ALLEN®
Mumbai, Maharashtra

ICSE BOARD SAMPLE PAPER - 2

SUBJECT: PHYSICS

Hint & Solutions

SECTION - A

Question 1

1. Ans. (B) F cos θ
2. Ans. (B) $\frac{mgh}{t}$
3. Ans. (B) $\frac{1}{2}kx^2$
4. Ans. (C) M.A. > 1
5. Ans. (D) both deviation and dispersion
6. Ans. (C) At the center of curvature
7. Ans. (D) the image is real and diminished formed by a convex lens
8. Ans. (C) Pitch doubles
9. Ans. (B) 2.4 Ω
10. Ans. (B) Switch
11. Ans. (C) 1100 V
12. Ans. (A) Water has higher specific heat capacity than copper
13. Ans. (C) It requires a large amount of heat to change its temperature
14. Ans. (A) Alpha particles
15. Ans. (A) Increase by 1

Question 2

(i) 1. velocity ratio
2. amplitude
3. higher, lower
4. frequency
5. conductance
6. gamma

(ii)

Column A – Movement of Body Part	Column B – Class of Lever
a. Movement of the neck	iii. First class lever
b. Movement of the forearm	ii. Third class lever
c. Movement of the foot while standing on toes	i. Second class lever

(iii) An echo is a repetition of a sound that occurs when sound waves are reflected off a surface. For a clear echo, the minimum distance between the sound source and the reflecting surface must be 17.2 meters. This is because the sound needs to travel to the surface and then back to the listener, and it must take at least seconds for this to be perceived as a separate sound.

An echo is the sound that is heard again after it has been reflected off a surface, such as a wall or mountain. It is a result of the reflection of sound waves.

The human ear can distinguish two sounds if they are separated by at least 0.1 seconds.

Using the speed of sound in air (approximately 340 m/s), we can calculate the total distance traveled by the sound in 0.1 seconds:

Distance = Velocity × times Time = 340 m/s × times 0.1 s = 34 m.

Since the sound travels to the reflecting surface and then back, the total distance is 34 m. The distance to the reflecting surface is half of this total distance: 34 m ÷ 2 = 17 m. Some sources may cite this as 17.2 m, accounting for slight variations in the speed of sound.

Question 3

(a) (i) The reciprocal of focal length is known as power of lens

$$P = \frac{1}{f} \text{ (unit diopter D)}$$

(ii) $f = 25 \text{ cm} \Rightarrow P = \frac{1}{f} = 4D$

(b) All three 3Ω are in parallel

So, $\frac{1}{R_p} = \frac{1}{3} + \frac{1}{3} + \frac{1}{3} \Rightarrow R_p = 1\Omega$

4Ω and 6 Ω are in parallel

$$\frac{1}{R_p} = \frac{1}{4} + \frac{1}{6} \Rightarrow R_p = \frac{6 \times 4}{6+4} = \frac{24}{10} = 2.4\Omega$$

Now 1 Ω, 5 Ω and 2.4 Ω are in series

$R_{eq} = 1 + 5 + 2.5 = 8.4\ \Omega$.

(c) P.E. $= mgh - m_1 = m_2$

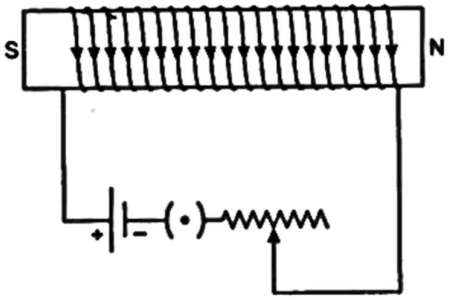
i.e. $(P.E.)_A : (P.E.)_B = 20: 30 \Rightarrow 2:3$

(d) $m_{fe} = 100 \text{ gm} = 0.1 \text{ kg}$, $C_{fe} = 470 \text{ Jkg}^{-1} \text{ k}^{-1}$

$M_w = 240 \text{ gm} = 0.24 \text{ kg}$, $Tw = 20^0C$, $t = 60^0C$

Heat gained by water = Heat lost by iron

(e) Precaution: The source of current must be DC battery



(f) Alpha decay:

${}^{A}_{Z}X \rightarrow {}^{A-4}_{Z-2}Y + {}^{4}_{z}\propto$ decreases by 2, A by 4

Beta decay:

${}^{A}_{Z}X \rightarrow {}^{A}_{Z+1}Y + {}^{0}_{-1}B$ increase by 1, A unchanged

(g) $v = 1500$ m/s , t = 50 sec, d = ?

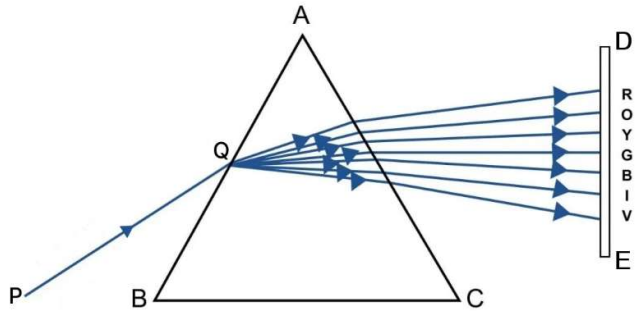
$$V = \frac{28}{t} \Rightarrow S = \frac{V \times t}{2} = \frac{1500 \times 50}{2}$$

distance of object = 37500 m OR 37.5 km

SECTION - B

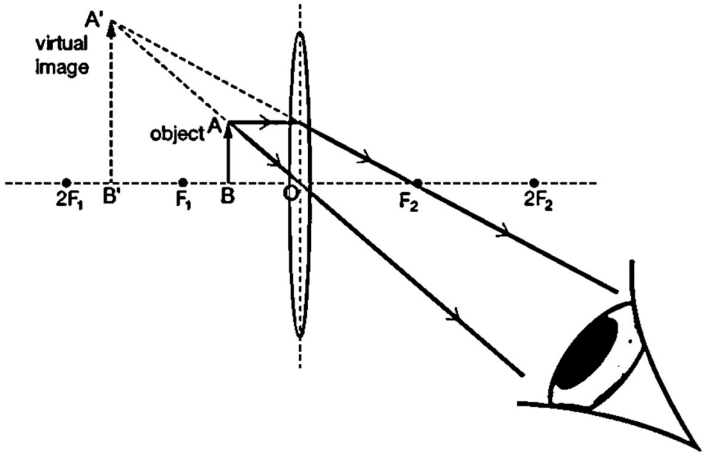
Question-4

1. (a) Free vibration is the motion of a body when it oscillates after being displaced from its equilibrium position, without any external forces acting on it. The body vibrates at its natural frequency and continues to do so until its energy is dissipated by damping forces like friction.
   (b) The amplitude of a vibrating body decreases during damped vibrations because a damping force, such as friction or air resistance, acts on the body, continuously removing its energy.
2. Real depth = 25 cm, $\mu_g = 1.25$
   (a) $\mu = \frac{R.d}{A.d} \Rightarrow A.d = \frac{R.d}{\mu} = \frac{25}{1.25} = 20\,cm$
   Ruler gets wet up to 20 cm mark
   (b) If $\mu > 1.25$ apparent depth become smaller so wet length will be less than 20 cm.
3. (a) Phenomenon – Dispersion of light
   (b) Rainbow, soap bubble, CD grooves
   (c) White light consists of 7 colours



Question-5

1. Ray diagram



2. (a) Branch of physics that deal with measurement of heat
   (b) Copper and aluminum are used
   (c) Because – Calorimeter should have small heat capacity and good thermal conductivity to attain equilibrium quickly
3. Heat energy taken by ice at 0^0C to convert into water aot 0^0C is
   $Q = m \times L$
   $= 2 \times 336 \times 10^3 = 6.72 \times 10^5$ J
   Heat energy lost by water is
   $Q = mcst$
   $= m \times 4200\ (100 - 0) = 420000\ m$ J

If there is no loss of energy

Heat gained = Heat lost

$672000 = 420000 \times m$

$$m = \frac{672000}{420000} - 1.6kg$$

Hence, 1.6 kg of water is required

Question-6

1. (a) Let Wgf be the weight of meter rule acting downward from 50 cm mark

In equilibrium position

Anticlock moment = Clockwise moment

$40 \times (30 - 5) = w(50 - 3)$

$1000 = 20\ w$

$$W = \frac{1000}{20} = 50\ gf$$

Weight of meter scale is 50 gf

(b) F is shifted toward 0cm mark

2. $m_1 = 50$ kg, $h_1 = 2$m, $t = 5$ min

(a) Work done = mgh = $50 \times 10 \times 2 = 1000$ J as height is same and mass, so work done is also same.

(b) $$\text{power} = \frac{\text{work}}{\text{time}}$$

$$P_1 = \frac{1000}{20} \qquad P_2 = \frac{1000}{50}$$

$P_1 = 50$ w $\quad P_2 = 20$ w

Power developed by 1st man is more

3. $m = 80$ kg, $h = 0.8$ m, $g = 10$ m/s^2

(a) force needed = weight of oil drum

$= 80 \times 10 = 800$ N

(b) energy used = mgh

$= 800 \times 0.8 = 640$ J

(c) chemical energy (fuel) $\rightarrow$ heat, kinetic energy, sound, etc.

(d) kinetic energy get dissipated in form of heat energy, sound, friction, internal energy of brake pad/road.

Question-7

1. In case-1 =the force F_1 and T_1 both are in upward direction.

Assuming system is in equilibrium and pulley is massless

$F_1 + T_1 = Mg \Rightarrow F_1 + F_1 = Mg \quad (F = T)$

$$F_1 = \frac{Mg}{2}$$

In Case-2 = the fixed pulley only changes the direction of force.

i.e. $F_2 + F_2 = Mg \rightarrow F_2 = Mg/2$

force ration = 1 : 1

2. (a) Yes it will produce audible sound if frequency is more than 20 Hz.

(b) Yes, these are kind of forced vibration

(c) If the frequency of tuning fork match with natural frequency of table.

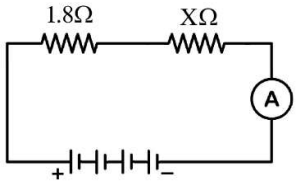
3. (a) Damped vibration

(b) Pendulum, tuning fork

(c) Energy getting lost due to air resistance

(d) Vibration eventually die out and body come to rest

Question-8

1. 

Total voltage/emf of battery = 4 × 1.5 v = 6v

Total resistance = 4 × (0.05) + 1.8 + x = 2 + x Ω

Current in circuit is 1A i.e.

$$V = IR \text{ i.e.} R = \frac{V}{I} \rightarrow 2 + x = \frac{6}{I}$$

$$x = 6 - 2$$

$$x = 4\Omega$$

Value of unknown resistance is 4 Ω.

p.d. across 4 Ω is = IR = 4V

2. (i) appliance get full mains voltage independently
   (ii) thin wire with low melting point and high resistance
   (iii) earth wire
3. (i) because moving magnet bring change in magnetic flux inducing an emf in wire
   (ii) according to lenz law direction of current at end A is anticlockwise
   (iii) when magnet move away, galvanometer deflect in opposite direction
   (iv) when magnet and coil move in same direction with same speed
   No change in magnetic flux → no induced emf → no change in G.

Question-9

1. 12Ω and 6 Ω are in parallel connection

$$\frac{1}{R_P} = \frac{1}{12} + \frac{1}{6} \Rightarrow \frac{1}{R_P} = \frac{6 \times 12}{6 \times 12} \quad R_P = 4\Omega$$

4 Ω is in series with 8 Ω

R_{eq} = 12 Ω

Current drawn by battery in $I = \frac{V}{R} = \frac{12}{12} = 1A$

(a) current through 8 Ω is 1A

(b) P.d across 6 Ω and 12 Ω is = IR = 1 × 4 = 4V

(c) current through 6 Ω is $I = \frac{V}{R} = \frac{4}{6} = 0.67A$

2. (a) AB moves downward CD moves upward
   (b) Commutator is necessary to change the direction of current after every half cycle.
   (c) the working of an electric generator is based on principle of electromagnetic induction
3. p = 15, n = 16
   (a) z = 15, A = 15 +16 = 31
   (b) z = 15, A = 15 + 17 = 32
   (c) $^{32}_{15}P \rightarrow ^{32}_{16}P + ^{0}_{-1}B$

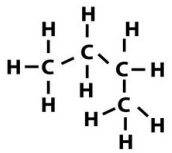
SUBJECT: CHEMISTRY

Hint & Solutions

SECTION – A

Question 1

(i). Ans. (d) Sodium hydroxide
(ii). Ans. (b) Iron (II) sulphate
(iii). Ans. (c) Both (A) and (R) are true and (R) is the correct explanation of (A).
(iv). Ans. (d) $Y - 2e^- \longrightarrow Y^{2+}$
(v). Ans. (d) Acidified potassium dichromate
(vi). Ans. (c) Potassium nitrate
(vii). Ans. (b) $SiCl_3$
(viii). Ans. (b) Lead
(ix). Ans. (d) Ethyne
(x). Ans. (b) ammonium hydroxide
(xi). Ans. (c) Al_2O_3
(xii). Ans. (d) Both positive and negative ions
(xiii). Ans. (d)



(xiv). Ans. (d) $C_6H_{12}O_6$
(xv). Ans. (a) Copper ions

Question 2

(i) (a) $Cu^{+2} + 2e^- \rightarrow Cu$
(b) $OH^- - 1e^- \rightarrow OH$
$2OH + 2OH \rightarrow 4OH$
$4OH \rightarrow 2H_2O + O_2$
(c) 380°C
(d) $Pb^{+2} + 2e^- \rightarrow Pb$
(e) $Br^- - 1e^- \rightarrow Br$; $Br + Br \rightarrow Br_2$

(ii) 1. Pale blue precipitate
2. More
3. Substitution
4. Largest
5. Alkaline

(iii) 1. Coordinate bond
2. Substitution reaction
3. Ionization energy
4. Decarboxylation
5. Cryolite

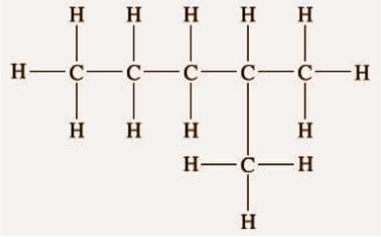
(iv) 1. C. Flurospar
2. E. Helium
3. D. Covalent compound
4. B. Carbonate ore
5. A. Contact process

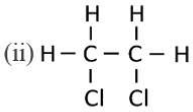
(v). (a). IUPAC names:

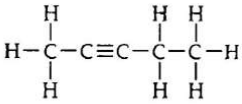
(i) Butan-2-ol

(ii) But-2-yne

(b). Draw structural for following:

(i) 

(ii) 

(iii) 

SECTION - B

Question 3

1. (a) Quick lime is basic in nature and it will react with HCl.

$$CaO + 2HCl \rightarrow CaCl_2 + H_2O$$

(b) Vanadium pentoxide is a preferred catalyst as it does not get poisoned easily and it is cheaper than platinum.

(c) Cryolite is added to reduce the fusion temperature of the electrolytic mixture from 2050°C to 950°C.

(d) Noble gases have effectively zero electron affinity due to their stable electron configurations, which do not favor the addition of extra electrons.

2. (a) $Pb(NO_3)_2 + NH_4OH \rightarrow Pb(OH)_2 + NH_4NO_3$

$Cu(NO_3)_2 + NH_4OH \rightarrow Cu(OH)_2 + NH_4NO_3$

$Cu(OH)_2 + NH_4NO_3 + NH_4OH \rightarrow [Cu(NH_3)_4]NO_3 + H_2O$

In the presence of excess ammonium hydroxide, the color of copper (II) hydroxide precipitate changes from pale blue to deep inky blue whereas lead hydroxide is insoluble in excess of ammonium hydroxide.

(b) $ZnSO_4 + NaOH \rightarrow Zn(OH)_2 + (NH_4)_2SO_4$

$Zn(OH)_2 + NaOH \rightarrow Na_2ZnO_2 + H_2O$

$FeSO_4 + NaOH \rightarrow Fe(OH)_2 + Na_2SO_4$

In presence of excess sodium hydroxide, the gelatinous white precipitate of zinc hydroxide will dissolve to form a soluble sodium zincate solution whereas iron hydroxide is not soluble in excess of sodium hydroxide.

3. (a) When sugar crystals are treated with Conc.sulphuric acid they get dehydrated due to the dehydrating nature of conc. sulphuric acid.

$$C_{12}H_{22}O_{11} + H_2SO_4 \rightarrow 12C + 11H_2O$$

(b) When copper (II) sulphate crystals are treated with Conc.sulphuric acid they get dehydrated due to the dehydrating nature of conc. sulphuric acid.

$$CuSO_4.5H_2O + H_2SO_4 \rightarrow CuSO_4 + 5H_2O$$

Blue Colorless

Question 4

1. The letters A–E represent the reagents or processes needed for each transformation.

A. $NaCl + H_2SO_4 \rightarrow NaHSO_4 + HCl\uparrow$

B. $Zn + 2HCl \rightarrow ZnCl_2 + H_2\uparrow$

C. $HCl + AgNO_3 \rightarrow AgCl\downarrow + HNO_3$

D. $MnO_2 + 4HCl \rightarrow MnCl_2 + Cl_2\uparrow + 2H_2O$

E. $HCl + NaOH \rightarrow NaCl + H_2O$

2. $CH_3COONa + NaOH \xrightarrow[\Delta]{CaO} +CH_4 + Na_2CO_3 + H_2O$

$$\underset{\text{1,2, dibromoethane}}{\underset{\text{[ethylene dibromide]}}{CH_2Br-CH_2Br}} + 2KOH \xrightarrow[\text{[alcoholic]}]{\text{boil}} \underset{\text{[}C_2H_2\text{]}}{\underset{\text{ethyne}}{\underset{\text{[acetylene]}}{CH\equiv CH}}} + 2KBr + 2H_2O$$

Dehydrohalogenation reaction

3. Chemical equation:

$2\,C_2H_6 + 7\,O_2 \longrightarrow 4\,CO_2 + 6\,H_2O$

Molecular weight of ethane = 30 g/mol

Molecular weight of CO_2 = 44 g/mol

Molecular weight of O_2 = 32 g/mol

In reaction, the number of moles of CO_2 formed is twice as that of ethane.

Therefore, the volume of CO_2 will be $2 \times 80 = 160$ ml.

In the reaction, the number of moles of O_2 used is 3.5 times that of ethane.

Therefore, the volume of O_2 will be $3.5 \times 80 = 280$ ml.

Unused oxygen is 300 – 280 ml = 20 ml.

Question 5

1. (a) Quicklime [CaO] is alkaline in nature and it reacts with HCl forming the respective chloride. Hence, it can't be used as a drying agent for Hydrogen chloride gas.
   $CaO + 2HCl \longrightarrow CaCl_2 + H_2O$
   (b) As ammonia gas is highly soluble in water, therefore, it is not collected over water.
2. (a) Pb^{2+}
   Reason - When ammonium hydroxide solution is added to lead nitrate, it forms a chalky white precipitate of lead hydroxide [$Pb(OH)_2$] which is insoluble in excess of ammonium hydroxide.
   $Pb(NO_3)_2 + 2NH_4OH \longrightarrow 2NH_4NO_3 + Pb(OH)_2 \downarrow$
   (b) Ca^{2+}
   Reason - When sodium hydroxide solution is added to calcium nitrate, a white precipitate of calcium hydroxide is obtained which is insoluble in excess of sodium hydroxide solution.
   $Ca(NO_3)_2 + 2NaOH \longrightarrow Ca(OH)_2 \downarrow + 2NaNO_3$
3. (a) K > Ca > Mg > Al
   Reason - According to the electrochemical series metals at the top of the series are most reactive and the reactivity decreases down the group.
   (b) Be < C < N < O
   Reason - Across a period, left to right in a periodic table, the non-metallic character increases.
   (c) F > P > Si > Be
   Reason - The valence electrons decrease from right to left in the periodic table.
4. (a) $2NH_4Cl + Ca(OH)_2 \longrightarrow CaCl_2 + 2H_2O + 2NH_3$
   (b) $2HNO_3 + ZnCO_3 \longrightarrow Zn(NO_3)_2 + H_2O + CO_2$
   (c) $H_2SO_4 + CuSO_4.\,5H_2O \longrightarrow CuSO_4 + 5H_2O + H_2SO_4$

Question 6

1. (i) $2NH_4Cl + Ca(OH)_2 \longrightarrow CaCl_2 + 2NH_3 + 2H_2O$
   (ii) $CuSO_4 + 2NH_4OH \longrightarrow (NH_4)_2SO_4 + Cu(OH)_2\downarrow$
   (iii) $Cu + 4HNO_3$ (conc.) $\longrightarrow Cu(NO_3)_2 + 2NO_2 + 2H_2O$
2. (i). $NaCl + H_2SO_4(\text{conc.}) \xrightarrow{<200^\circ C} NaHSO_4 + HCl$
   (ii). $\mathbf{C_2H_4 + Br_2 \xrightarrow{CCl_4} C_2H_4Br_2}$

3. Given :

Atomic mass of H 1

Atomic mass of O 16

Atomic mass of S 32

Atomic mass of Cu 64

Molar mass of $CuSO4.5H_2O$ (64) + (32) + (9 x 16) + (10 x 1)

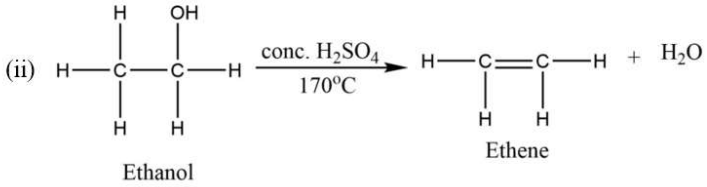
= 250

Molar mass of five water molecules (10 x 1) + (5 x 16)

= 90

Percentage of water of crystallization $= \frac{90 \times 100}{250}$ = 36% water of crystallization.

4. (i) $CH_4 + Cl_2 \xrightarrow{light} H_3C{-}Cl + HCl$

(ii) 

Ethanol Ethene

(iii) 

Question 7

1.

Element	Percentage	Molecules	Simple ratio	Ration	Simple whole ratio
Carbon	82.76	$\frac{82.76}{12} = 6.9$	$\frac{6.89}{6.89} = 1$	$\frac{6.9}{6.9} = 1$	2
Hydrogen	17.24	$\frac{17.24}{1} = 17.24$	$\frac{17.24}{6.89} = 2.5$	$\frac{17.24}{6.9} = 2.5$	5

Empirical formula = C_2H_5

Empirical formula mass = (12 × 2) + (1 × 5)

= 24 + 5

= 29

Vapour density = 29 ...(Given)

Molecular weight = 2 × Vapour density

Molecular weight = 2 × 29 = 58 gm

Molecular formula mass = n × Empirical formula mass

$\Rightarrow n = \frac{\text{Molecular formula mass}}{\text{Empirical formula mass}} = \frac{58}{29} = 2$

Molecular formula = n × Empirical formula

$= 2 \times C_2H_5$

$= C_4H_{10}$

2. (a) $CH_2Br-CH_2Br + 2KOH \xrightarrow[\text{[alcoholic]}]{\text{boil}} HC\equiv CH + 2KBr + 2H_2O$

1,2, dibromoethane [ethylene dibromide] — Dehydrohalogenation reaction — $[C_2H_2]$ ethyne [acetylene]

(b) $CH_3COOH + CH_3CH_2OH \rightleftharpoons CH_3COOCH_2CH_3 + H_2O$

Ethanoic acid — Ethanol — Ethyl Ethanoate

(c) $MnO_2+4HCl \rightarrow MnCl_2+2H_2O+Cl_2$

(d) $CaC_2 + 2H_2O \rightarrow C_2H_2 + Ca(OH)_2$

3. Properties of sulphuric acid :

(a) $NaOH + H_2SO_4 \rightarrow Na_2SO_4 + H_2O$

(b) $C_{12}H_{22}O_{11} \rightarrow 6C + 11H_2O$

(c) $NaCl + H_2SO_4 \rightarrow NaHSO_4 + HCl$

(d) $S + 2H_2SO_4 \rightarrow 3SO_2 + 2H_2O$

SUBJECT: BIOLOGY

Hint & Solutions

SECTION A

Question 1

(i) Renal artery
(ii) Ripe banana
(iii) A is true but R is false
(iv) Adrenal, cortisone
(v) Artery
(vi) A is false and R is true
(vii) Cornea and Lens
(viii) Knitting without looking
(ix) Growth Rate
(x) 14 days
(xi) Gametes
(xii) 3 : 1
(xiii) Homo Habilis, Homo Erectus, Neanderthal, Cro – Magnon Man
(xiv) Option c
(xv) Option b

Question 2

(i) (a) Sclera
(b) CFC
(c) Inguinal canal
(d) Grana
(e) Tropic movements

(ii) (a) Portal vein
(b) Hepatic portal vein
(c) nutrients
(d) deamination
(e) hepatic vein

(iii) (a) X – rays, sources of water pollution
(b) Spinal cord – parts of brain
(c) Ureter – parts of female reproductive system
(d) Plasmolysis – Responsible for ascent of sap
(e) Oxytocin – plant hormones

(iv) (a) Iodopsin/ Visual violet
(b) Blind spot, there are no sensory cells present here
(c) Tears
(d) Hyperopia/ Hypermetropia

(v) (a) Ovary
(b) Cervix
(c) Fallopian tube
(d) Vagina
(e) Endometrium

SECTION - B

Question 3

(i) Menopause is the permanent stoppage of menstruation in females at about age of 45 years.

(ii)

Guttation	Bleeding
- It occurs from the edge of leaves by hydathodes in uninjured plants	- It occurs from any cut or injured part of a plant
- The exudate is mainly water with some dissolved mineral salts	- The exudate is mainly plant sap and sugars

(iii) (a) Cerebrum
(b) Cerebellum

(iv) Cell wall is freely permeable and it allows both solutes and solvent to pass through it whereas plasma membrane is semi permeable and it allows solvent to pass through more easily and only selected solutes to pass through it.

(v) Diagram of Human Heart – Pg 102, Selina textbook

Question 4

(i) The process of passing out urine (urination) by relaxation of sphincter muscles under impulse from nervous system is called as micturition.

(ii) Function of ADH is to reabsorb excess water from DCT and collecting tubule and hyposecretion of it may cause Diabetes insipidus (watery urine) whereas function of insulin is to lower blood glucose levels and hyposecretion of it may cause Diabetes mellitus (urine containing glucose).

(iii) (a) Shape of pea seed
(b) It is a monohybrid cross as only one character i.e., shape of the seed is being studied

(iv) No osmosis occurs in isotonic solution as the relative concentration of water molecules and the solute on either side of the cell membrane is the same.
Exosmosis occurs in hypertonic solution as the solution outside the cell has a higher solute concentration than the fluids inside the cell.

(v) (a) Auxin
(b) Gibberellin
(c) Auxin

Question 5

(i) Tyre rubber particles, dust particles

(ii) Hormonal method : Various hormonal preparations come in the form of tablets or pills (contraceptive pills). These hormones prevent the release of egg from the ovary.

Barrier method (Condoms) : It is used by men, made of latex and prevents the sperms from being deposited in the vagina.

(iii) (a) Fallen leaves - Earthworm – Rat - Hawk

(b) Algae – limpets – starfish – shark

(iv)

Spinal Nerve	**Cranial Nerve**
- Emerge from the spinal cord	- Emerge from the brain
- There are total 31 pairs	- There are total 12 pairs

(iv) (a) This experiment's primary goal is to explain the role that carbon dioxide plays in photosynthesis.

(b) No, the experiment won't provide the desired results because KOH is kept inside the flask which absorbs all the carbon dioxide and hence photosynthesis cannot occur.

(c) The first step taken before any photosynthesis related experiment is destarching. For destarching, the potted plant is kept in a dark room for 2-3 days.

Question 6

(i) When there are two pairs of characters, the distribution of the alleles of one character into the gametes is independent of the distribution of the alleles of the other character.

(ii) Transpiration provides a cooling effect to the plants. Transpiration also helps in the ascent of sap by producing a suction force.

(iii) (a) Indole 3-acetic acid

(b) Nicotinamide adenine dinucleotide phosphate

(iv) Dark adaptation involves changes like regeneration of the visual purple or rhodopsin and dilation of the pupil permitting more light to enter the eyes.

(v) (a) Parents- Pure breed tall plants: TT and pure breed dwarf plant: tt

(b) Experiment A: Tt x Tt

	T	t
T	TT	Tt
t	Tt	tt

Genotype - 1 (TT): 2 (Tt): 1 (tt)

Experiment B: Tt x tt

	T	t
t	Tt	tt
t	Tt	tt

Genotypic ratio - 2 (Tt) : 2 (tt)

(c) Phenotypic ratio of Experiment A – 3 Tall : 1 dwarf

Question 7

(i) Mortality is the number of deaths per 1000 of population per year.

(ii) Nerves of sympathetic system arise from the spinal cord between the neck and the waist region. The parasympathetic system is located at two places, one anteriorly in the head and neck and the other posteriorly in sacral region.

(iii) (a) The process intended is transpiration. Transpiration is the process of loss of water in the form of water vapour from the leaves and other aerial parts of the plant.
(b) There is a loss in weight in test tube A after the experiment. In test tube B there is no change in weight after the experiment.
There is loss of weight in test tube A because there is a leafy shoot kept in the bright sunlight and because of transpiration there is loss in weight. In test tube B there is no leafy shoot and a layer of oil is kept over water level so no water can evaporate even in bright sunlight due to evaporation, hence no change in weight.

(iv) Diagram of malpighian corpuscle containing glomerulus and Bowman's capsule

(v) Explain – Root pressure, Transpirational pull, Cohesion theory or Capillarity

Question 8

(i) Melting of snow caps, rise in sea level, decline in food production in agricultural fields and in fishery resources in the oceans.

(ii) Forehead was receding, jaws were still projecting and chin was absent. Their body size had increased to about 120 – 150 cm.

(iii) Two substances that diffuse into placenta are glucose and oxygen. Two substances that diffuse out of placenta are urea and carbon dioxide.

(iv) (a) Myopia
(b) Diagram showing correction of Myopia, Pg – 147

(v) (a) The diagram is phototropism, it is a tropic movement as here the plant shoot is showing growth towards the stimulus sunlight.
(b)

Tropic Movement	Nastic Movement
- Directional oriented movement	- Non directional movement
- Growth oriented movement	- No growth is seen
- Permanent change	- Temporary change

SUBJECT: MATHEMATICS

Hint & Solutions

SECTION - A

Question-1

1. (d) –11

$x = -1$ $\quad p(-1) = (-1)^3 - 2(-1)^2 + a(-1) + 12 = 20$
$-1-2-a+12 = 20$
$a = -20 + 9$
$a = -11$

2. (c) ₹19,800

$$\text{Total money} = 1100 \times \frac{3}{2} \times 12$$
$$= 19800$$

3. (b) SAS

4. (a) 6 cm

$r^2 + \ell^2 = a^2$
$\ell^2 = 100 - 64$
$\ell = 6$ cm

5. (c) $45° \le \theta \le 90°$

$$\tan\theta = \frac{6}{2\sqrt{3}} = \sqrt{3}$$

$\tan\theta = 60$

6. (a) Only Statement 1.

Circumference $= 2\pi r = 22$

$r = 3.5$

$v = \pi r^2 h$

$v = 42 \quad 3.5\ cm^3$

$CSA = 2\pi rh$

$= 242$

7. (c) Only (2) and (3)

8. (c) 12

9. (c) Both A and R are true and R is the correct explanation for A.

10. (b) 4

11. (d) 6%

12. (d) ₹900

13. (a) –5

14. (c) $(4,2)$

15. (b) $\{0,1,2,3\}$

Question-2

1. $2x^3 - 9x^2 + 7x + 6$

Let $x = 2$ $\quad 2(2)^3 - 9(2)^2 + 7(2) + 6$

$16 - 36 + 14 + 6$

$36 - 36 = 0$, $(x - 2)$ is a root

$2x^2 - 5x - 3$

$2x^2 - 6x + x - 3$

$2x(x - 3) + (x - 3)$

$(2x + 1)(x - 3)$

$$x = \frac{-1}{2},\ x = 3$$

2. (a) $x = \dfrac{m_1x_2 + m_2x_1}{m_1 + m_2} = \dfrac{-5I - 2}{I + 1}$ (b) $y = \dfrac{-6I + 5}{I + 1}$

(c) 5 : 12 (d) $P\left(\dfrac{-49}{77}, \dfrac{30}{17}\right)$

3. ΔOMB

$OB^2 = 12^2 + 5^2$

$= 144 + 25$

$r = OB = 13$

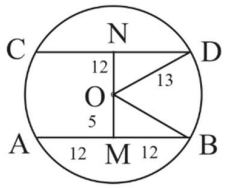
ΔOND

$ND^2 = 13^2 - 12^2$

$= 25$

$ND = 5$

$CD = 10$



Question-3

1. $a_6 = 4(a_1)$

$a + 5d = 4a$

$a = \frac{5}{3}d$

$S_6 = 75$

$S_6 = \frac{A}{2}[2a + (n-1)d] = 3[2(\frac{5}{3}d) + 5d] = 75$

$= \frac{10}{3}d + 5d = 25$

$25d = 75$

$d = 3$

$a = \frac{5}{3} \times 3 = 5$

2. $r = 3m \quad x = 4$

$\ell = 5$

equation $v = V_{cone} + V_{cy}$

$= \frac{1}{3}\pi R^2 H + \pi r^2 h$

CSA of solid = $CSA_{cone} + CSA_{cy}$

$\pi r\ell + 2\pi rh$

$\pi r[5 + 2(21)]$

$\pi\left[\frac{1}{3} \times 3 \times 3 \times 4 + 3 \times 3 \times 21\right]$

$\frac{22}{7} \times (12 + 129)$

$\frac{22}{7} \times 201 \cong 631 \text{ cm}^3$

3. (a) Plot (b) (4, 2)

(c) (2, 0) (d) Parallelogram or Rhombus

(e) (–x, –y)

SECTION - B

Question-4

(i) (a) Investment = 62 × 132

= 8184

(b) Annual Income = No. of share × face value

$= 62 \times 100 \times \frac{7.5}{100} = 62 \times 7.5 = 465$

(c) Income per share = f.v × Div

$100 \times \frac{7.5}{100} = 7.5$

Extra share needed = $\frac{150}{7.5} = 20$ shares

(ii) $3 - 2x \geq x + \frac{1-x}{3} > \frac{2x}{5}$ $\quad x + \frac{1-x}{3} > \frac{2x}{5}$

$3 - 2x \geq x + \frac{1-x}{3}$ $\quad 3x + 1 - x > \frac{6x}{5}$

$-6x \geq 3x + 1 - x$ $\quad$ $15x + 5 - 5x > 6x$

$8 \geq 8x$ $\quad$ $4x > -5$

$x \leq 1$ $\quad$ $x > -1.25$

$-1.25 < x \leq 1$

(iii) (a) $(\sin\theta + \cos\theta)(\tan\theta + \cot\theta) = \sec\theta + \cos ec\theta$

$$(\sin\theta + \cos\theta)\left(\frac{\sin\theta}{\cos\theta} + \frac{\cos\theta}{\sin\theta}\right)$$

$$\sin\theta + \cos\theta\left[\frac{\sin^2\theta + \cos^2\theta}{\sin\theta - \cos\theta}\right]$$

$$\frac{\sin\theta}{\sin\theta\cos\theta} + \frac{\cos\theta}{\sin\theta\cos\theta}$$

$\sec\theta + \cos ec\theta$ H.P.

(b) $\dfrac{(1+\sin\theta)^2 + (1-\sin\theta)^2}{2\cos^2\theta} = \sec^2\theta + \tan^2\theta$

$$\frac{1 + \sin^2\theta + 2\sin\theta + 1 + \sin^2\theta - 2\sin\theta}{2\cos^2\theta}$$

$$\frac{2 + 2\sin^2\theta}{2\cos^2\theta} = \frac{1 + \sin^2\theta}{\cos^2\theta} =$$

$$\frac{1}{\cos^2\theta} + \frac{\sin^2\theta}{\cos^2\theta}$$

$\sec^2\theta + \tan^2\theta$ H.P

Question-5

(i) ΔOBE is iso Δ

$\angle OBE = \angle BEO$

ΔABD

$90 + 55 + \angle B = 180^0$

$\angle B = 35^0$

$\angle OEB = 35$

$\angle EOB = 180^0$

$= 110^0$

Line AB $\angle AOE = y$

$y + 110 = 180^0$ Linear pair

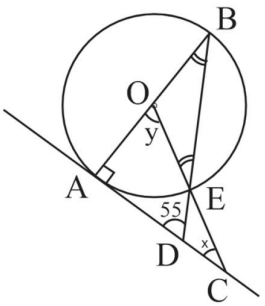
$y = 70$

ΔAOC $90 + y + x = 180$

$90 + 70 + x = 180$

$x = 180 - 160$

$x = 20$



(ii) (a) Total money deposited = 3000 × 24 = 72000 Rs.

(b) Total interest earned = Maturity value – Deposited

= 2,16,000 -72,000

= 1,44,000 Rs.

(c) Rate of interest = $I = \frac{Pn(n+1)\times R}{2\times 12\times 100}$

$R = 192\%$

3.

C.I.	f	x_i	$\propto$	u_i	$u_i f_i$
85 – 90	15	87.5	–10	–2	–30
90 – 95	15	92.5	–5	–1	–15
95 – 100	10	97.5	0	0	0
100 – 105	15	102.5	5	1	15
105 – 110	5	107.5	10	2	10
	$\sum f_1 = 60$				$\sum f_1 u_i = -20$

$$\bar{x} = a + \frac{\sum fiui}{\sum fi}\times 4 = 97.5 + 5\left(\frac{-20}{360}\right)$$

$$= 97.5 - \frac{5}{3} = 975 - 1.67 = 95.83$$

Question-6

(i) (a) Slope A(7,5) and B(0,10) is $\Rightarrow m = \frac{y_2 - y_1}{x_2 - x_1} = \frac{10-5}{-7} = \frac{-5}{7}$

(b) equation of line $\Rightarrow y - y_1 = m(x - x_1)$

$y - 5 = m(x - 7)$

$y - 5 = \frac{-5}{7}(x-7) \Rightarrow 7y - 35 + 5x - 35 = 0$

$5x + y = 70$

(c) length of AB = $\sqrt{(0-7)^2 + (10-5)^2} = \sqrt{49+25} = \sqrt{74}$

(ii) (a) PQ bisects $\angle RPB$

$\angle RPQ = 45^0$

PS bisects $\angle RPA$

$\angle APS = \angle SPR = a$

AB line $a + a + 45 + 45 = 180$

$2a = 40$

$A = 45$

$\angle SPQ = 90^0$ So, SQ is diameter

(b) ΔPQR

$\angle PSQ = 45^0$ ($\angle QPB = 45^0$)

So, $\angle PRQ = 45^0$ by $\overline{PQ}$

Opposite sides will be equal

RQ = PQ ΔPQR is iso. Δ

(iii) Selling price of ram = 1000 + 300

= ₹1300

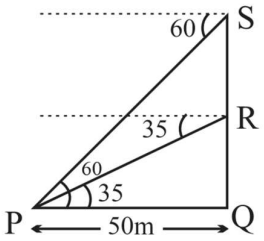
GST = SP × GST rate

= 1300 × 0.12

Tax liability of Ram = ₹36

Question-7

(i) (a) RS = ?



ΔPQR

$$\tan 35^0 = \frac{RQ}{50}$$

$$0.700 = \frac{RQ}{50} \qquad \therefore\ RQ = 35$$

$$\Delta PSQ\ \tan 60^0 = \frac{SQ}{50}$$

$$50\sqrt{3} = SQ$$

$$SQ = 50 \times 1.732 = 86.6 \qquad \therefore\ RS = SQ - RQ = 51.6$$

(b) Nearest whole number = 51.6

is 52 m

(ii)

C.I.	f	x
50 – 60	4	55
60 – 70	8	65
70 – 80	14	75
80 – 90	19	85
90 – 100	5	95

Mode = 82.63

Question-8

(i) (a) Number divisible by 4 [4,8,12,16,20]

$$P(E) = \frac{5}{10} = \frac{1}{2}$$

(b) Multiple of 6 (6,12, 18)

$$P(E) = \frac{3}{10}$$

(c) odd number = 0

$$P(E) = \frac{0}{10} = 0$$

(ii) $$\frac{(8a-5b)+(8a+5b)}{(8c-5d)-(8a+5b)} = \frac{(8c-5d)+(8c+5d)}{(8c-5d)-(8c+5d)}$$

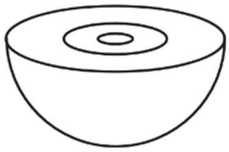
$$\frac{16a}{-10b} = \frac{16c}{-10d} \Rightarrow \frac{a}{b} = \frac{c}{d}$$

(iii) r = ? R = 8

$2\pi r = 44$

$$2 \times \frac{22}{7} \times r = 44$$

$r = 7$



Volume of metal = $V_o - V_i$

$$= \frac{4}{3}\pi(R^3 - r^3) \quad = \frac{4}{3} \times \frac{22}{7}(8^3 - 7^3)$$

$$= \frac{4}{3} \times \frac{22}{7}(512 - 343) \qquad \therefore\ \text{Required metal} = 709.190\ cm^3.$$

Question-9

(i)

	f	x	fx
0 – 20	17	10	170
20 – 40	f_1	30	$30f_i$
40 – 60	32	50	1600
60 – 80	f_2	70	$70f_2$
80 – 100	19	90	1710

$N = 120$

$\sum f = 17 + 32 + 19 + f_1 + f_2$

$= 68 + f_1 + f_2 = 120$

$f_1 + f_2 = 52 \quad \ldots\ldots(1)$

$$\text{Mean} = \frac{\sum fixi}{\sum fi} = 50 = \frac{3480 + 30f_1 + 70f_2}{120}$$

$$6000 = 3480 + 30f_1 + 70f_2$$

$$3f_1 + 7f_2 = 252 \quad \ldots..(2)$$

By (1) and (2)

$$3f_1 + 3f_2 = 156$$

$$3f_1 + 7f_2 = 252$$

$$\underline{\quad - \quad - \quad}$$

$$-4f_2 = -96$$

$f_2 = 24$

(ii) $a = 5$ $\qquad S_n = \frac{n}{2}[a + \ell]$

$l = 85$ $\qquad 405 = \frac{n}{2}(5 + 85)$

$S_n = 405 \quad 810 = n(90)$

$x = 9$

$l = a + (n - 1)d$

$85 = 5 + 8d$

$8d = 80$

$d = 10$

(iii) (a) $\frac{a}{r} \times a \times ar = 729$

$a^3 = 729$

$a = \sqrt[3]{729} = 9$

(b) Product of 1st and 2nd added to proof 2nd or 3rd = 270

$$\frac{a^2}{r} + a^2 r = 270$$

$a = 9$ $\qquad \frac{9^2}{r} + 9^2 r = 270$

$$\frac{81}{r} + 81r = 270$$

$$\frac{1 + r^2}{r} = \frac{10}{3}$$

$3+3r^2=10r$

$3r^2-10r+3=0$

$3r(r-3)-1(r-3)=0$

$r=3 \quad r=1/3$

Number are 3, 9, 27 Or 27, 9, 3

Question-10

(i) $x+y=8$

$$\frac{1}{x}-\frac{1}{y}=\frac{2}{15}\Rightarrow\frac{1}{x}-\frac{1}{8-x}=\frac{2}{15}$$

$$\frac{(8-x)-x}{x(8-x)}=\frac{2}{15}$$

$$15(8-2x)=2(8x-x^2)$$

$$2x^2-46x+120=0$$

$$x^2-23x+60=0$$

$$(x-20)(x-3)=0$$

$x=3 \qquad x=20$

$y=5 \qquad y=-12$

(ii) $$2\begin{bmatrix}x & 7\\ 9 & y-5\end{bmatrix}+\begin{bmatrix}6 & -7\\ 4 & 5\end{bmatrix}=\begin{bmatrix}10 & 7\\ 22 & 15\end{bmatrix}$$

$2x+6=10 \Rightarrow x=2$

$2(y-5)+5=15$

$2y-5=15 \Rightarrow y=10$

(iii) 1. Draw AB = 5.5 cm.

2. Construct ∠BAR 105°.

3. With centre A and radius 6 cm, cut off arc on AR at C.

4. Join BC. ABC is the required triangle.

(a) Draw angle bisector BD of LABC, which is the locus of points equidistant from BA and BC.

(b) Draw perpendicular bisector EF of BC, which is the locus of point equidistant from B and C.

(c) BD and EF intersect each other at point P. Thus, P satisfies the above two loci.

(d) By measurement, PC –4.8 cm.