# Sample questions for Selection Test 2026-27

| | |
|---|---|
| **Duration** | **150 mins** |
| **Max. Marks** | **300** |

## Instructions to Examinee

| | |
|---|---|
| **NAME** | |
| **Hall Ticket No.** | |
| **SCHOOL** | |

(i) The duration of test is 150 mins. Total Marks : 300

- **Instructions for Physics Section A:**
  - This section contain **10** questions (numbered **01 to 10)**.
  - Each question is followed by 4 options (A), (B), (C) and (D)
  - Only one of the option among these is correct.
- To answer the question shade the appropriate bubble in ORS.
- **Marking scheme:**
  - +4 if correct answer is marked.
  - 0 in all other cases
- **Instructions for Chemistry Section A:**
  - This section contain **10** questions (numbered **11 to 20)**.
  - Each question is followed by 4 options (A), (B), (C) and (D)
  - Only one of the option among these is correct.
  - To answer the question shade the appropriate bubble in ORS.
- **Marking scheme:**
  - +4 if correct answer is marked.
  - 0 in all other cases
- **Instructions for Mathematics Section A:**
  - This section contain **10** questions (numbered **21 to 30)**.
  - Each question is followed by 4 options (A), (B), (C) and (D)
  - Only one of the option among these is correct.
  - To answer the question shade the appropriate bubble in ORS.
- **Marking scheme:**
  - +4 if correct answer is marked.
  - 0 in all other cases

- **Instructions for Biology Section A:**
- **Instructions for questions numbered 31 to 42**
  - This section contain **12** questions (numbered **31 to 42)**.
  - Each question is followed by 4 options (A), (B), (C) and (D)
  - Only one of the option among these is correct.
  - To answer the question shade the appropriate bubble in ORS.
  -
- **Instructions for questions numbered 43 to 45**
  - This section contain linked comprehension questions (numbered **43 to 45**)
  - A passage is given which is followed by three questions
  - Corresponding to each question, there are 4 options (A), (B), (C) and (D)
  - Only one of the option among these is correct.
  - To answer the question shade the appropriate bubble in ORS.

- **Marking scheme:**
  - +4 if correct answer is marked.
  - 0 in all other cases

- **Instructions for Section B:**
- **Instructions for Quantitative Aptitude**
  - This section contain **15** questions (numbered **46 to 60).**
  - These questions are based on quantitative aptitude.
  - Answer to each question is an integer between 000 to 999 (both values inclusive).
  - To answer the question, shade the appropriate bubble in ORS (optical response sheet).
- **Marking scheme:**
  - +4 if correct answer is marked.
  - 0 in all other cases.
- **Instructions for Physics Section B:**
  - This section contain **5** questions (numbered **61 to 65** )
  - Answer to each question is an integer between 000 to 999 (both values inclusive).
  - To answer the question, shade the appropriate bubble in ORS
- Marking scheme:
  - +4 if correct answer is marked.
  - 0 in all other cases
- **Instructions for Chemistry Section B:**
  - This section contain **5** questions (numbered **66 to 70**)
  - Answer to each question is an integer between 000 to 999 (both values inclusive).
  - To answer the question, shade the appropriate bubble in ORS

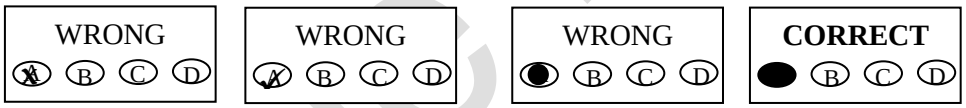
- **Marking scheme:**
  - +4 if correct answer is marked.
  - 0 in all other cases

- **Instructions for Mathematics Section B:**
  - This section contain **5** questions (numbered **71 to 75**)
  - Answer to each question is an integer between 000 to 999 (both values inclusive).
  - To answer the question, shade the appropriate bubble in ORS

- **Marking scheme:**
  - +4 if correct answer is marked.
  - 0 in all other cases
  - 0 in all other cases

**Instructions for filling the ORS** (OPTICAL RESPONSE SHEET)**:**

1. Write your **name** and **register number** with black ball point pen in the response sheet and darken the appropriate circle **under** each alphabet/digit.
2. While marking your answers in the ORS, darken the circle/s (in full) as shown in the example below using **Black ball point pen**.




3. Folding of ORS, stray markings on the ORS will lead to rejection during evaluation.

Space for rough work is provided in the question paper booklet.

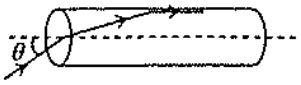
# PART – A
# PHYSICS

**Multiple choice questions with one correct alternative**

1. A cut diamond sparkles because of its
   (A) Hardness (B) High refractive index
   (C) Emission of light by the diamond (D) Absorption of light by the diamond
   **Ans** (B)
   Due to high refractive index its critical angle is very small so that most of the light incident on the diamond is total internally reflected repeatedly and diamond sparkles.

2. A transparent solid cylindrical rod has a refractive index of $\frac{2}{\sqrt{3}}$. It is surrounded by air. A light ray is incident at the mid-point of one end of the rod as shown in the figure. The incident angle θ for which the light ray grazes along the wall of the rod is

   (A) $\sin^{-1}\left(\frac{1}{2}\right)$ (B) $\sin^{-1}\left(\frac{\sqrt{3}}{2}\right)$

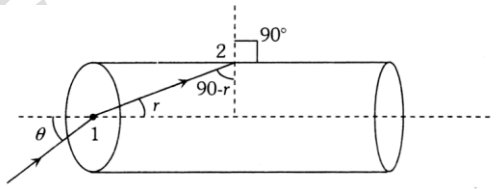
   (C) $\sin^{-1}\left(\frac{2}{\sqrt{3}}\right)$ (D) $\sin^{-1}\left(\frac{1}{\sqrt{3}}\right)$

   **Ans** (D)

   At interface 1 : $\mu = \frac{\sin\theta}{\sin r} \Rightarrow \sin\theta = \mu \sin r$ … (1)

   At interface 2 : (90 – r) = C $\Rightarrow$ sin(90 – r) = sin C

   $\Rightarrow \cos r = \frac{1}{\mu}$ $\left[\because \sin C = \frac{1}{\mu}\right]$

   $\Rightarrow \cos r = \frac{1}{2/\sqrt{3}} = \sqrt{3}/2 \Rightarrow r = 30°$

   From eqn. (1), $\sin\theta = \frac{2}{\sqrt{3}} \sin 30° = \frac{1}{\sqrt{3}}$

   $\theta = \sin^{-1}\left(\frac{1}{\sqrt{3}}\right)$

3. If aperture of lens is halved then effect on image will be
   (A) no effect on size (B) intensity of image decreases
   (C) both (A) and (B) (D) none of (A), (B) and (C)
   **Ans** (C)
   Since intensity ∝ (Aperture), so intensity of image will decrease but no change in the size occurs.

4. A particle is moving with a constant speed along a straight line path. A force is not required to
   (A) Increase its speed (B) Decrease the momentum
   (C) Change the direction (D) Keep it moving with uniform velocity
   **Ans** (D)
   Particle will move with uniform velocity due to inertia.

5. A person sitting in an open car moving at constant velocity throws a ball vertically up into air. The ball falls

(A) Outside the car (B) In the car ahead of the person

(C) In the car to the side of the person (D) Exactly in the hand which threw it up

**Ans** (D)

Horizontal velocity of ball and person are same so both will cover equal horizontal distance in a given interval of time and after following the parabolic path the ball falls exactly in the hand which threw it up.

6. A reference frame attached to the earth

(A) Is an inertial frame by definition

(B) Cannot be an inertial frame because earth is revolving round the sun

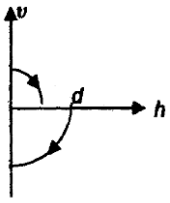
(C) Is an inertial frame because Newton's laws are applicable

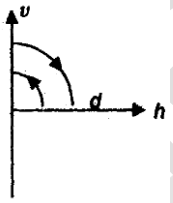
(D) Is an inertial frame because the earth is rotating about its own axis

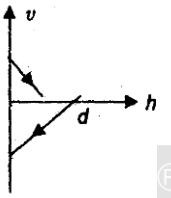
**Ans** (B)

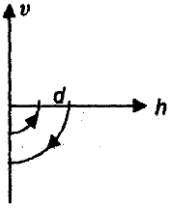
The frame of reference which are at rest or in uniform motion are called inertial frames while frames which are accelerated with respect to each other are non-inertial frames. Spinning or rotating frames are accelerated frames, hence these are non-inertial frames.

7. A ball is dropped vertically from a height d above the ground. It hits the ground and bounces up vertically to a height $\frac{d}{2}$. Neglecting subsequent motion and air resistance, its velocity v varies with the height h above the ground as

(A) 


(B) 


(C) 


(D) 


**Ans** (A)

The graph between h and v is the parabola. Taking upward direction as positive, we find that at h = d, velocity is zero. Then its – VE magnitude increases. At h = 0, the velocity is magnitude increases. At h = 0, the velocity is reversed and then goes on decreasing to zero at $h = \frac{d}{2}$.

8. If a body loses half of its velocity on penetrating 3 cm in a wooden block, then how much will it penetrate more before coming to rest?

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

**Ans** (A)

We know, $v^2 - u^2 = 2ax$

substituting, $v = \frac{u}{2}$, x = 3 cm, a′ = – a (retardation)

We, find $\left(\frac{u}{2}\right)^2 - u^2 = -2a \times 3$ that is, $a = \frac{u^2}{8}$

Now, for the calculation of total distance penetrated, we have

$v^2 - u^2 = 2ax' \Rightarrow -u^2 = -2ax'$ (because final velocity v = 0)

$\Rightarrow \quad x' = \dfrac{u^2}{2a}$

Substituting $a = \dfrac{u^2}{g}$ (calculated above), we get $x' = \dfrac{u^2}{2\left(\dfrac{u^2}{8}\right)} = 4$ cm

Hence, remaining distance penetrated by the body before coming to rest = $(x' - x) = (4 - 3)$ cm = 1 cm

9. A person slides freely down a frictionless inclined plane while his bag falls down vertically from the same height. The final speeds of the man ($V_M$) and the bag ($V_B$) should be such that

(A) $V_M < V_B$ (B) $V_M = V_B$

(C) they depend on the masses (D) $V_M > V_B$

**Ans** (B)

$v_{bottom} = \sqrt{2gh}$

It depends on height and not the length of the inclined plane.

10. Which of the following statements for an object in equilibrium is not true?

(A) The object must be at rest (B) The object can be at rest

(C) The object may be moving at constant speed (D) The acceleration of the object is zero

**Ans** (A)

In the state of equilibrium, the object may be at rest or in motion with uniform velocity.

## CHEMISTRY

### Multiple choice questions with one correct alternative

11. An element X on exposure to moist air turns reddish-brown and a new compound Y is formed. The substance X and Y are

(A) X = Fe, Y = $Fe_2O_3$ (B) X = Ag, Y = $Ag_2S$

(C) X = Cu, Y = CuO (D) X = Al, Y = $Al_2O_3$

**Ans** (A)

12. During the formation of sodium chloride from its constituents

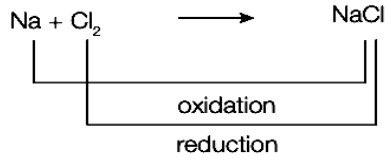
(A) Na undergoes oxidation and acts as an oxidizing agent

(B) Na undergoes reduction and Cl undergoes oxidation

(C) Cl undergoes reduction and acts as a reducing agent

(D) Na acts as a reducing agent and Cl acts as an oxidizing agent

**Ans** (D)




During the formation of NaCl, Na undergoes oxidation and Cl undergoes reduction. Hence, Na is the reducing agent and Cl is the oxidizing agent.

13. Which one of the following constitutes a group of the isoelectronic species?

(A) $C_2^{2-}, O_2^-, CO, NO$ (B) $NO^+, C_2^{2-}, CN^-, N_2$

(C) $CN^-, N_2, O_2^{2-}, C_2^{2-}$ (D) $N_2, O_2^-, NO^+, CO$

**Ans** (B)

Species having same number of electrons are iso-electronic calculating the number of electrons in each species given here, we get.

$CN^-$(6 + 7 + 1 = 14); $N_2$ (7 + 7 = 14)

$O_2^{2-}$ (8 + 8 + 2 = 18); $C_2^{2-}$ (6 + 6 + 2 = 14) $\Rightarrow$ $O_2^-$ (8 + 8 + 1= 17); $NO^+$(7 + 8 –1 = 14)

CO(6 + 8 = 14); NO (7 + 8 = 15)

From the above calculation we find that all the species listed in choice (B) have 14 electrons each so it is the correct answer.

14. What is the pH of acid rain?

(A) around 5.6 (B) around 4.3 (C) around 6.5 (D) around 3.4

**Ans** (A)

15. Match the following

| Natural Source | | Acid | |
|---|---|---|---|
| (i) | Orange | (P) | Tartaric acid |
| (ii) | Tamarind | (Q) | Citric acid |
| (iii) | Tomato | (R) | Lactic acid |
| (iv) | Curd | (S) | Oxalic acid |

(A) (i) $\rightarrow$ (P); (ii) $\rightarrow$ (Q); (iii) $\rightarrow$ (R); (iv) $\rightarrow$ (S)

(B) (i) $\rightarrow$ (Q); (ii) $\rightarrow$ (P); (iii) $\rightarrow$ (S); (iv) $\rightarrow$ (R)

(C) (i) $\rightarrow$ (Q); (ii) $\rightarrow$ (S); (iii) $\rightarrow$ (P); (iv) $\rightarrow$ (R)

(D) (i) $\rightarrow$ (R); (ii) $\rightarrow$ (S); (iii) $\rightarrow$ (P); (iv) $\rightarrow$ (Q)

**Ans** (B)

16. A colourless solution of a compound gives a precipitate with $AgNO_3$ solution but no precipitate with a solution of $Na_2CO_3$. The action of concentrated $H_2SO_4$ on the compound liberates a suffocating reddish brown gas. The compound is

(A) $Ba(CH_3COO)_2$ (B) $CaBr_2$ (C) NaI (D) NaBr

**Ans** (D)

$Ag^+ + Br^- \rightarrow AgBr\downarrow$ (pale yellow); $NaBr + Na_2CO_3 \rightarrow$ No reaction

$2NaBr + 2H_2SO_4 \rightarrow Br_2\uparrow$ (reddish brown) + $SO_2$ + $SO_4^{2-}$ + $2Na^+$ + $2H_2O$

17. Calculate the average atomic mass of carbon from the following

| Isotope | Relative abundance (%) | Atomic mass (amu) |
|---|---|---|
| $^{12}C$ | 98.892 | 12 |
| $^{13}C$ | 1.108 | 13.00335 |
| $^{14}C$ | $2 \times 10^{-10}$ | 14.00317 |

(A) 12.2 (B) 12.02 (C) 12.011 (D) 12.1

**Ans** (C)

18. Equimolar quantities of $CH_4$ and $C_2H_4$ occupying together 0.56 L at STP will weigh

(A) 2.20 g (B) 1.11 g (C) 0.82 g (D) 0.55 g

**Ans** (D)

$\frac{0.56}{22.4} = 0.025$ mol

0.0125 mol of $CH_4$ = 0.2 g

0.0125 mol of $C_2H_4$ = 0.35 g

Mass of the mixture = 0.55 g

19. Sting of ants/bees containing can be neutralised by rubbing

(A) soap (B) acetic acid (C) alcohol (D) common salt

**Ans** (A)

Soap contains sodium hydroxide which neutralises the formic acid in the Sting.

20. When iron nail is dipped in $CuSO_4$ solution the blue colour of the solution fades. This is an example of

(A) Displacement reaction (B) Double displacement reaction

(C) Oxidation reaction (D) Decomposition reaction

**Ans** (A)

## MATHEMATICS

### Multiple choice questions with one correct alternative

21. If $a^2 + b^2 = 1$, $x^2 + y^2 = 1$ and $c^2 + z^2 = 1$. Then the maximum value of $ax + by + cz$ is

(A) $\frac{3}{2}$ (B) $\frac{1}{3}$ (C) $\frac{3}{4}$ (D) $\frac{4}{3}$

**Ans** (A)

$(a - x)^2 + (b - y)^2 + (c - z)^2 \geq 0$

$\Rightarrow a^2 + x^2 + b^2 + c^2 + y^2 + z^2 \geq 2(ax + by + cz)$

$\Rightarrow \frac{3}{2} \geq ax + by + cz$

22. If $\alpha$, $\beta$ be the roots of the equation $(x - a)(x - b) = c$, $c \neq 0$, then the roots of the equation $(x - \alpha)(x - \beta) + c = 0$ are

(A) a, b (B) a, c (C) b, c (D) a + c, b + c

**Ans** (A)

$(x - a)(x - b) = c$

$\Rightarrow x^2 - (a + b)x + ab - c = 0$

$\Rightarrow \alpha + \beta = a + b$, $\alpha\beta = ab - c$

Consider $(x - \alpha)(x - \beta) + c = 0$

$\Rightarrow x^2 - (\alpha + \beta)x + \alpha\beta + c = 0$

$\Rightarrow x^2 - (a + b)x + ab - c + c = 0 \Rightarrow (x - a)(x - b) = 0$

$\therefore$ roots are a, b.

23. If $n + 1 = 2010^2 + 2011^2$, then find the value of $\sqrt{2n + 1}$.

(A) 2010 (B) 2011 (C) 4021 (D) 4019

**Ans** (C)

$n + 1 = 2010^2 + 2011^2$

$n = 2010^2 + (2011^2 - 1)$

$= 2010^2 + 2010 \cdot 2012$

$= 2 \cdot 2010 \cdot 2011$

$2n + 1 = 2010^2 + 2011^2 + 2 \cdot 2010 \cdot 2011$

$= (2010 + 2011)^2$

$\therefore \sqrt{2n+1} = 4021$

24. The sum of a number and its reciprocal is $\frac{10}{3}$. Find the number.

(A) 3 (B) $\frac{1}{3}$ (C) $\frac{1}{9}$ (D) 3 or $\frac{1}{3}$

**Ans** (D)

Let number be x

$x + \frac{1}{x} = \frac{10}{3} \Rightarrow 3x^2 - 10x + 3 = 0$

$(x - 3)(3x - 1) = 0 \Rightarrow x = 3$ or $\frac{1}{3}$

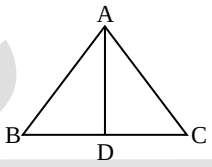
25. If A(–2, 4), B(0, 0), C(4, 2) are vertices of ΔABC, then the length of the median through vertex A is

(A) 5 units (B) 6 units (C) 7 units (D) 9 units

**Ans** (A)

$D = \left(\frac{0+4}{2}, \frac{0+2}{2}\right) = (2, 1)$

$AD = \sqrt{(2+2)^2 + (1-4)^2} = \sqrt{4^2 + 3^2} = 5$




26. 5 years hence, the age of a man shall be 3 times the age of his son, while 5 years earlier the age of man was 7 times the age of his son. The present age of the man is

(A) 45 years (B) 50 years (C) 47 years (D) 40 years

**Ans** (D)

Let present ages of man and his son respectively be x, y

So $(x + 5) = 3(y + 5)$ and $(x - 5) = 7(y - 5)$

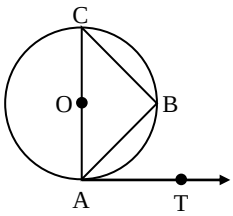
$x - 3y = 10$ … (1)

$x - 7y = -30$ … (2)

$(2) - (1) \Rightarrow -4y = -40 \Rightarrow y = 10$

So, x = 40

27. In the given figure, O is centre of a circle, AOC is its diameter such that $\angle ACB = 50°$. If AT is the tangent to the circle at point A. Then $\angle BAT$ is




(A) 40°

(B) 50°

(C) 60°

(D) 65°

**Ans** (B)

$|\underline{ABC} = 90°,\ |\underline{ACB} = 50°$

$\Rightarrow |\underline{BAC} = 40°$

Now $|\underline{BAT} = 90° - 40° = 50°$

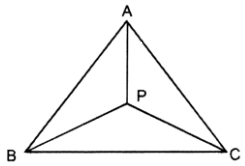
28. P is a point inside ΔABC. If $|\underline{PBA} = 20°,\ |\underline{BAC} = 50°$ and $|\underline{PCA} = 35°,$ then the measure of $|\underline{BPC}$ is

(A) 65°

(B) 75°

(C) 90°

(D) 105°



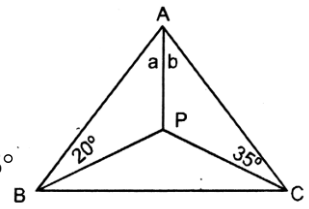

**Ans** (D)

In ΔAPB, $|\underline{APB} = 180° - a - 20°$

In ΔAPC, $|\underline{APC} = 180° - b - 35°$

$\therefore |\underline{APB} + |\underline{APC} = 360° - (a + b) - 55°$ = 360° – 50° – 55° = 360° – 105° = 255°

Required $|\underline{BPC} = 360° - 255° = 105°$.




29. Four times the sum of digits of a two digit number is equal to the number itself. If the digit in its unit place is a perfect square, then the digit in its ten's place is

(A) 8 (B) 6 (C) 4 (D) 2

**Ans** (D)

Let the two digit number be xy.

Given, 10x + y ⇒ 4(x + y) = 10x + y

⇒ 4x + 4y = 10x + y ⇒ 3y = 6x ⇒ y = 2x

Given y is a perfect square

Single digit perfect squares are 1, 4 and 9, we have y = 2x [x = 1, 9 does not satisfy the equations]

4 = 2x ⇒ x = 2.

30. X takes 3 hours more than Y to walk 30 km. But, if X doubles his pace, he is ahead of Y by $1\frac{1}{2}$ hours.

Find the speed of Y in km $h^{-1}$.

(A) 5 (B) 10 (C) 15 (D) 20

**Ans** (A)

Let the speed of X and Y be $x\ km\,h^{-1}$ and $y\ km\,h^{-1}$ respectively. Then,

Time taken by X to cover 30 km $= \frac{30}{x}$ hrs and time taken by Y to cover 30 km $= \frac{30}{y}$ hrs

By the given conditions, we have

$\frac{30}{x} - \frac{30}{y} = 3 \Rightarrow \frac{10}{x} - \frac{10}{y} = 1$

If X doubles his pace, then speed of X is $2x\ km\,h^{-1}$ … (i)

$\therefore$ Times taken by X to cover 30 km $= \frac{30}{2x}$ hrs

Times taken by Y to cover 30 km $= \frac{30}{y}$ hrs

According to the given conditions, we have

$\frac{30}{y}-\frac{30}{2x}=1\frac{1}{2} \Rightarrow \frac{30}{y}-\frac{30}{2x}=\frac{3}{2} \Rightarrow \frac{10}{y}-\frac{5}{x}=\frac{1}{2}$

$\Rightarrow -\frac{10}{x}+\frac{20}{y}=1$ … (ii)

Putting $\frac{1}{x}=u$ and $\frac{1}{y}=v$, in equations (i) and (ii) we get

$10u-10v=1 \Rightarrow 10u-10v-1=0$ … (iii)

$-10u+20v=1 \Rightarrow -10u+20v-1=0$ … (iv)

Adding equations (iii) and (iv), we get $10v-2=0 \Rightarrow v=\frac{1}{5}$

Putting $v=\frac{1}{5}$ in equation (iii), we get $10u-3=0 \Rightarrow u=\frac{3}{10}$

Now, $u=\frac{3}{10} \Rightarrow \frac{1}{x}=\frac{3}{10} \Rightarrow x=\frac{10}{3}$ and $v=\frac{1}{5} \Rightarrow \frac{1}{y}=\frac{1}{5} \Rightarrow y=5$

Hence, X's speed $=\frac{10}{3}\text{km h}^{-1}$ and Y's speed $=5\text{ km h}^{-1}$

## BIOLOGY

### Multiple choice questions with one correct alternative

31. Storage, photosynthesis, buoyancy are the functions respectively exhibited in which of the following set of tissues
    (A) Chlorenchyma, aerenchyma, parenchyma
    (B) Aerenchyma, sclerenchyma, chlorenchyma
    (C) Parenchyma, chlorenchyma, aerenchyma
    (D) Sclerenchyma, chlorenchyma, collenchyma
    **Ans** (C)

32. A farmer cultivating sugar cane expects increase in yield by the application of the _____ phytohormone
    (A) Cytokinin (B) Abscisic acid (C) Gibberellin (D) Auxin
    **Ans** (C)

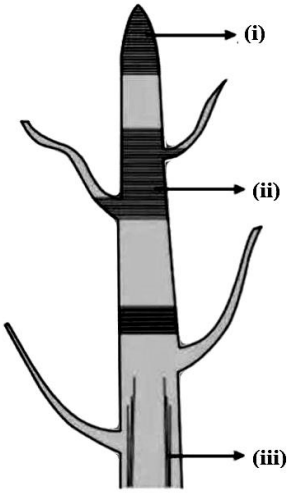
33. Difference in concentration of ions between the root and soil occurs due to
    (A) Active absorption (B) Passive absorption (C) Transpiration (D) Simple diffusion
    **Ans** (A)

34. **Statement-** A 25 meter tall tree supplies water from root to leaf at the tip of the tree
    Which of the following reasons would be appropriate for the given statement?
    (i) The electrical motor present in plant helps in the movement of water to the greater height 25 m
    (ii) The suction force created by the evaporation of water from cells of leaf pulls water from xylem cells of roots
    (iii) Water is supplied through a process called translocation
    (iv) Transpiration helps in reducing water loss
    (A) Both (i) and (iii) (B) (ii), (iii) and (iv)
    (C) Only (iv) (D) Only (ii)

**Ans** (D)

35. **Statement I:** Mitosis helps in growth, replaces old, dead and injured cells, it maintains the constant chromosome number from one generation to another generation.
**Statement II:** Mitosis undergoes two consecutive divisions and results in 4 identical daughter cells.
**Statement III:** Meiosis reduces the number of chromosomes in the daughter cells to the half of the mother cell.
(A) Statement I, Statement II and Statement III are correct
(B) Statement I and Statement II are correct, Statement III is incorrect
(C) Statement I and Statement III are correct, Statement II is incorrect
(D) Statement II is correct, Statement I and Statement III are incorrect.
**Ans** (C)

36. Identify the correct function of (i), (ii) and (iii) in the following diagram and choose the correct option given below




(A) (i) - Increases length of the root only, (ii) - increases the length of leaf,
(iii) - decreases the stem length
(B) (i) - Increases length of stem and root and forms new cells, (ii) - increases the stem length,
(iii) - increases the girth of stem and root
(C) (i) - Decreases length of stem and root, (ii) - Increases length of stem and root,
(iii) - increases the girth of stem and root,
(D) (i) - Increases length of the root only, (ii) - increases the girth of stem and root,
(iii) - Increases length of stem and root
**Ans** (B)

37. What is the correct order of the reflex arc?
(A) Effector → Spinal cord → Sensory neuron → Motor neuron → Receptors
(B) Receptors → Motor neuron → Sensory neuron → Spinal cord → Effector
(C) Receptors → Sensory neuron → Spinal cord → Motor neuron → Effector
(D) Spinal cord → Motor neuron → Sensory neuron → Effector → Receptors
**Ans** (C)

38. Match the following

| Column I | | Column II | |
|---|---|---|---|
| (i) | Abscisic acid | (p) | Synthesized at shoot tip |
| (ii) | Cytokinin | (q) | Growth of stem |
| (iii) | Gibberellin | (r) | Inhibits growth |
| (iv) | Auxin | (s) | Rapid cell division |
| | | (t) | Stimulates the ripening of fruit |

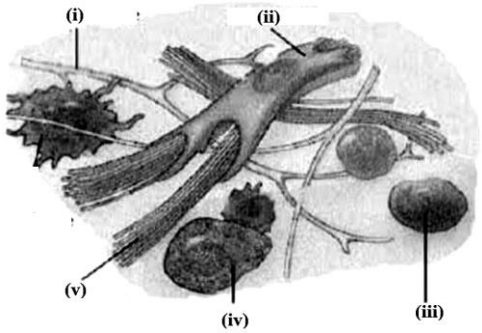
(A) (i) → (r); (ii) → (s); (iii) → (q); (iv) → (p)
(B) (i) → (s); (ii) → (q); (iii) → (r); (iv) → (p)
(C) (i) → (s); (ii) → (t); (iii) → (q); (iv) → (p)
(D) (i) → (r); (ii) → (t); (iii) → (s); (iv) → (p)
**Ans** (A)

39. What are systolic and diastolic blood pressures?
(A) The pressure of blood inside artery during ventricular relaxation and pressure of blood inside artery during ventricular contraction respectively.
(B) The pressure of blood inside artery during ventricular contraction and pressure of blood inside artery during ventricular relaxation respectively.
(C) The pressure of blood inside vein during ventricular contraction and pressure of blood inside vein during ventricular relaxation respectively.
(D) The pressure of blood inside vein during ventricular relaxation and pressure of blood inside vein during ventricular contraction respectively.
**Ans** (B)

40. Find the correct statement/s and select the correct option from the following
(i) Mitochondria have two membrane coverings
(ii) The outer membrane is very porous allowing all types of substances to pass through
(iii) The inner membrane is semipermeable, smooth and without folds
(iv) Mitochondria have their own lysosomes and ribosomes
(A) (i) and ii (B) (ii) and (iii) (C) (i), (ii) and (iii) (D) (i), (ii), (iii) and (iv)
**Ans** (A)

41. Which of the following is a consequence of adrenaline stimulation of the sympathetic nervous system?
(A) Dilation of blood vessels (B) Constriction of blood vessels
(C) Relaxation of skeletal muscles (D) Increased blood flow to skin
**Ans** (B)

42. Choose the correct labelling from the following options for the given diagram of areolar connective tissue.




(A) (i) → collagen fibre, (ii) → mast cell (iii) → Reticular fibre, (iv) → fibroblast, (v) → plasma cell
(B) (i) → mast cell, (ii) → fibroblast, (iii) → collagen fibre, (iv) → Reticular fibre, (v) → plasma cell
(C) (i) → Reticular fibre, (ii) → mast cell, (iii) → fibroblast, (iv) → collagen fibre, (v) → plasma cell
(D) (i) → Reticular fibre, (ii) → fibroblast, (iii) → plasma cell, (iv) → mast cell, (v) → collagen fibre
**Ans** (D)

**Read the passage given below and answer questions 43 to 45 by choosing the correct alternative**

Lysosomes are membrane bound organelles in animal cells that function primarily to digest and recycle cellular waste. They contain a variety of digestive enzymes capable of breaking down proteins, nucleic acids, carbohydrates, and lipids. These enzymes are synthesized in the rough endoplasmic reticulum and subsequently processed and packaged into lysosomes by the Golgi apparatus. Lysosomes fuse with other cellular components such as damaged organelles or ingested particles, enabling the breakdown and recycling of their contents. They are also involved in autophagy, a process where they help clear out malfunctioning cellular components to maintain overall cellular health. Disruptions in lysosomal function can lead to lysosomal storage diseases, which are characterized by the accumulation of undigested substrates due to enzyme deficiencies.

43. Which cellular components do lysosomes fuse with to perform their function?
(A) Mitochondria and ribosomes
(B) Golgi vesicles and endoplasmic reticulum
(C) Damaged organelles and ingested particles
(D) Plasma membrane and cytoskeleton
**Ans** (C)

44. What is the role of lysosomes in autophagy as mentioned in the passage?
(A) To produce new cellular components
(B) To break down and recycle malfunctioning cellular components
(C) To store genetic information
(D) To transport materials between organelles
**Ans** (B)

45. Where are lysosomal enzymes synthesized and modified?
(A) Mitochondria
(B) Endoplasmic reticulum
(C) nucleus
(D) Endoplasmic reticulum and Golgi apparatus
**Ans** (D)

# PART B
# Quantitative Aptitude

**Numerical problems**

**(The answer to each of the following question is an integer ranging from 0 to 999)**

46. A is two years older than B who is twice as old as C. If the total of ages of A, B, C is 27, then age of B is

**Ans** 10

Given A = B + 2

B = 2C

Let C = x $\Rightarrow$ B = 2x

$\Rightarrow$ A = 2x + 2

$\therefore$ 2x + 2 + 2x + x = 27

5x = 25

x = 5

B = 10

47. On dividing 15968 by a certain number, the quotient is 89 and the remainder is 37. Then the divisor is

**Ans** 179

Divisor = $\frac{\text{dividend} - \text{remainder}}{\text{quotient}} = \frac{15968 - 37}{89} = 179$

48. A sum of Rs. 312 was divided among 100 boys and girls in such a way that each boy gets Rs. 3.60 and each girl gets Rs. 2.40. The number of girls are

**Ans** 40

Let number of girls be x $\Rightarrow$ boys be 100 – x

So x × 2.40 + (100 – x) 3.60 = 312

x × 2.40 + 360 – x × 3.60 = 312

1.2x = 48

$x = \frac{48}{1.2} = 40$

49. If 50 % of (x – y) = 30 % of (x + y), then what percent of x is y?

**Ans** 25

50 % of (x – y) = 30 % of (x + y)

$\frac{50}{100}(x - y) = \frac{30}{100}(x + y)$

$\Rightarrow$ x = 4y

Required percentage = $\left(\frac{y}{x} \times 100\right)\% = 25\%$

50. a and b are two positive integers such that the least prime factor of a is 3 and the least prime factor of b is 5. Then, the least prime factor of (a + b) is

**Ans** 2

Clearly, 2 is neither a factor of a nor that of b

$\Rightarrow$ a and b are odd

$\Rightarrow$ a + b is even

$\Rightarrow$ Least prime factor of a + b is 2

51. One pipe can fill a tank three time as fast as another pipe. If together the two pipes can fill the tank in 36 minutes, then find the time taken (in minutes) by the slower pipe alone to fill the tank.

**Ans** 144

Let the slower pipe alone fill the tank in x minutes.

Then, faster pipe will fill it in $\frac{x}{3}$ minutes.

$\therefore \ \frac{1}{x}+\frac{3}{x}=\frac{1}{36}\Rightarrow\frac{4}{x}=\frac{1}{36}\Rightarrow x=144 \text{ min}$

52. The product of the ages of Shyam and Sunil is 240. If twice the age of Sunil is more than Shyam's age by 4 years, what is Sunil's age?

**Ans** 12

Let age of Sunil = x and age of Shyam = y

then xy = 240 ...(i)

$2x = y + 4 \Rightarrow y = 2x - 4 \Rightarrow y = 2(x - 2)$ …(ii)

Substituting equation (ii) in equation (i)

We get $x \times 2(x - 2) = 240 \Rightarrow x(x - 2) = \frac{240}{2} \Rightarrow x(x - 2) = 120$ …(iii)

$x(x - 2) = 120 \Rightarrow x^2 - 2x - 120 = 0 \Rightarrow (x - 12)(x + 10) = 0 \Rightarrow x = 12 \text{ or } -10$

Since x is the age, cannot be negative. $\therefore$ x = 12

53. One third of Arun's marks in Mathematics exceeds half of his marks in English by 30. If he got 240 marks in two subjects together, how many marks did he get in English?

**Ans** 60

Marks in Maths = x

Marks in English = y

Given $\frac{1}{3}x=\frac{1}{2}y+30$

$2x - 3y = 180$ … (1)

and $x + y = 240$ … (2)

From (1) and (2) x = 180, y = 60

54. The sum of two numbers is 22. Five times one number is equal to 6 times the other. Find the sum of squares of the numbers.

**Ans** 244

Let the numbers be x and (22 – x).

Then, $5x = 6(22 - x) \Rightarrow 11x = 132 \Rightarrow x = 12$.

So, the numbers are 12 and 10.

55. On selling 17 balls at Rs720, there is a loss equal to the cost price of 5 balls. What is the cost price of a ball ?

**Ans** 60

(C.P. of 17 balls) – (S.P. of 17 balls) = (C.P. of 5 balls)

$\Rightarrow$ C.P. of 12 balls = S.P. of 17 balls = Rs. 720

$\Rightarrow$ C.P. of 1 ball $= \left(\frac{720}{12}\right) =$ Rs. 60

56. A sum of Rs. 800 amounts to Rs. 920 in 3 years at simple interest. If the interest rate is increased by 3 %, it would amount to how much?

**Ans** 992

S.I = 920 – 800 = 120

P = 800, T = 3

Now $SI = \frac{PTR}{100} \Rightarrow R = \left(\frac{100 \times SI}{PT}\right)\%$

$R = \frac{100 \times 120}{800 \times 3} = 5\%$

New rate = (5 + 3) % = 8 %

New SI = $\frac{800 \times 8 \times 3}{100} = 192$

New amount = R(800 + 192) = Rs.992

57. Village X has a population of 68000, which is decreasing at the rate of 1200 per year. Village Y has a population of 42000, which is increasing at the rate of 800 per year. The number of years after which the population of the two villages become equal is

**Ans** 13

Let the population of X and Y be equal after p years.

68000 – 1200p = 42000 + 800p

2000p = 26000

p = 13

58. A can do a piece of work in 10 days, B in 15 days. They work for 5 days. The rest of the work was finished by C in 2 days. If they get Rs. 1500 for the whole work, find the sum of daily wages of B and C.

**Ans** 225

Part of the work done by $A = \left(\frac{1}{10} \times 5\right) = \frac{1}{2}$

Part of the work done by $B = \left(\frac{1}{15} \times 5\right) = \frac{1}{3}$

Part of the work done by $C = 1 - \left(\frac{1}{2} + \frac{1}{3}\right) = \frac{1}{6}$

So, (A's share) : (B's share) : (C's share) $= \frac{1}{2} : \frac{1}{3} : \frac{1}{6} = 3 : 2 : 1$

$\therefore$ A's share $= \left(\frac{3}{6} \times 1500\right) = 750$, B's share $= \left(\frac{2}{6} \times 1500\right) = 500$ and C's share $= \left(\frac{1}{6} \times 1500\right) = 250$

A's daily wages $= \left(\frac{750}{5}\right) = 150$, B's daily wages $= \left(\frac{500}{5}\right) = 100$ and C's daily wages $\left(\frac{250}{2}\right) = 125$

$\therefore$ Daily wages of B and C = (100 + 125) = 225

59. A man covered a certain distance at some speed. Had he moved 3 km $hr^{-1}$ faster, he would have taken 40 minutes less. If he had moved 2 km $hr^{-1}$ slower, he would have taken 40 minutes more. Find the distance (in km) the man has covered.

**Ans** 40

Let distance = x km and usual rate = y km $hr^{-1}$

$\frac{x}{y}-\frac{x}{y+3}=\frac{40}{60}$ or $2y(y+3)=9x$ and … (i)

$\frac{x}{y-2}-\frac{x}{y}=\frac{40}{60}$ or $y(y-2)=3x$ … (ii)

On dividing equation (i) by equation (ii), and on simplifying we get x = 40 km

60. If 12 men can reap 120 acres of land in 36 days, how many acres of land can 54 men reap in 54 days?

**Ans** 810

$M_1 = 12$, $W_1 = 120$ acres, $D_1 = 36$ days

$M_2 = 54$, $W_2 = x$, $D_2 = 54$ days

$\frac{M_1D_1}{W_1}=\frac{M_2D_2}{W_2}$

$\frac{12\times36}{120}=\frac{54\times54}{x}$

$x=\frac{54\times54\times120}{12\times36}$ = 810 acres

## PHYSICS

### Numerical problems

61. The wavelength of light in two liquids x' and 'y' is 3500 Å and 7000 Å, then the critical angle of x relative to y will be _____ °

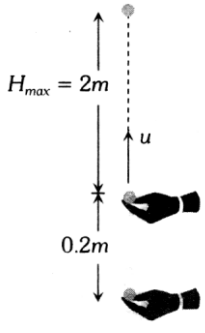
**Ans** 30

The critical angle C is given by $\sin C=\frac{n_2}{n_1}=\frac{\lambda_1}{\lambda_2}=\frac{3500}{7000}=\frac{1}{2}\Rightarrow C=30°$

62. A ball of mass 0.2 kg is thrown vertically upwards by applying a constant force by hand. If the hand moves 0.2 m while applying the force and that ball goes upto 2m height further, find the magnitude of the force (in N). (Consider g = 10 $ms^{-2}$)

**Ans** 22

Let the balls starts moving with velocity 'u' and it reaches up to maximum height $H_{max}$, then




From $H_{max}=\frac{u^2}{2g}\Rightarrow u=\sqrt{2g(H_{max})}=\sqrt{2\times10\times2}=2\sqrt{10}$ m/s

This velocity is supplied to the boil by the hand and initially the hand was at rest, it acquires this velocity in distance of 0.2 meter

$\therefore\quad a=\frac{u^2}{2s}=\frac{40}{2\times0.2}=100\,m/s^2.$

So upward force on the ball F = m(g + a)

$0.2\ (10 + 100) = 0.2 \times 110 = 22$ N.

63. Same force acts on two bodies of different masses 3 kg and 5 kg initially at rest. The ratio of time taken to acquire same final velocity is 3 : x, then the value of x is _____

**Ans** 5

$t = \frac{v}{a} \Rightarrow t \propto \frac{1}{a}$ (v is same)

$\Rightarrow \frac{t_1}{t_2} = \frac{a_2}{a_1} = \frac{m_1}{m_2} = \frac{3}{5}, \qquad \left[\because a \propto \frac{1}{m}, \text{ F is same}\right]$

64. A man is throwing balls in air. He throws next ball when previous one is at highest point. If he throws each ball after 2 seconds, then height to which ball rises is _____ m. (take g = 10 m/s$^2$)

**Ans** 20

The ball reaches the highest point after 2 seconds

Using $v = u + at$

We find $0 = u - g \times 2$ or $u = 2g$

Hence, $h = \frac{v^2 - u^2}{2a} = \frac{(0)^2 - 4g^2}{2 \times (-g)} = 2g = 20$ m

65. A body dropped from a height 'h' with an initial speed zero reaches the ground with a velocity of 3 km h$^{-1}$. Another body of the same mass was dropped from the same height 'h' with an initial speed 4 km h$^{-1}$, will reach the ground with a velocity of _____ km h$^{-1}$.

**Ans** 5

Initial velocity, u = 0

Final velocity, v = 3 km/h

Distance, S = h

Substituting the values in the following eqn.,

$v = u + gt \Rightarrow t = \frac{v}{g} = \frac{3}{10}$ … (1)

Now, from $S = ut + \frac{1}{2}gt^2$, we have

$h = \left(\frac{1}{2}\right)gt^2 = \left(\frac{1}{2}\right) \times 10 \times \left(\frac{3}{10}\right)^2$ (using (1))

Therefore, h = 0.45

Now, for II$^{nd}$ body : u = 4 km/h

$v^2 - u^2 = 2gh$ or $v^2 - 16 = 2 \times 10 \times 0.45$ (using (2))

On solving, we get v = 5 km/h

## CHEMISTRY

### Numerical problems

66. Caffeine has a molecular mass of 194. If it contains 28.9% by mass of nitrogen, number of atoms of nitrogen in one molecule of caffeine is

**Ans** 4

Mass of one molecule of caffeine = 194 amu

Amount of nitrogen present in one molecule $= \frac{28.9}{100} \times 194 = 56$ amu = four nitrogen atoms

67. What is the volume occupied by $30.1 \times 10^{23}$ molecules of carbon dioxide gas at STP? (in L)

**Ans** 112

Number of molecules = $30.1 \times 10^{23}$

Number of moles of gas $= \frac{30.1 \times 10^{23}}{6.023 \times 10^{23}} = 5$ moles

Volume occupied by 5 moles of gas = $22.4 \times 5 = 112$ L

68. A signature made by graphite (carbon) pencil weighs 6.00 mg. Number of carbon atoms present in the signature is nearly equal to ___ $\times 10^{20}$

[Avogadro number = $6 \times 10^{23}$ ; atomic mass of carbon = 12]

**Ans** 3

Mass of carbon = 6.00 mg = $6.00 \times 10^{-3}$ g

Number of carbon atoms = $\frac{6 \times 10^{23} \times 6.0 \times 10^{-3}}{12} = 3 \times 10^{20}$

69. The number of moles of $CO_2$ gas containing $30.1 \times 10^{23}$ molecules of it is ___

**Ans** 5

1 mol of $CO_2$ contains $6.023 \times 10^{23}$ molecule

$6.023 \times 10^{23}$ molecules are present in 1 mol

So, $30.1 \times 10^{23}$ molecules would be present in $\frac{30.1 \times 10^{23}}{6.023 \times 10^{23}} = 5$ moles

70. $N_2 + 3H_2 \rightarrow 2NH_3$

How many grams of ammonia can be formed from 14 g of $N_2$?

**Ans** 17

| $N_2$ | + | $3H_2$ | $\rightarrow$ | $2NH_3$ |
|---|---|---|---|---|
| 28 g | | 6 g | | $2 \times 17 = 34$ g |
| $(14 \times 2)$ | | $(3 \times 2)$ | | |

28 g of $N_2$ gives 34 g of $NH_3$

$\therefore$ 14 g of $N_2$ gives $\frac{34 \times 14}{28} = 17$ g of $NH_3$

## MATHEMATICS

### Numerical problems

71. If $\frac{2x}{1+\frac{1}{1+\frac{x}{1-x}}} = 1$, then the value of 3x is

**Ans** 2

$$\frac{2x}{1+\frac{1}{\frac{1-x+x}{1-x}}} = \frac{2x}{1+\frac{1}{\frac{1}{1-x}}} = \frac{2x}{1+1-x} = \frac{2x}{2-x} = 1 \Rightarrow 2x = 2 - x \Rightarrow 3x = 2$$

72. Let a and b be real numbers, with a > 1 and b > 0. If $ab = a^b$ and $\frac{a}{b} = a^{3b}$ then find the value of a.

**Ans** 4

$ab = a^b$ and $\frac{a}{b} = a^{3b} \Rightarrow (ab)\left(\frac{a}{b}\right) = a^b a^{3b} \Rightarrow a^2 = a^{4b} \Rightarrow b = \frac{1}{2}$

Substituting $b = \frac{1}{2}$ in $ab = a^b \Rightarrow \frac{a}{2} = a^{\frac{1}{2}}$

$\Rightarrow a = 2\sqrt{a} \Rightarrow a^2 = 4a \Rightarrow a(a-4) = 0$

$\Rightarrow a = 0$ (or) $a = 4$, since $a > 1$, then $a = 4$.

73. A rhombus OABC is drawn inside a circle whose centre is at O in such a way that the vertices A, B and C of the rhombus are on the circle. If the area of the rhombus is $32\sqrt{3}\,m^2$, then find the radius of the circle in metres.

**Ans** 8

OABC is a rhombus with centre O

Let the diagonal be OB = 2x and AC = 2y

$\therefore$ Radius of the circle = OB = OA = OC = 2x

Let P be the point of intersection of diagonals

In $\Delta POC$, $OC^2 = OP^2 + PC^2$

or $(2x)^2 = x^2 + y^2$ or $4x^2 = x^2 + y^2$

$\therefore x = \frac{y}{\sqrt{3}}$ … (i)

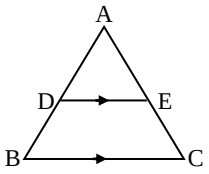
Also, area of rhombus $= \frac{1}{2} \times 2x \times 2y = 32\sqrt{3}$.

Given that

$\therefore 2xy = 32\sqrt{3}$ or $xy = 16\sqrt{3}$ or $x \times \sqrt{3}x = 16\sqrt{3}$ or $\sqrt{3}x^2 = 16\sqrt{3}$ $\therefore x = 4$

$\therefore$ radius = $2 \times 4 = 8$ m

74. In the given figure, DE || BC, AD = 2 cm, BD = 2.5 cm, AE = 3.2 cm and DE = 4 cm, then BC (in cm), is




**Ans** 9

By similarity, $\Delta ADE \sim \Delta ABC \Rightarrow \frac{AD}{AB} = \frac{DE}{BC} = \frac{AE}{AC}$

$\frac{2}{4.5} = \frac{4}{BC} \Rightarrow BC = 9$

75. Find the absolute value of a + b such that the zeroes of $q(x) = x^3 + 2x^2 + a$, are also the zeroes of the polynomial $p(x) = x^5 - x^4 - 4x^3 + 3x^2 + 3x + b$?

**Ans** 3

If zeroes of q (x) are also the zeroes of p (x), then p (x) is divisible by q (x). In other words, when p (x) is divided by q (x), the remainder is zero. Let us now divide p (x) by q (x) to obtain the remainder

$$x^3+2x^2+a\overline{)x^5-x^4-4x^3+3x^2+3x+b}\,(x^2-3x+2$$

$$x^5+2x^4+ax^2$$
$$-\quad -\quad -$$

$$-3x^4-4x^3+(3-a)x^2+3x+b$$
$$-3x^4-6x^3-3ax$$
$$+\quad +\quad +$$

$$2x^3+(3-a)x^2+3x(1+a)+b$$
$$2x^3+4x^2+2a$$
$$-\quad -\quad -$$

$$(-1-a)x^2+3x(1+a)+b-2a$$

If p (x) is divisible by q (x), then remainder must be zero

Now, Remainder = 0

$\Rightarrow (-1-a)x^2+3x(1+a)+b-2a=0$ for all x.

$\Rightarrow -1-a=0,\ 3(1+a)=0$ and $b-2a=0$ [On equating the coefficients of like powers of x]

$\Rightarrow a=-1$ and $b-2a=0$

$\Rightarrow a=-1$ and $b=-2$

* * *