect cube
- (c) A perfect cube but not a perfect square
- (d) A perfect square but not a perfect cube

Ans. (c)

Sol. $3^8(3^{10} + 6^5) + 2^3(2^{12} + 6^7)$

$$3^{18} + 3^8 \cdot 3^5 \cdot 2^5 + 2^{15} + 2^{10} \cdot 3^7$$

$$3^{18} + 3^{13} \cdot 2^5 + 3^7 2^{10} + 2^{15}$$

$$3^{18} + 3^7 \cdot 2^5 (3^6 + 2^5) + 2^{15}$$

$$(3^6)^3 + 3(3^6)(2^5)(3^6 + 2^5) + (2^5)^3$$

$$(3^6 + 2^5)^3 \text{ which is perfect cube.}$$

It is a perfect cube but not a perfect square

So, option (c) is correct.

19. Melting point of a substance is 10°C . What does this mean?
- (a) The substance is a liquid at 10°C .
 (b) The substance is a solid at 10°C .
 (c) There is an equilibrium between solid phase and liquid phase at 10°C
 (d) The substance is 50% solid and 50% liquid at 10°C .

Ans. (c)

Sol. Melting point is defined as the temperature at which solid and liquid phase of a substance are in state of dynamic equilibrium at a fixed pressure.

20. The following substances have approximately same molecular mass. Which is likely to have the highest boiling point?

- (a) n-butane (b) Isobutane (c) n-butanol (d) Isobutanol

Ans. (c) n-butanol.

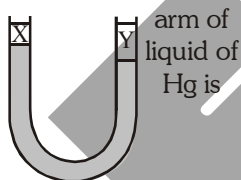
Sol. B.P. of n-Butanol = 117.7°C

B.P. of iso-Butanol = 108°C

B.P. of n-Butane = -1°C

B.P. of iso-Butane = -11.7°C

21. U-tube contains some amount of mercury. Immiscible liquid X is poured in left arm and immiscible liquid Y is poured in the right arm. Length of liquid X is 8 cm. length Y is 10 cm and upper levels of X and Y are equal. If density of Y is $3.36\text{ g}\cdot\text{cm}^{-3}$ and $13.6\text{ g}\cdot\text{cm}^{-3}$ then density of X is



- (a) $0.8\text{ g}\cdot\text{cm}^{-3}$ (b) $1.2\text{ g}\cdot\text{cm}^{-3}$ (c) $1.4\text{ g}\cdot\text{cm}^{-3}$ (d) $16\text{ g}\cdot\text{cm}^{-3}$

Ans. (a)

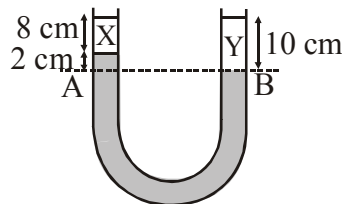
Sol. $P_A = P_B$

$$P_0 + \rho_X g(8) + \rho_{\text{Hg}} g(2) = \rho_Y \times G \times 10 + P_0$$

$$8\rho_X = 10\rho_Y - 2\rho_{\text{Hg}} = 10 \times 3.36 - 2 \times 13.6 = 33.6 - 27.2$$

$$8\rho_X = 6.4$$

$$\rho_X = \frac{6.4}{8} = 0.8\text{ g}\cdot\text{cm}^{-3}$$



22. Let the number of rectangles formed by 6 horizontal and 4 vertical lines be n and those formed by 5 vertical and 5 horizontal lines be m then we have

- (a) $n = m$ (b) $n \geq m + 1$ (c) $m \geq n$ (d) $m > n + 5$

Ans. (d)

Sol. Number of rectangles formed by 6 horizontal and 4 vertical lines is ${}^6C_2 \times {}^4C_2 = 90$

$$\therefore n = 90$$

Also number of rectangles formed by 5 vertical and 5 horizontal lines is ${}^5C_2 \times {}^5C_2 = 100$

$$\Rightarrow m = 100$$

$$\therefore m > n + 5$$

so, option (d) is correct.

23. In a human cell undergoing Meiosis, what are the total number of cellular DNA molecules present during Prophase-I

- (a) 23 (b) 46 (c) 69 (d) 92

Ans. (d)

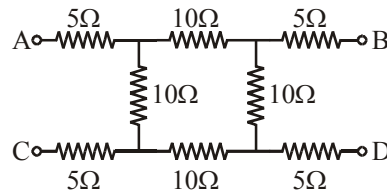
Sol. During the interphase the process of DNA replication will occur. That's why the DNA content in prophase-I will be doubled.

24. During gaseous exchange in the alveoli, what happens to nitrogen?
- There is no net nitrogen exchange, as nitrogen is filtered out by the alveoli.
 - The nitrogen is absorbed by the alveolus to form amino acids.
 - The nitrogen is filtered out by the alveolus, as the nitrogen molecule is too large to cross the gaps in the capillaries
 - There is no net nitrogen exchange, as the blood is saturated with nitrogen

Ans. (d)

Sol. There is no net nitrogen exchange as, the blood is saturated with nitrogen.

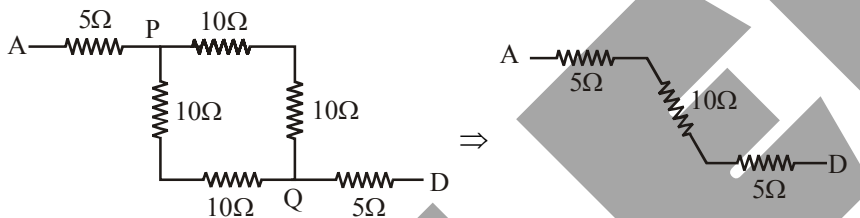
25. The effective resistance between A and D in the circuit shown in the adjacent figure is



- (a) $5\ \Omega$ (b) $10\ \Omega$ (c) $15\ \Omega$ (d) $20\ \Omega$

Ans. (d)

Sol. From the fig.



Equivalent resistance

Between P and Q is $10\ \Omega$

$$R_{eq} = 5 + 10 + 5 \\ = 20\ \Omega$$

26. If ABCD is a rhombus and $\angle ABC = 60^\circ$ then

- The points A,B,C,D are concyclic
- The quadrilateral has exactly half the area of the square with same sides as ABCD
- The quadrilateral has area $\frac{\sqrt{3}}{2} AB^2$
- The diagonals of the quadrilateral ABCD are equal and bisect each other at right angle

Ans. (c)

Sol. Here

$$AM = \sin 60^\circ \times a$$

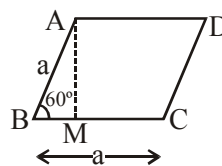
$$= \frac{\sqrt{3}a}{2}$$

$$\therefore \text{Area of rhombus} = \text{Base} \times \text{height} = a \times \frac{\sqrt{3}a}{2}$$

$$= \frac{\sqrt{3}a^2}{2}$$

$$= \frac{\sqrt{3}}{2} (AB)^2$$

so, option (c) is correct.



Ans. (d)

Sol. If $a, b > 0$

Then $AM \geq GM$

$$\Rightarrow \frac{a+b}{2} \geq \sqrt{ab}$$

$$\Rightarrow \boxed{a+b \geq 2\sqrt{ab}} \Rightarrow a+b > \sqrt{ab}$$

So option (b) is correct.

31. Which of the following is true about ATP

- (a) It is a derivative of one of the nitrogenous bases that form DNA
- (b) It splits into ADP and phosphate and the energy produced is used by muscle cells to contract
- (c) It is produced in both aerobic and anaerobic conditions.
- (d) All of the above

Ans. (d)

Sol. ATP is derivative of Adenosine, ATP is also used in muscle contraction, ATP is also produced in both aerobic & anaerobic condition. That's why the answer will be all of the above.

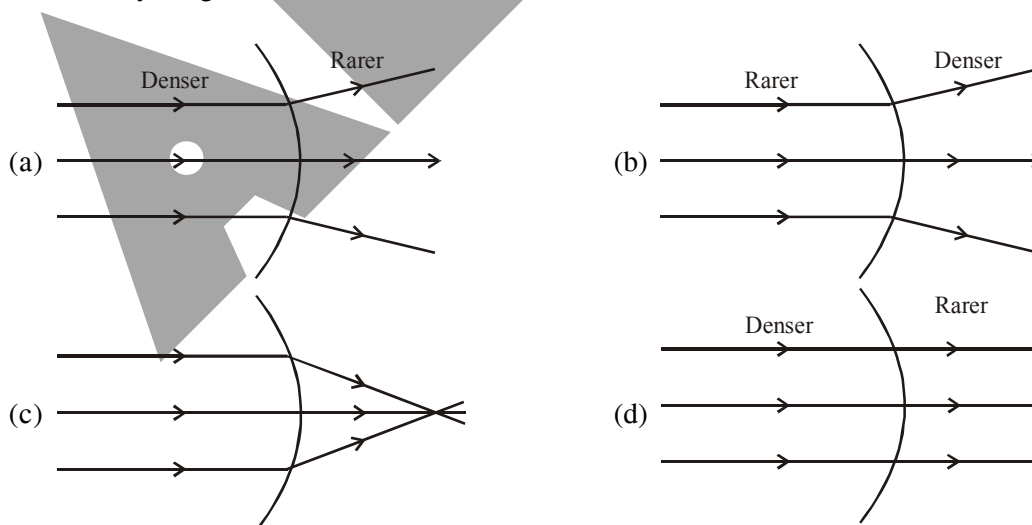
32. Which of the following is true regarding communication in neurons

- (a) Free electrons are moved along the plasma membrane of the axon and control the expression of neurotransmitters
- (b) A chemical signal travels along the axon and is converted into an electric impulse at the synapse
- (c) An electric impulse travels along the length of the axon. The electric impulse is converted to a chemical signal at the synapse.
- (d) An electrical signal is converted to a chemical signal by the Myelin sheath before it reaches the synapse

Ans. (c)

Sol. An electric impulse travels along the length of the axon. The electric impulse is converted to a chemical signal with the help of neurotransmitter "Acetyl choline" at synapse.

33. Following diagram shows refraction of parallel beam of light through a spherical surface. Identify the correct ray diagram



Ans. (b)

Sol. As rays bend towards normal in denser medium so, option (b) is correct.

34. Tenth term in the sequence 12, 18, 20, 28, ... is
 (a) 336 (b) 63 (c) 216 (d) 68

Ans. (b)

Sol. 12, 18, 20, 28,

$$2^2 \times 3, 3^2 \times 2, 2^2 \times 5, 2^2 \times 7, \dots$$

These are the number with 6 factors so next possible terms with 6 factors are

$$2^5 \times 1, 2^2 \times 11, 3^2 \times 5, 5^2 \times 2, 2^2 \times 13, 3^2 \times 7, \dots$$

∴ 10th term is 63.

So option (b) is correct.

35. An electron pair donor is a Lewis base and an electron pair acceptor is a Lewis acid. Which among the following statements, is correct?

- (a) NH_3 is a Lewis acid, because nitrogen has only 6 electrons around it
 (b) BF_3 is a Lewis base, because fluorine has 8 electrons around it.
 (c) NF_3 is a Lewis base, because nitrogen has a lone electron.
 (d) BCl_3 is a Lewis acid because it has only 6 electrons around it.

Ans. (d)

Sol. (d) most appropriate

(c) Option has lone e^- not lone pair of e^- s.

36. Greenhouse gases absorb (and trap) outgoing infrared radiation (heat) from Earth and contribute to global warming. A molecule that acts as a greenhouse gas, generally has a permanent dipole moment and sometimes for other reasons. Going only by the condition of permanent dipole moment, in the list of gases given below, how many can be potential greenhouse gases?

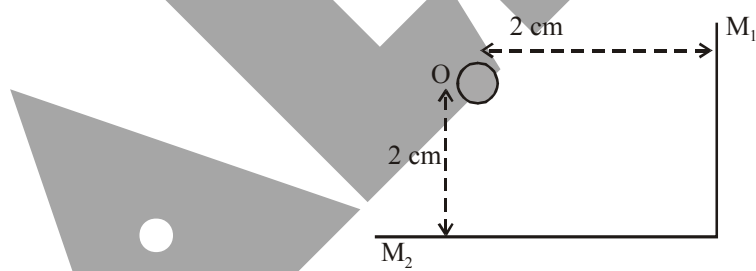
Water, Sulphur dioxide, Boron trifluoride, carbon monoxide, carbon dioxide, nitrogen, oxygen, methane, hydrogen sulphide, ammonia.

- (a) Five (b) Six (c) Seven (d) Four

Ans. (a) five

Sol. Water, SO_2 , CO, H_2S and NH_3 will have permanent dipole moment

37. In the diagram M_1 and M_2 are two plane mirrors at right angles to each other. O is a luminous point object. Consider two images formed due to first reflection at M_1 and M_2 . The area of the triangle formed by the object and two images is



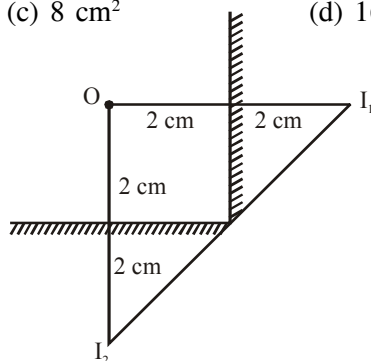
- (a) 4 cm^2 (b) 2 cm^2 (c) 8 cm^2 (d) 16 cm^2

Ans. (c)

Sol. Area of $\triangle OI_1I_2 = \frac{1}{2} \times OI_1 \times OI_2$

$$= \frac{1}{2} \times 4 \times 4$$

$$= 8 \text{ cm}^2$$



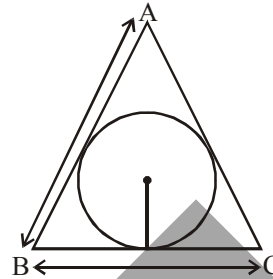
38. The probability of a point within an equilateral triangle with side 1-unit lying outside its in-circle (inscribed circle) is

- (a) $1 - \frac{1}{2(\sqrt{3})}$ (b) $1 - \frac{\pi}{3\sqrt{3}}$ (c) $1 - \frac{\pi}{2\sqrt{3}}$ (d) $1 - \frac{2\pi}{3\sqrt{3}}$

Ans. (b)

Sol. Radius of in-circle = $\frac{\Delta}{s}$

$$= \frac{\frac{\sqrt{3}}{4}(1)^2}{\frac{3}{2}} = \frac{1}{2\sqrt{3}}$$



$$\therefore \text{Probability of a point lying outside the circle} = \frac{\frac{\sqrt{3}}{4}(1)^2 - \pi(r^2)}{\frac{\sqrt{3}}{4}(1)^2} = 1 - \frac{\pi}{3\sqrt{3}}$$

So option (b) is correct.

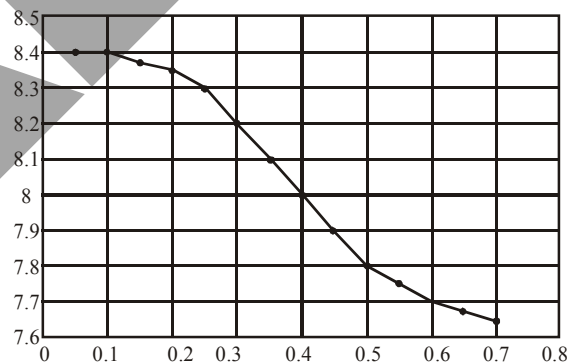
39. Penicillin cannot be used to treat influenza because:

- (a) It only helps to bring the temperature down, and does not reduce the infection
 (b) The penicillin is broken down by the organism
 (c) Viruses do not have cell walls
 (d) Reproduction of protozoans is not affected by penicillin

Ans. (c)

Sol. Antibiotics are not used in viral disease, because virus do not have cell wall.

40. Thin cuboidal strips are made by slicing a potato. They are all made to be exactly 8 cm long and 2 mm wide. Each strip is placed in sugar solutions of different concentration. After soaking it for 5 hours, their lengths are measured again. The following graph shows the results of the experiment. What concentration of sugar solution is isotonic with the contents of the cells of the potato.



- (a) 0.2 (b) 0.4 (c) 0.6 (d) 0.1

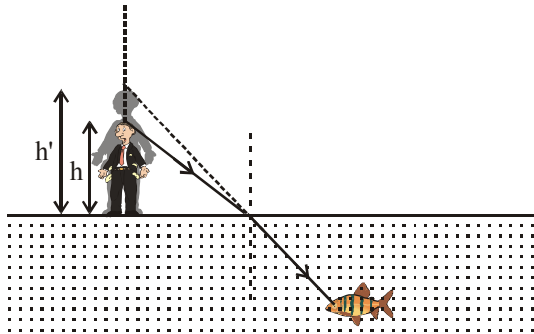
Ans. (b)

Sol. In the mention graph, 8 cm length of the slice will be on 0.4 concentrate solution [Isotonic] which will be similar to the initial slice length 8 cm.

41. A fisherman of height h is standing on the bank of a lake. A fish in the water perceives his height as h' . Then
- (a) $h' > h$ (b) $h' < h$
 (c) $h' = h$ (d) $h' > h$ or $h' < h$ depending on position of fish

Ans. (a)

Sol.



From Fig. itself $h' = \mu h$

42. A triangle has perimeter 316 and its sides are of integer length. The maximum possible area for such a triangle is achieved for
- (a) Single triangle (b) Two triangles
 (c) Three triangles (d) More than three triangle

Ans. (a)

Sol. $a + b + c = 316$ and $a, b, c \in \mathbb{I}$

Now, area is maximum only if $a = b = c$

But here sides are integers,

so it is not possible as $3a = 316 \Rightarrow a = \frac{316}{3} = 105.33$

\therefore Area is Max. only when $a = b = 105$ and $c = 106$.

So option (a) is correct.

43. Hennig Brand, one of the many alchemists was in pursuit of the philosopher's stone. Brand's method is believed to have consisted of evaporating large quantities of urine to leave a black residue that was then left for a few months. The residue was then heated with sand, driving off a variety of gases and oils. The final substance to be driven off, was condensed as a white solid, which he called as "cold fire" as it was luminous and glowed in the dark and also caught fire on slight warming and producing a large quantity of light. It has also been called as the "Bearer of light". Which element is "cold fire"?
- (a) Lithium (b) Tungsten (c) Phosphorus (d) Cesium

Ans. (c)

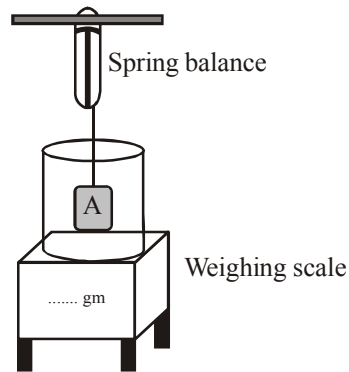
Sol. Phosphorus is called cold fire.

44. When solid KOH is mixed with solid NH_4Cl , a gas is produced. Which gas is it?
- (a) chlorine (b) hydrogen (c) hydrogen chloride (d) ammonia

Ans. (d) ammonia

Sol. $\text{KOH} + \text{NH}_4\text{Cl} \rightarrow \text{KCl} + \text{H}_2\text{O} + \text{NH}_3 \uparrow$

45. Object A is completely immersed in water. True weight of object A is W_A . Weight of water with beaker is W_B . Let B be the buoyant force. W_1 and W_2 are scale readings of spring balance and weighing scale respectively.



- (a) $W_1 = W_A$ (b) $W_1 = W_A + B$ (c) $W_2 = W_B$ (d) $W_2 = W_B + B$

Ans. (d)

Sol. For spring balance

$$kx = W_A - B$$

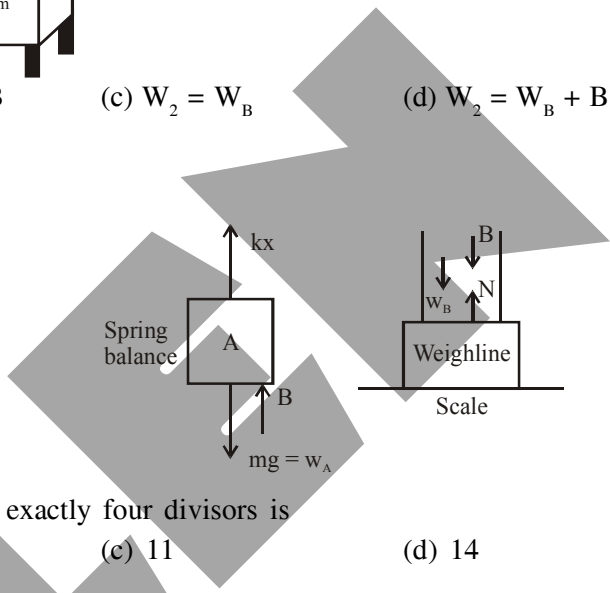
$$\Rightarrow W_A - B \quad \dots\dots (1)$$

For weighing machine

$$N = B + W_B$$

$$\Rightarrow W_2 = W_B + B \quad \dots\dots(2)$$

Hence 'd' is correct



46. Number of numbers less than 40 having exactly four divisors is

- (a) 15 (b) 12 (c) 11 (d) 14

Ans. (d)

Sol. Number having 4 divisor should be in the form of $a_1^1 \times a_2^1$ or a_1^3

\therefore Possible Numbers are

$6 = 2 \times 3$	$15 = 3 \times 5$
$10 = 2 \times 5$	$21 = 3 \times 7$
$14 = 2 \times 7$	$33 = 3 \times 11$
$22 = 2 \times 11$	$39 = 3 \times 13$
$26 = 2 \times 13$	$35 = 5 \times 7$
$34 = 2 \times 17$	$8 = 2^3$
$38 = 2 \times 19$	$27 = 3^3$

So, option (d) is correct.

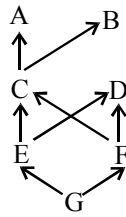
47. Antibodies play an important role in defending the body against infections by which of the following mechanism:

- (a) They engulf the bacteria and make them harmless
 (b) They bind to the surface of pathogens, so that they can be easily identified and removed by other cells of the immune system
 (c) They enter the pathogen and prevent cell division
 (d) They are highly reactive and chemically react with the DNA of the pathogen

Ans. (b)

Sol. Antibody, binds to the surface of pathogen, so that they can be easily identified & removed by other cells of Immune system.

48. The figure shows a food web, where A, B, C, D etc. are different species. And the direction of the arrows symbolizes the direction of flow of nutrients
An increase in the population of which species is likely to decrease the population of species A.

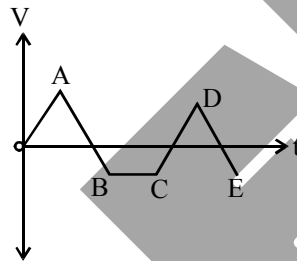


- (a) Species D (b) Species F (c) Species G (d) Species E

Ans. (a)

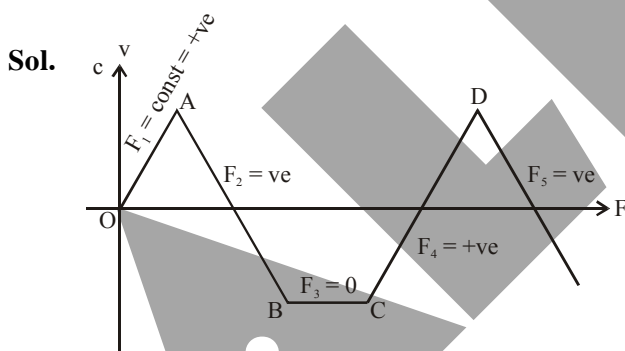
Sol. As mentioned in the figure, "C" is eaten by "A", "E" is eaten by both "C" & "D", that's why if we increase the number of "D", the number of "E" will decrease similarly "C" & "A" also decrease.

49. Velocity of a particle moving along a straight line varies with time as shown in the figure. Net forces acting on the particle are F_1, F_2, F_3, F_4 and F_5 in the intervals OA, AB, BC, CD and DE respectively. Identify the correct statement



- (a) F_1 increases with time (b) F_5 is initially positive and then becomes negative
(c) F_1 and F_2 are in opposite directions (d) F_3 is negative

Ans. (c)



Sol.

\therefore Slope of the velocity time gives us acceleration and $F = ma$ option 'c' is correct.

50. If set X consists of three elements then the number of elements in the power set of power set of X is
(a) 3^3 (b) 2^3 (c) 3^8 (d) 2^8

Ans. (d)

Sol. Let $X = \{a, b, c\}$

Then number of elements in the power set of A = $2^3 = 8$

\therefore Number of element in the power set of power set of A = 2^8

So, option (d) is correct.

51. The heat of neutralisation of CH_3COOH , HCOOH , HCN and H_2S are -55.2 , $-56.07 - 2.8$ and -3.34 kJ per equivalent respectively. The increasing order of strength of these acids is
- (a) $\text{HCOOH} < \text{CH}_3\text{COOH} < \text{H}_2\text{S} < \text{HCN}$ (b) $\text{H}_2\text{S} < \text{HCN} < \text{HCOOH} < \text{CH}_3\text{COOH}$
 (c) $\text{HCN} < \text{H}_2\text{S} < \text{CH}_3\text{COOH} < \text{HCOOH}$ (d) $\text{CH}_3\text{COOH} < \text{HCOOH} < \text{HCN} < \text{H}_2\text{S}$

Ans. (c) $\text{HCN} < \text{H}_2\text{S} < \text{CH}_3\text{COOH} < \text{HCOOH}$

Sol. Higher the heat of neutralisation stronger will be the acid

52. To prevent the formation of oxides, peroxides, and superoxides, alkali metals are sometimes stored in an unreactive atmosphere. Which of the following gases should not be used for lithium :
- (a) Ne (b) Ar (c) N_2 (d) Kr

Ans. (c) N_2

Sol. As Li can react with N_2 forming explosive Li_3N .

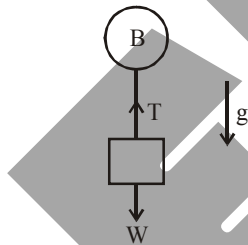
53. A wooden block (W) is suspended by using a cord from a heavy steel ball (B). The entire system is dropped from a height. Neglecting air resistance, the tension in the cord is
- (a) Zero (b) The difference in the masses of B and W
 (c) The differences in the weights of B and W (d) The weights of B

Ans. (a)

Sol. For wooden block

$$W - T = mg$$

$$\Rightarrow T = 0$$



54. In a n -sided regular polygon, the radius of the circum-circle is equal in length to the shortest diagonal. the number of values of $n < 60$ for which this can happen is
- (a) 0 (b) 1 (c) 10 (d) 2

Ans. (b)

Sol. $\triangle OCE$ is an equilateral triangle.

$$\text{So } \angle COE = 60^\circ$$

$$\triangle OCP \cong \triangle OEP$$

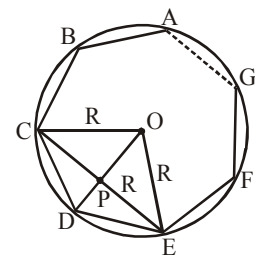
$$\text{So } \angle DOE = 30^\circ$$

$$\text{Angle made at centre by the side of regular polygon} = 30^\circ$$

$$\text{So, } \frac{360^\circ}{n} = 30^\circ$$

$$n = \frac{360^\circ}{30} = 12$$

So, option (b) is correct.



55. Which of the following does NOT contain living cells?
- (a) Bone tissue (b) Xylem sieve tubes (c) Phloem (d) epidermis

Ans. (b)

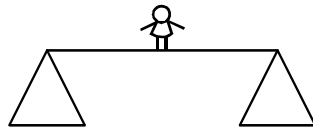
Sol. Xylem sieve tubes do not contain living cells.

56. If DNA was made of 6 nucleotides instead of 4, what are the total number of triplet codons possible?
- (a) 24 (b) 18 (c) 64 (d) 216

Ans. (d)

Sol. If we have 4 nitrogen base then we have 64 codons (triplet) $4^3 \Rightarrow 64$, As in question there are 6 nucleotides, then $6^3 = 216$.

57. A circus performer of weight W is standing on a wire as shown in the figure. The tension in the wire is



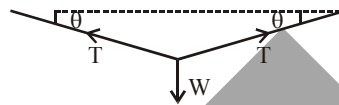
- (a) Approximately $\frac{W}{4}$ (b) Approximately $\frac{W}{2}$ (c) Much more than $\frac{W}{2}$ (d) Much less than $\frac{W}{2}$

Ans. (c)

Sol. From equilibrium condition

$$W = 2T \sin\theta$$

$$\text{or } T = \frac{W}{2\sin\theta}$$



Since θ is small, T will be much more than $\frac{W}{2}$.

58. Number of integers n such that the number $1 + n$ is a divisor of the number $1 + n^2$ is :

- (a) 0 (b) 1 (c) 4 (d) 2

Ans. (c)

Sol. $n^2 + 1 = n^2 - 1 + 2 = (n - 1)(n + 1) + 2$

Now, $n^2 + 1$ is divisible by $n + 1$ only when 2 is divisible by $n + 1$

So, $n = -3, -2, 0, 1$

So, option (c) is correct.

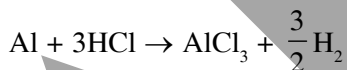
59. When 1 gram of a mixture of aluminium and zinc was treated with HCl , a gas was liberated. At the end of the reaction the volume of the liberated gas was found to be 524 cm^3 , under STP conditions. The individual weight of aluminium and zinc in the mixture respectively are :

- (a) 0.2 g and 0.8 g (b) 0.8 g and 0.2 g (c) 0.5 g and 0.5 g (d) 0.322 g and 0.678 g

Ans. (a)

Sol. $\text{Al} = x \text{ g}$

$\text{Zn} = 1 - x \text{ g}$



$$\frac{x}{27} \quad \frac{3}{2} \times \frac{x}{27} \text{ moles}$$



$$\frac{1-x}{65.3} \quad \frac{1-x}{65.3} \text{ moles.}$$

$$\text{Total H}_2 \text{ produced} = \frac{x}{18} + \frac{(1-x)}{65.3} \text{ moles} = \frac{524}{22400} \text{ (give)}$$

\Rightarrow Solving this $x = 0.21 \text{ gm}$ and $\text{Zn} = 0.79 \text{ gm}$

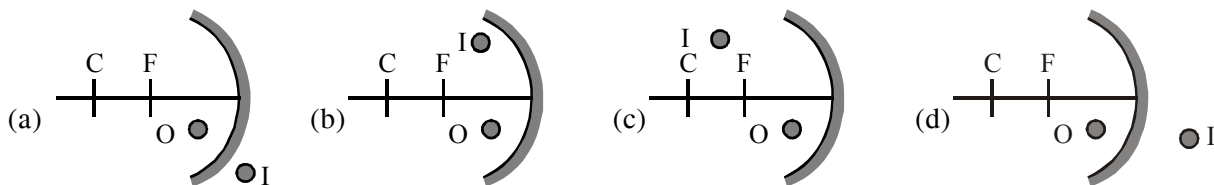
60. Choose that element which is most different from the other three.

- (a) Carbon (b) Nitrogen (c) Silicon (d) Phosphorous

Ans. (a)

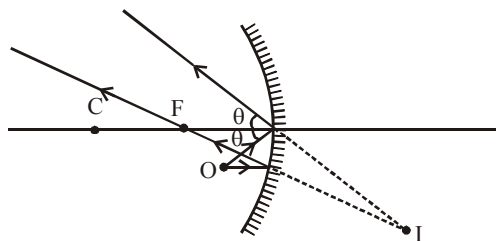
Sol. Carbon. due to its special character forming organic chemistry.

61. In the following diagrams O is point object and I is its image formed by a concave mirror. Identify the diagram. In which position of image I is nearly correct.



Ans. (a)

Sol. From ray diagram, it is clear that option 'a' is correct.



62. If for $x, y > 0$ we have $\frac{1}{x} + \frac{1}{y} = 2$ then the minimum value of xy is

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

Ans. (b)

Sol. If $\frac{1}{x} + \frac{1}{y} = 2$

Now, $AM \geq GM$

$$\Rightarrow \frac{\frac{1}{x} + \frac{1}{y}}{2} \geq \sqrt{\frac{1}{xy}}$$

$$\Rightarrow \sqrt{\frac{1}{xy}} \leq \frac{2}{2}$$

$$\Rightarrow \sqrt{\frac{1}{xy}} \leq 1$$

$$\Rightarrow xy \geq 1$$

Hence least value of $xy = 1$

So, option (b) is correct.

63. Which of these is a mollusc?

- (a) Lobster (b) Scorpion (c) Crab (d) Octopus

Ans. (d)

Sol. "Octopus" belongs to mollusc

64. What is the mechanism used by the kidney to remove waste products from the body?
- Nephrons convert nitrogenous waste to uric acid and pass it out as urine
 - Nephrons actively transport uric acid and other nitrogenous waste into the proximal and distal convoluted tubules, from where it is collected to form urine.
 - The blood is filtered to retain cells and large plasma proteins within the blood. The remaining filtrate passes through the proximal and distal convoluted tubules, where needed substances are reabsorbed by active transport
 - Nephrons filter out the nitrogenous waste which is passed through the proximal and distal convoluted tubules and collected by the collecting duct as urine.

Ans. (c)

Sol. In kidney blood cells & plasma will not enter in PCT & the remaining filtrate is passed through the Nephron, & all useful materials are re-absorbed actively.

65. Two bodies A and B are charged with equal magnitude of charge but A with positive charge and B with negative. If M_A and M_B are masses before charging and M_A^I and M_B^I are the masses after charging the (m_0 is some constant mass)

- $M_A^I = M_A + m_0$ and $M_B^I = M_B - m_0$
- $M_A^I = M_A - m_0$ and $M_B^I = M_B + m_0$
- $M_A^I = M_B^I$
- $M_A^I = M_A - \frac{m_0}{2}$ and $M_B^I = M_B + \frac{m_0}{2}$

Ans. (b)

Sol. If a particle is positively charged then electron leaves the object. If particle is negatively charged, extra electron comes into it.

$$\therefore M_A^I = M_A - m_0, M_B^I = M_B + m_0$$

66. The number of natural numbers $n \leq 30$ for for which $\sqrt{n + \sqrt{n + \sqrt{n + \dots}}}$ is a natural number is
- 30
 - Zero
 - 6
 - 5

Ans. (d)

Sol. Let $K = \sqrt{n + \sqrt{n + \sqrt{n + \dots}}}$

$$\Rightarrow K = \sqrt{n + K}$$

$$\Rightarrow K^2 = n + K$$

$$\Rightarrow K^2 - n - K = 0$$

$$\Rightarrow K = \frac{1 + \sqrt{1 + 4n}}{2} \text{ is a natural no only}$$

When $4n + 1$ is a perfect square

$$\therefore n = 2, 6, 12, 20, 30$$

So, option (d) is correct.

67. Elements A, B and C have atomic numbers X, X + 1 and X + 2, respectively. 'C' is an alkali metal 'A' reacts with another element 'Y' to form the compound 'AY'. 'A' and 'Y' belong to the same group. 'AY' possesses an
- ionic bond
 - covalent bond
 - metallic bonding
 - coordinate bond

Ans. (b) Covalent bond

Sol. AY is an interhalogen compound Ex ICl

68. Air has three major components : nitrogen, oxygen and argon. Given that one mole of air at sea level is made up of 78% nitrogen, 21% oxygen, and 1% argon, by volume. What is the density of air? Assume that gases behave in an ideal manner. (Atomic mass of argon is 40 amu)
- (a) 14.62 g/L (b) 1.3 g/L (c) 29 g/L (d) 0.65 g/L

Ans. (b) 1.3 gm/L

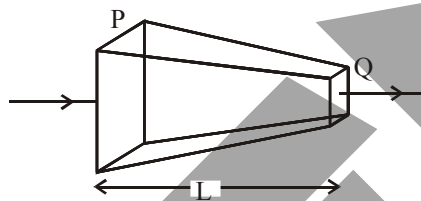
Sol. Molar mass of air = $\frac{78 \times 28 + 21 \times 32 + 1 \times 40}{100} = 28.96 \text{ gm}$

$$\text{density} = \frac{\text{mass}}{\text{volume}}$$

1 moles of air will occupy 22.4 litre.

$$\therefore d = \frac{28.96 \text{ gm}}{22.4 \text{ lit}} = 1.29 \text{ gm/L.}$$

69. A conductor of length L has a varying cross section with area 2A at P and A at Q as shown in the figure. If it carries a steady current I, then



- (a) Net charge per unit volume near P is more than net charge per unit volume near Q.
 (b) Net charge per unit volume near Q is less than net charge per unit volume.
 (c) Current per unit area near P is more than current per unit area near Q.
 (d) Current per unit area near P is less than current per unit area near Q.

70. The number of natural numbers $n \leq 30$ for which $\sqrt{n + \sqrt{n + \sqrt{n + \dots}}}$ is a prime number is
- (a) Three (b) Zero (c) Nine (d) Two

Ans. (a)

Sol. Let $K = \sqrt{n + \sqrt{n + \sqrt{n + \dots}}} \Rightarrow K = \frac{1 + \sqrt{1 + 4n}}{2}$

Here, K is prime only when $n = 2, 6, 20$

So, option (a) is correct.

71. Rhodospirillum rubrum is a species of photosynthetic bacteria. From your knowledge about bacteria in general, identify the components that CANNOT be present in this organism.

- (a) Chloroplasts (b) ATP
 (c) Ribosomes (d) Cell wall

Ans. (a)

Sol. Bacteria do not have membrane bound cell - organelles, that's why chloroplast will be absent in bacteria.

72. If atmospheric humidity decreases, transpiration rate
- (a) Decreases because the concentration gradient between the mesophyll and the atmosphere decreases.
 (b) Stays the same because active transport does not depend on humidity
 (c) Increases because of the higher concentration gradient between the air spaces of the mesophyll and the atmosphere
 (d) Decreases because the concentration of water vapour decreases

Ans. (c)

Sol. If humidity decreases the transpiration rate will increase, because there will be more water in mesophyll cell as compared to atmosphere.

73. Vessels A and B are made of conducting material. Both contain water. Vessel A floats in B. Vessel B is now heated at a uniform rate, then
- Water in A boils first.
 - Water in A boils some time after water in B starts boiling.
 - Water in both A and B start boiling simultaneously.
 - Water in A does not boil.

Ans. (d)

Sol. As water in vessel A gets heat via conduction through the vessel, so when temp. reaches 100°C on both inside and outside of vessel A, conduction stops and the water inside, does not get latent heat for boiling whereas the vessel B gets continuous heat from the burner for boiling. So water in A does not boil.

74. The number of squares formed by 5 vertical and 4 horizontal lines (all are equispaced) is
- 60
 - 20
 - 40
 - 46

Ans. (d)

Sol. No. of square formed by 5 vertical and 4 horizontal lines

$$= 4 \times 3 + 3 \times 2 + 2 \times 1 = 20$$

So, option (d) is correct.

75. If 0.50 mole of a monovalent metal (M^{+1}) halide is mixed with 0.2 mole of a divalent metal (L^{+2}) phosphate, the maximum number of moles of M_3PO_4 that can be formed is
- 0.25
 - 0.30
 - 0.16
 - 0.20

Ans. (c) 0.166 mole of M_3PO_4

Sol. $6\text{MX} + \text{L}_3(\text{PO}_4)_2 \rightarrow 2\text{M}_3\text{PO}_4 + 3\text{LX}_2$

MX is acting as Limiting reagent.

76. Every major city in India has a pollution control board to monitor air and water pollution. The following data is from three different localities in Bangalore city from the year 2015.

Locality	Annual average of SO_2 in the air (volume/volume)
P	16.3 mL/m ³
Y	16.3 ppb (m ³ /m ³)
Z	16.3 ppm (m ³ /m ³)

ppb stands for parts per billion and ppm stands for parts per million. These are different units to express concentration. They are very similar to percentage (which is actually parts per hundred). Based on the above data, which place will you choose to live in?

- All localities are equally polluted, so I have no preference.
- P is more polluted than Y and Z, hence I will live in either Y or Z.
- Locality Y is least polluted, hence I will live in Y.
- Z and Y are more polluted than P, hence I will live in P.

Ans. (c) Locality Y is least polluted, hence I will live in Y.

Sol. $P = 16.3 \frac{\text{ml}}{\text{m}^3} = \frac{16.3 \text{ml}}{10^6 \text{ml}} = 16.3 \text{ ppm ml/ml}$

$$Y = 16.3 \text{ ppb} = \frac{16.3}{10^9} \frac{\text{m}^3}{\text{m}^3}$$

$$Z = 16.3 \text{ ppm} = \frac{16.3}{10^6} \frac{\text{m}^3}{\text{m}^3} = 16.3 \text{ ppm}$$

77. A body thrown vertically up reaches a maximum height and returns back. Its acceleration is

- (a) Downward during both ascent and descent.
- (b) Downward at all positions except at the highest point, where it is zero.
- (c) Upward during both ascent and descent.
- (d) Downward during ascent and upward during descent.

Ans. (a)

Sol. In both cases acceleration will be in downward direction and equal to 'g' if we neglect air friction.

78. The number of integers a, b, c for which $a^2 + b^2 - 8c = 3$ is

- (a) 2
- (b) Infinite
- (c) 0
- (d) 4

Ans. (c)

Sol. If $a^2 + b^2 - 8c = 3$

$$\text{so } a^2 + b^2 = 8c + 3$$

Case I : If both a = even, b = even

$$a = 2m, b = 2n$$

$$4m^2 + 4n^2 = 8c + 3$$

LHS = Even , But RHS = odd

Hence no solution

Like wise for both a = odd , b = odd., There is no solution.

Case II :If any one number is odd,

$$\text{Let } a = 2m, b = 2n + 1$$

$$\text{so, } (2m)^2 + (2n + 1)^2 = 8c + 3$$

$$4m^2 + 4n^2 + 4n + 1 = 8c + 3$$

$$4(m^2 + n^2 + n) = 8c + 2$$

LHS is divisible by 4

But RHS is not divisible by 4.

Hence no solution.

So, option (c) is correct.

79. Which of the following is NOT produced by the endoplasmic reticulum?

- (a) Lipids
- (b) Proteins
- (c) Monosaccharides
- (d) Hormones

Ans. (c)

Sol. Monosaccharides, are not produced by endoplasmic reticulum.

80. Vaccines prevent infections by pathogens by:

- (a) Presenting the body's immune system with antigens in a controlled manner, so that it is prepared to counter the pathogen producing it when it attempts to infect the body
- (b) Affecting the reproductive cycle of the invading pathogen
- (c) Binding to antigens on the surface of the pathogen and inactivating it
- (d) Affecting the metabolic pathways of the pathogen

Ans. (a)

Sol. Vaccines stimulate formation of antibody in our body to counter with the upcoming pathogen.