5.5 GENERAL SCIENCE (237)

5.5.1 General Science Paper 1 (237/1)

SECTION A: BIOLOGY (34 marks)

1. (a) The child requires more energy than an adult for rapid cell division/ growth; and high activity/ high metabolic rate; (2 marks)

   (b) A translucent mark; when the food substance is rubbed on a piece of paper confirms presence of lipids; (2 marks)

2. (a) Amoeba/ plasmodium/ paramecium/ spyrogyra; (1 mark)

   (b) Kingdom: plantae; (1 mark)
   Division: spermatophyta; (1 mark)

3. (a) Osmosis; (1 mark)

   (b) Visking tube bulged because sugar solution is hypertonic; and distilled water is hypotonic; therefore water molecules moved into the visking tube by osmosis; (3 marks)

4. (a) (i) Artery;
   (ii) Thick walled/ small lumen; (2 marks)

   (b) Have valves; to prevent backflow of blood;
   Has large lumen/ is lined with smooth muscles; to facilitate smooth flow of blood;
   Any one correct (2 marks)

5. (a) Excretion is the elimination of metabolic waste products;
   Egestion is the elimination of undigested and indigestible materials from the alimentary canal; (mark as a whole) (2 marks)

   (b) The hypothalamus sends impulses to the liver to increase exothermic metabolic reactions; when the temperature is low/ increase endothermic metabolic reactions when the temperature is high; (2 marks)

   (c) Poor diet lacking certain vitamins and inadequate water intake;
   Chemical salts in urine;

   (2 marks)

6. (a) Fermentation/ anaerobic respiration; (1 mark)
   (b) Lime water turns white/ white precipitate is formed; air bubbles produced; (2 marks)

7. (a) Boiled water contained no gases/ carbon (IV) oxide; oil layer prevented entry of atmospheric carbon (IV) oxide; (2 marks)

   (b) oxygen; (1 mark)

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8.

Cell wall;

Nucleus;

Sap vacuole; (centred);

Cell membrane;

Chloroplast;
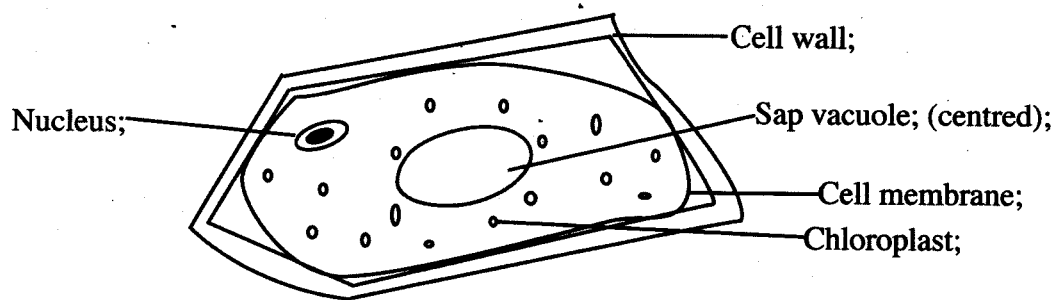
(3 marks)

9.   (i)   Exercise

(ii) Age

(iii) Emotions

(iv) Health

(4 marks)

SECTION B: CHEMISTRY (33 marks)

10.   J - Sublimation √½, K - Melting √½.

11.   (a)   Dilute sulphuric (VI) acid + solid Sodium carbonate ——→ √1
Sodium sulphate + Carbon (IV) oxide + water.

(b)   Used in making drugs, soap, soapless detergents, fertilizers and in cleaning metals.
(Any one correct) √1

12.   (a)   I - In I there is no air/dissolved oxygen since water is boiled √1.

II - In II there is no water vapour/water. √1

(b)   Rusting would take less time/ Nails would rust more and faster. √1

(c)

Substance	Type of oxide	
Hydrogen	Neutral	
Phosphorus	Acidic	√½
Magnesium	Basic	√½

13.   (a) $H_2(g) + CuO(s) \longrightarrow Cu(s) + H_2O(l)$. √1 Accept $H_2O_{(g)}$

(b)   Hydrogen is oxidised, since it gains oxygen to form water. √1

(c)   Excess / unreacted hydrogen burns/hydrogen. √1

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14. (a) $$\frac{12 \times 98.8 + 13 \times 1.2}{100} = \frac{1185.6 + 15.6}{100} \checkmark 1 \quad \text{or} \quad \left(\frac{12 \times 98.8}{100}\right) + \left(\frac{13 \times 1.2}{100}\right)$$

$$= \frac{1201.2}{100} = 12.012 \checkmark\tfrac{1}{2}$$

$$= 12.012$$

or

$$= 12.01 \checkmark\tfrac{1}{2} \qquad \qquad \text{(2 marks)}$$

   (b) (i) $X^{3+} \longrightarrow 2.8 \checkmark \tfrac{1}{2}$

   (ii) $Y \longrightarrow 2.8.7 \checkmark \tfrac{1}{2}$

   (c) $XY_3 \quad \checkmark 1$

15. (a) T, $\checkmark\tfrac{1}{2}$ has highest number of energy $\checkmark\tfrac{1}{2}$ levels, with one electron in outermost $\checkmark\tfrac{1}{2}$ energy level which is weakly attracted by the nucleus hence readily removed during reaction. $\checkmark\tfrac{1}{2}$ (2 marks)

   (b) S because its outermost energy level has the maximum number of electrons (octet) hence stable/has the outermost energy level filled. $\checkmark 1$

   (c) Q $\checkmark\tfrac{1}{2}$ /Be/Beryllium

   (d) ionic/ electrovalent. $\checkmark\tfrac{1}{2}$

16. (a) Mainly caused by sulphates (SO_4^{2-}) of either Mg^{2+} or Ca^{2+}./dissolved $MgSO_4$, $CaSo_4$ or $Mgcl_2$ and $Cacl_2$. (2 marks)

   (b) Boiling. (1 mark)

17. Add solid Calcium carbonate in small amounts to the hydrochloric acid while stirring and continue until in excess when effervescence stops $\checkmark 1$. Filter the mixture to collect the calcium chloride filtrate $\checkmark 1$. Heat the filtrate to dryness to obtain the solid calcium chloride $\checkmark 1$.

(3 marks)

18. (a) (i) The water molecules absorb heat energy $\checkmark\tfrac{1}{2}$ increasing their kinetic energy $\checkmark\tfrac{1}{2}$ resulting in increased collisions among molecules $\checkmark\tfrac{1}{2}$. (1½ marks)

   (ii) The energy absorbed $\tfrac{1}{2}$ by the water molecules is used to break the intermolecular forces $\checkmark\tfrac{1}{2}$ making water molecules to change to vapour $\checkmark\tfrac{1}{2}$. (1½ marks)

   (b) Separating funnel/ burette/dropping funnel. (1 mark)

19. (a)

 OR
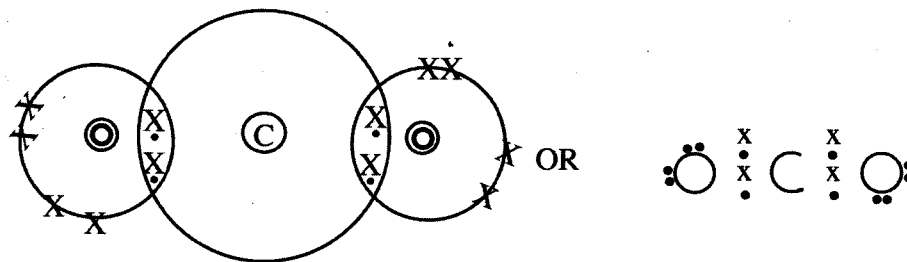
(2 marks)

(b) Graphite has delocalised electrons/mobile electrons. (1 mark)

20. Experiment II √1 because molten potassium bromide √1 contains free/ mobile ions.

(2 marks)

SECTION C: (33 marks)

21. Volume = (140 - 80) cm^3 = 60 cm^3;

$$Density = \frac{mass}{volume} = \frac{144g}{60cm^3};$$

$$= 2.4 \text{ g cm}^{-3}.$$ (3 marks)

22. Weight = mass acceleration due to gravity;

$$Mass = \frac{weight}{acceleration} = \frac{23.5}{10};$$

$$= 2.35 \text{ kg.}$$ (3 marks)

23. (a) The height of the air column at sea level is greater than the height of the air column at the higher altitude. (1 mark)

(b) When the piston is pulled upward the pressure inside the syringe becomes less; than the atmospheric pressure. The atmospheric pressure then pushes the liquid into the syringe. (2 marks)

24. The tiny particles of a gas are free to move to occupy any available space in the container. (1 mark)

25. (a) The degree of hotness (or coldness);

(b) When the bimetallic becomes very hot it bends upward and disconnects the circuit; when the bimetallic cools it straightens and reconnects the circuit. (3 marks)

26. Heated molecules vibrate faster and make the neighbouring molecules to also vibrate faster. (2 marks)

Vibration is relayed to other molecules in the solid hence conduction of heat.

27. 20 x 10 + 100 F = 15 x 40;

100 F = 600 - 200

$$F = \frac{400}{100} = 4 \text{ N};$$ (3 marks)

28.   (a)   Stable;   (1 mark)
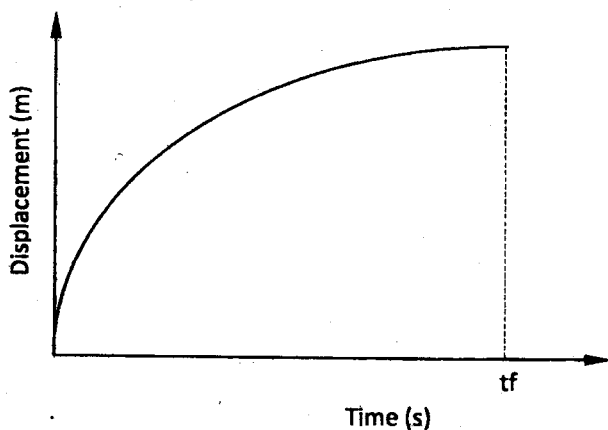
       (b)   When displaced slightly, the glass does not topple the C.O.G is raised/ C.O.G remains within the base.   (1 mark)

29.   Spring constant = slope;

$$= \frac{(5-0)N}{(0.10-0)M} \quad ;\text{substitution}$$

$$= 50 \text{ N/m.} \quad\quad\quad\quad (3 \text{ marks})$$

30.

- curve of decreasing gradient;
- gradient of curve is zero at point tf.

(2 marks)

31.   When the wheelbarrow is in motion the box is also in motion; When the wheelbarrow is stopped suddenly the box continues in its state of motion and hence slides forward.

(2 marks)

32.   (a)
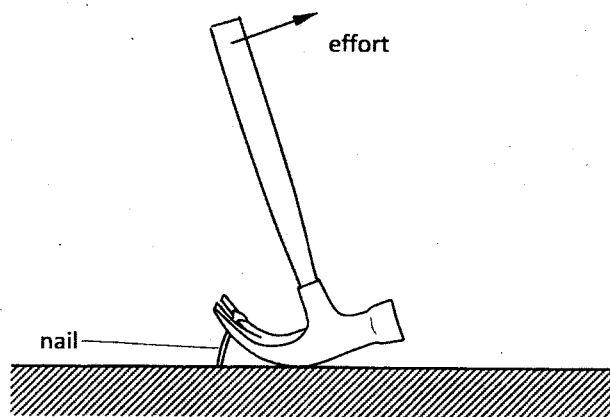
(1 mark)

       (b)   Light energy changes to electrical energy; Electrical energy changes to chemical energy; in the car battery.

                              OR

       Light   Electrical   Chemical   (2 marks)

33.   (a)   Reading decreases;   (1 mark)

       (b)   Block displaces more water; hence more upthrust on the block.   (2 marks)

5.5.2 General Science Paper 2 (237/2)

SECTION A: BIOLOGY

1.   (a)   Q - Animals;
                R - Ammonia/NH4;
                S - Nitrates;   (3 marks)

   (b)   Nitrogen fixation;   (1 mark)

      (c)   Fungi/saprohytic organisms; Bacteria;
                   (any one correct)   (1 mark)

2.   (a)   (i)   Produce ova; produce hormones;
                     (any one correct)   (1 mark)

            (ii)   Temporary storage of sperms;
                   place where sperms develop motility;
                   (any one correct)   (1 mark)

      (b)   The time between fertilization and birth.   (1 mark)

3.   (a)   Growth is quantitative increase in size which is permanent;   (1 mark)
            Development is qualitative changes involving differentiation; to form
            tissues.   (1 mark)

      (b)   To survive adverse conditions;
            To allow dispersal;
            To allow embryo to mature;   (3 marks)

4.   Continuous variation has intermediates for a particular characteristic while
     discontinuous variation has no intermediates;   (1 marks)

      -    Continuous variation is influenced by both genes and environment while
           discontinuous variation is influenced by genes only;   (1 mark)

5.   (a)   (i)   Organisms with favourable variations survive and reproduce while
                   those with unfavourable variations reduce in numbers/become extinct;
                                                        (1 mark)

            (ii)   Industrial melanism/peppered moth;
                   Resistance to drugs/pesticides/antibiotics;
                   (any one correct)   (1 mark)

      (b)   Thick cuticle; secretion of antienzymes/mucus;
                   (any one correct)   (1 mark)

6.   (a)   Thigmotropism/Haptotropism;   (1 mark)

      (b)   Support;exposure to light;   (2 marks)

7. (a) (i)   Myelin sheath;   (1 mark)
        (ii) U-has dendrites which receive impulses from other neurones;   (1 mark)

    (b) Semi-circular canals;   (1 mark)

8. (a) hinge joints; ball and socket joints; gliding joints; pivot joint;
              (first two correct)   (2 marks)

    (b) Packing; mechanical support;
                    (first one correct)   (1 mark)

9. (a) Attachment of zygote to the wall of the uterus;   (1 mark)

    (b) Avoid indiscriminate sex/kissing;
         Avoid sharing of needles and syringes;   (2 marks)

10. Father produces two types of gametes/sperms X and Y;
    Mother produces only one type of gamete/ova X;
    When an ovum is fertilized by the Y sperm, a boy results;
    An ovum fertilized by the X sperm forms a girl;   (4 marks)

SECTION B

CHEMISTRY (33 Marks)

11. (a) A white ring is formed in the glass tube.   (1 mark)

    (b) (i)   The cross (X) should be nearer to the source HCl (g).   (1 mark)
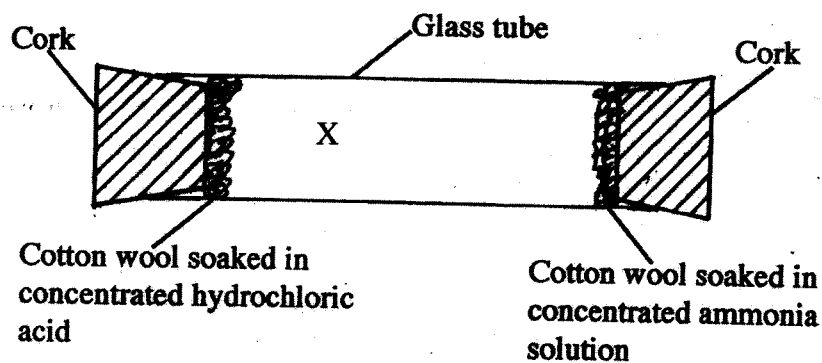
        (ii) Since ammonia (RMM =17) is less dense than HCl gas (RMM = 36.5), it will
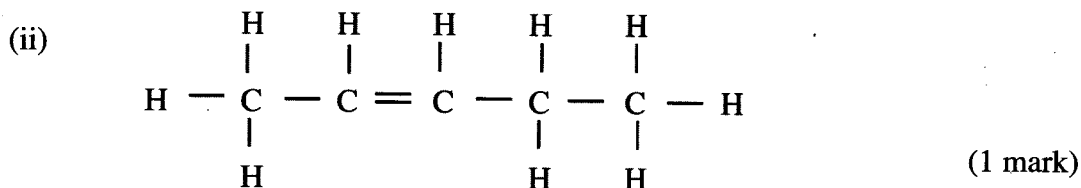   diffuse faster than HCl.   (1 mark)

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12. $CaCO_3\checkmark = 40 + 12 + 48 = 100\checkmark$

$$\frac{0.1 \times 100}{1} = 10g\checkmark \qquad \text{(2 marks)}$$

13. (a) Blue litmus paper will turn to red and then bleached/turns white.   (1 mark)

    (b) Litmus paper turned to red because chlorine is acidic and then decolourised/turned white because the gas is a bleaching agent.   (1 mark)

14. (a) (i) 2 - bromobutane   (1 mark)

    (ii)

    $$H - \underset{\underset{H}{|}}{\overset{\overset{H}{|}}{C}} - \underset{}{\overset{\overset{H}{|}}{C}} = \underset{}{\overset{\overset{H}{|}}{C}} - \underset{\underset{H}{|}}{\overset{\overset{H}{|}}{C}} - \underset{\underset{H}{|}}{\overset{\overset{H}{|}}{C}} - H$$

    (1 mark)

    (b) Place acidified potassium manganate (VII)/bromine water in separate test tubes. Bubble the gases separately through the solutions. With but-1-ene, the two solutions will be decolourised while butane will not decolourise both solutions.   (2 marks)

15. (a) (i) The water comes out inform of a "fountain".   ($\frac{1}{2}$ mark)
       (ii) This is due to the partial vacuum$^{\checkmark\frac{1}{2}}$ that is created in the flask as a lot of the ammonia gas dissolves$^{\checkmark\frac{1}{2}}$ in the first drop of water and the water is forced rapidly up the tube and enters the flask as foutain. $\checkmark\frac{1}{2}$ ($1\frac{1}{2}$ marks)

    (b) Ammonium chloride salt (NH_4Cl)
    Calcium hydroxide ($Ca(OH)_2$)   (1 mark)

       (i) Bubble but-1-ene and butane through separate test tubes containing acidified potassium manganate (vii). Acidified $KMnO_4$ will turn from purple to colourless with butane.
       (ii) Bubble but-1-ene and Butane through separate test tubes containing bromine water. Bromine water is decolourised by but-1-ene but it remains brown with butane.
       But-1-ene burns with sooty luminous flame but butane burns with blue non-luminous flame.
       Bubble but-1-ene and butane through separate test tubes containing acidified potassium dichromate (VI).
       But-1-ene turns acidified potassium dichromate (VI) from orange to green but remains orange with butane.

    (c) • Large quantities of ammonia gas used to make fertilizers
        • Liquid ammonia used as a refrigerant
        • Ammonia solution is used as a solvent in laundry
        • Manufacture of ammonia salts.
        • Ammonia gas used in manufacture of nitric (V) acid.
        • Manufacture of dyes and fibres.
   • Manufacture of fibres.

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- Used to soften hard water.

(Any two correct)   (1 marks)

16.   (a)   the reaction is exothermic.   (1 mark)

$\sqrt{^1}$ $\sqrt{^1}$

(b)   The equilibrium will shift to the right since the volume of product is less than that of reactants.   (2 marks)

(c)
- Purifying petroleum products
- Manufacture of sulphuric (VI) acid
- Bleaching fumigant and as food preservative.   (Any one correct)(1 mark)

17.   (a)   A fuel is a material that releases heat energy when burned.   (1 mark)

(b) $C_{(s)} + O_{2(g)} \longrightarrow CO_{2(g)}$ (1 mark)
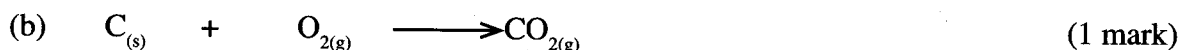
(c)
- High heat content
- Does not lead to deforestation
- Easy to transport
- Cleaner fuel than charcoal.
- Easier to ignite

(d)   Solar, Geothermal, wind, hydroelectricity & tidal waves.   (Any two correct marks)

                                                                 (2 marks)

18.   (a) Na_2SO_4 RFM = $(23 \times 2) + 32 + (16 \times 4)$

$$= 46 + 32 + 64 = 142 \; \sqrt{\tfrac{1}{2}}$$

$$= \frac{142}{142} = 1 \text{ mole } \sqrt{\tfrac{1}{2}}$$

$500 cm^3$ contains 1 mole

$1000 cm^3$ would contain ?

$$\frac{1000}{500} \times 1 \sqrt{\tfrac{1}{2}}$$

$$= 2 M \; \sqrt{\tfrac{1}{2}} \qquad\qquad\qquad\qquad (2 \text{ marks})$$

(b) $M_1 V_1 = M_2 V_2$

$2 \times V_1 = 0.5 \times 1000 \sqrt{\tfrac{1}{2}}$

$$V_1 = \frac{0.5 \times 1000}{2} \sqrt{\tfrac{1}{2}} = 250 \text{ cm}^3 \sqrt{^1} \qquad\qquad (2 \text{ marks})$$

19.   (a)   (i) $Fe_2O_{3(s)} + 3CO_{(g)} \longrightarrow 2Fe_{(1)} + 3CO_{2(g)}$ (1 mark)

       (ii)   Decomposes to give carbon (IV) oxide and calcium oxide which are both used in the process.   (1 mark)

       (iii)   Calcium oxide react with silica to give calcium silicate (slug) which form a liquid layer on top of liquid iron as it flows away.   (2 marks)

(b)   Steel   (1 mark)

PHYSICS (33 Marks)

1. Magnification = $\dfrac{\text{Image height}}{\text{object height}}$; $= 0.5$

   Image height = 0.5 x object height
   = 0.5 x 24 cm;
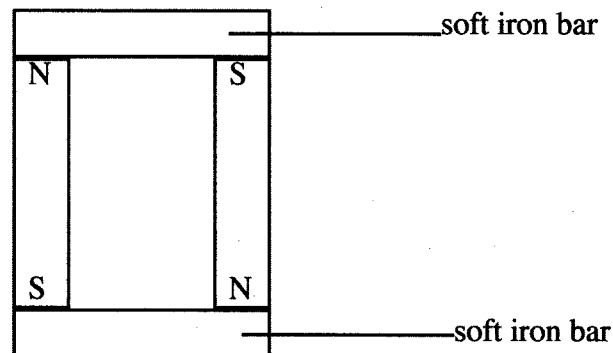   = 12 cm;   (3 marks)

2. The glass rod is positively charged;   (1 mark)

3. (a) carbon powder - to increase conductivity between the carbon rod and the zinc case;   (1 mark)
   (b) manganese IV oxide - a depolarizer;   (1 mark)

4.

                                                                              (1 mark)
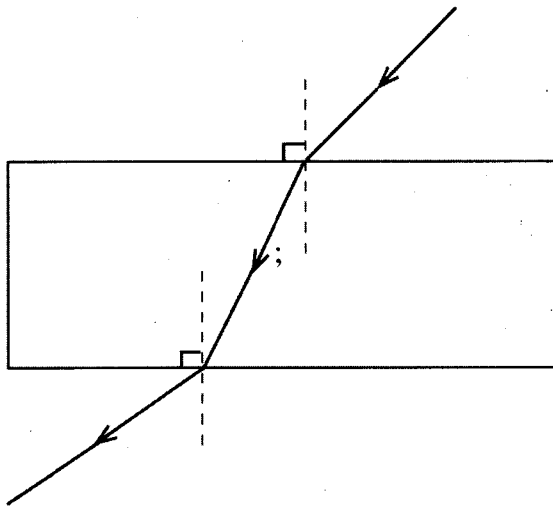
5. - Transverse wave;
   - Movement of the block is perpendicular to the direction of the wave motion;
                                                                              (2 marks)

6. A vacuum was created by pumping the air out of the jar;
   Sound requires a material medium for propagation;   (2 marks)

7. (a) IV;
   (b) 0.3 A;   (2 marks)

8. Heat will increase;
   Reducing resistance increases the current;   (2 marks)
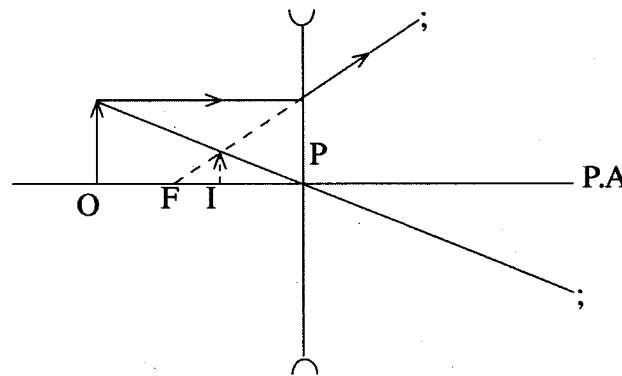
9.

Refracted Ray Bending Towards Normal;
Emerging ray bending away from normal;

(2 marks)

10.

Ray from O parallel to PA then from lens;
Ray from O through pole P;
Image erect virtual at intersection of they rays;   (3 marks)

11.   Periodic time = 0.4 seconds;   (1 mark)

12.   (a)   Stepping up reduces current of transmission;
              hence reducing heat loss;   (2 marks)
       (b)   To isolate all parts which are connected to the live wire;
              When there is excess current.   (1 marks)

13.   (a)   Anode;
       (b)   To head the cathode;
       (c)   The screen glows;   (3 marks)

14.   (a)   Increase the anode voltage;
       (b)   X-rays have no charge;   (2 marks)

15.   Radioactive emission enters the tube and causes ionization; of the gas inside the tube.
       Opposite charges are attracted to opposite electrodes creating a current;   (2 marks)

16.   By doping; with Group 5 element;   (2 marks)

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