CLASS X (2019-20)
SCIENCE (CODE 086)
SAMPLE PAPER-1

Time : 3 Hours   **Maximum Marks : 80**

General Instructions :

(i)   The question paper comprises of three sections-A, B and C. Attempt all the sections.

(ii) All questions are compulsory.

(iii) Internal choice is given in each sections.

(iv) All questions in Section A are one-mark questions comprising MCQ, VSA type and assertion-reason type questions. They are to be answered in one word or in one sentence.

(v)   All questions in Section B are three-mark, short-answer type questions. These are to be answered in about 50-60 words each.

(vi) All questions in Section C are five-mark, long-answer type questions. These are to be answered in about 80-90 words each.

(vii) This question paper consists of a total of 30 questions.

Section A

1. Name a device that helps to maintain a potential difference across a conductor. [1]

Ans :

Electric cell or electric battery.

2. What change in colour is observed when white silver chloride is left exposed to sunlight? What type of chemical reaction is this? [1]

Ans :

The white solid turns grey.
Type of chemical reaction is photo-decomposition.

3. **Answer question numbers 3.1–3.4 on the basis of your understanding of the following paragraph and the related studied concepts.**

The ciliary muscles of eye control the curvature of the lens in the eye and hence can alter the effective focal length of the system. When the muscles are fully relaxed, the focal length is maximum. When the muscles are strained the curvature of lens increases (that means radius of curvature decreases) and focal length decreases. For a clear vision the image must be on retina. The image distance is therefore fixed for clear vision and it equals the distance of retina from eye-lens. It is about 2.5 cm for a grown-up person.

A person can theoretically have clear vision of objects situated at any large distance from the eye. The smallest distance at which a person can clearly see is related to minimum possible focal length, The ciliary muscles are most strained in this position. For an average grown-up person minimum distance of object should be around 25 cm.

A person suffering for eye defects uses spectacles (Eye glass). The function of lens of spectacles is to form the image of the objects within the range in which person can see clearly. The image of the spectacle-lens becomes object for eye-lens and whose image is formed on retina.

The number of spectacle-lens used for the remedy of eye defect is decided by the power of the lens required and the number of spectacle-lens is equal to the numerical value of the power of lens with sign. For example power of lens required is +3D (converging lens of focal length 100/3 cm) then number of lens will be +3.
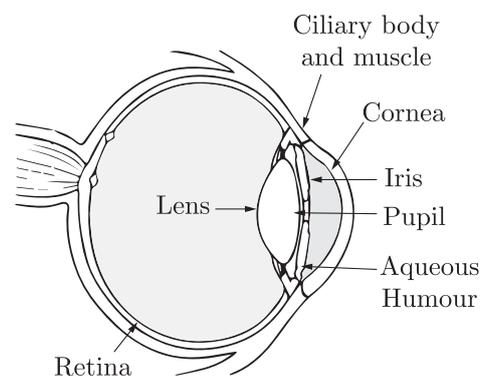
For all the calculations required you can use the lens formula and lens maker's formula. Assume that the eye lens is equiconvex lens. Neglect the distance between eye lens and the spectacle lens.

3.1 What do you mean by the ciliary muscles? [1]

Ans : The muscles which are used to the change in the focal length of eye lens by changing radii of curvature is known ciliary muscles.

3.2 What is the minimum focal length of eye lens of a normal person? [1]

Ans : 25/11 cm

3.3 What is the maximum focal length of eye lens of normal person? [1]

Ans : 2.5 cm

3.4 A near-sighted man can clearly see object only up-to a distance of 100 cm and not beyond this. What is the number of the spectacles lens necessary for the remedy of this defect? [1]

Ans :

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

Here $v = 2.5$ (Distance of retina as positions of image is fixed)

$$u = -x$$

$$\frac{1}{f} = \frac{1}{2.5} + \frac{1}{x}$$

For $f_{\min} : x$ is minimum,

$$\frac{1}{f_{\min}} = \frac{1}{2.5} + \frac{1}{25}$$

For $f_{\max} : x$ is miximum,

$$\frac{1}{f_{\max}} = \frac{1}{2.5} + \frac{1}{\infty}$$

For near sighted man lens should make the image of the object within 100 cm range

For lens
$$u = -\infty$$
$$v = -100$$
$$\frac{1}{f_{\text{lens}}} = \frac{1}{-100} - \frac{1}{-\infty}$$

4. Question numbers 4.1–4.4 are based on the two table given below. Study these tables related to blood pressure level and answer the question that follow :

Table-A

BLOOD PRESSURE CATEGORY	SYSTOLIC mm Hg (Upper number)	DIASTOLIC mm Hg (Lower number)
Normal	120	80
Elevated	120-129	Less than 80
High Blood Pressure (Hypertension) Stage 1	130-139	80-90
High Blood Pressure (Hypertension) Stage 2	140 or higher	90 or higher
Hypertensive crisis (consult your doctor immediately)	Higher than 180	Higher than 120

Table-B

Time of Measurement	Blood Pressure	
	Patient−X	Patient−Y
Morning	75−115	85−125
Afternoon	79−122	80−120
Evening	82−132	75−110

4.1 In the table B, at which time patent−Y have ideal normal blood pressure? [1]

Ans : Afternoon (80-120)

4.2 Identify the patient, which have hypertension stage-1 blood pressure? [1]

Ans : Patient $\times$ (82-132) Evening

4.3 Which Diet is the best for high blood pressure patient? [1]
(a) Grain and fruits
(b) High fat dairy products
(c) Take large amount of sodium in diet
(d) All of the above

Ans : (a) Grain and fruits

4.4 The ideal blood pressure measurement is [1]
(a) 80-120 mm Hg (b) 85-125 mm Hg
(c) 90-150 mm Hg (d) 95-100 mm Hg

Ans : (a) 80-120 mm Hg

5. The length of a wire is doubled. By what factor does the resistance change [1]
(a) 4 time as large (b) twice as large
(c) unchanged (d) half as large

Ans : (a) 4 time as large

or

If a student while studying the dependence of current on the potential difference keeps the circuit closed for a long time to measure the current and potential difference, then
(a) ammeter's zero error will change
(b) ammeter will give more reading
(c) voltmeter will show constantly higher readings
(d) resistor will get heated up and its value will change

Ans : (d) resistor will get heated up and its value will change

6. A small electric lamp is placed at the focus of a convex lens. When the lamp is switched on, the lens will produce : [1]
(a) converging beam of light
(b) parallel beam of light
(c) diverging beam of light
(d) diffused beam of light

Ans : (b) parallel beam of light

7. Before setting up an experiment to show that seeds release CO_2 during respiration, the seeds should be : [1]
(a) dried completely
(b) boiled to make then soft
(c) soaked in vinegar
(d) kept moist till they germinate

Ans : (d) kept moist till they germinate

8. A well-stained leaf peel mount, when observed under the high power of a microscope, shows nuclei in : [1]
(a) guard cells only
(b) epidermal cells only
(c) guard cells and epidermal cells
(d) guard cells, epidermal cells and stomata

Ans : (c) guard cells and epidermal cells

or

During germination of seed, water enter in seeds through
(a) hilum (b) micropyle
(c) raphe (d) cotyledon

Ans : (b) micropyle

9. $Fe_2O_3 + 2Al \longrightarrow Al_2O_3 + 2Fe$ [1]

The above reaction is an example of a :
(a) combination reaction
(b) double displacement reaction

(c) decomposition reaction

(d) displacement reaction

Ans : (d) displacement reaction

10. Ethanoic acid was added to sodium bicarbonate solution and the gas evolved was tested with a burning splinter Which one of the following four observations is correct? [1]
   (a) The gas burns with a pop sound and the flame gets extinguished
   (b) The gas does not burn but the splinter burns with a pop sound
   (c) The flame extinguishes and the gas does not burn
   (d) The gas burns with a blue flame and the splinter burns brightly

   Ans : (c) The flame extinguishes and the gas does not burn

11. A colourless sample was tested with a strip of pH paper. The colour of the strip changed to green. The sample should be : [1]
   (a) tap water   (b) distilled water
   (c) sodium hydroxide   (d) lemon juice

   Ans : (b) distilled water

12. Beakers A, B and C contain zinc sulphate, silver nitrate and iron (II) sulphate solutions respectively. Copper pieces are added to each beaker. Blue colour will appear in case of [1]
   (a) beaker A (b) beaker B
   (c) beaker C (d) all the beakers

   Ans : (b) beaker B

                              or

   A student puts one big iron nail each in four test tubes containing solutions of zinc sulphate, aluminium sulphate, copper sulphate and iron sulphate. A reddish brown coating was observed only on the surface of iron nail which was put in the solution of
   (a) zinc sulphate   (b) iron sulphate
   (c) copper sulphate   (d) aluminium sulphate

   Ans : (c) copper sulphate

   For question numbers 13 and 14, two statements are given-one labelled Assertion (A) and the other labelled Reason (R). Select the correct answer to these questions from the codes (a), (b), (c)and (d) as given below :

   (a) Both A and R are true and R is correct explanation of the assertion.
   (b) Both A and R are true but R is not the correct explanation of the assertion.
   (c) A is true but R is false.
   (d) A is false but R is true.

13. **Assertion** : Respiration in living beings is called exothermic reaction.
   Reason : Respiration in living beings involves with absorption of heat energy. [1]
   Ans : (c) A is true but R is false.

14. **Assertion**: Copper is used to make hot water tanks and not steel.
   Reason : Copper is a better conductor of heat than steel and it is fairly resistant to corrosion than steel. [1]
   Ans : (a) Both A and R are true and R is correct explanation of the assertion.

Section B

15. How do guard cells regulate opening and closing of stomatal pores? [3]
   Ans :

   The opening and closing of stomatal pore is a function of guard cells. Stomata act as turgor operated valves. The guard cells are thicker on the inner side and thinner on the outer side. The guard cells swell when water flow into them from the surrounding epidermal cells. They get curved out due to thick inner walls and produce a pore in between. Similarly, the pore closes when guard cells lose water to their surrounding cells and shrink back to their original position.

16. 2 g of ferrous sulphate crystals were heated in a hard glass test tube and observations recorded.
   a. What type of odour is observed on heating ferrous sulphate crystals?
   b. Name the products obtained on heating ferrous sulphate crystals.
   c. What type of reaction is taking place.

   Ans :

   a. As of burning sulphur.
   b. Ferric oxide, sulphur dioxide, sulphur trioxide.
   c. Decomposition reaction.

                              or

   a. Why metals are not found in their free state generally?
   b. If a strip of aluminium with scratched clean surface is dipped into an aqueous solution of copper sulphate for little time, surface of the strip becomes brownish. What is the reason for this? Write the balanced chemical equation for the reaction. [3]

   Ans :

   a. Most of the metals are found in the form of their compounds, i.e., in the combined state. It is because, their position is above hydrogen in the chemical reactivity series and hence, readily react with air, water, carbon dioxide, etc. They are found in the form of their sulphides, carbonates or oxides.
   b. When a strip of aluminium is dipped into an aqueous solution of copper sulphate it will displace copper and forms aluminium sulphate. Copper will deposit on the surface of aluminium strip so that it will become brownish.

   $$3CuSO_4(aq) + 2Al(s) \longrightarrow Al_2(SO_4)_3(aq) + 3Cu$$
   Copper sulphate   Aluminium   Aluminium sulphate   Copper
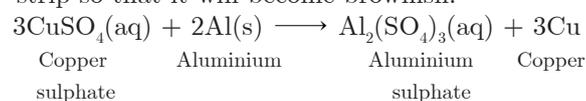
17. Write the chemical formula for washing soda. How may it be obtained from baking soda? Name an industrial use of washing soda other than washing clothes. [3]
   **Ans :**

a. The chemical formula of washing soda is $Na_2CO_3 \cdot 10H_2O$.

b. Baking soda ($NaHCO_3$) is strongly heated to form soda ash.

$$2NaHCO_3(s) \xrightarrow{heat} Na_2CO_3 + H_2O(l) + CO_2(g)$$

The soda ash is dissolved in boiling hot water so as to obtain its saturated solution. The saturated solution so obtained is allowed to cool, when washing soda crystals separate out.

$$Na_2CO_3 + 10H_2O \longrightarrow Na_2CO_3 \cdot 10H_2O$$

c. Washing soda is used in the manufacture of glass.

18. Study the diagram given below:
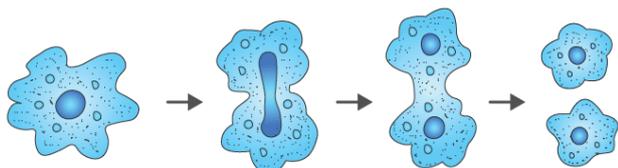
a. Identify the process.
b. Which organism uses the above method of reproduction?
c. How is the above method different from the process of fragmentation? [3]

Ans :

a. Binary fission.
b. Amoeba.
c. Binary fission occurs in unicellular organisms only. In fragmentation the body of a simple multicellular organism breaks down into many 'fragments'. All cells undergo division and the organism develops from each fragment

or

How do organisms, whether reproduced asexually or sexually maintain a constant chromosome number through several generations? Explain with the help of suitable example.

Ans :

In asexual reproduction of organisms, only mitotic divisions are involved and thus the chromosome number remains the same. During asexual reproduction the DNA in the chromosomes of the cells involved are copied and then equally divided among the two daughter cells formed. So, chromosome number remains unchanged. Thus, it maintains constant chromosome number.

In sexual reproduction, organisms produce gametes through a meiosis division - reduction al division, in which the original number of chromosomes becomes half. These two gametes combine to form the zygote and thus the original number of chromosomes is restored. During sexual reproduction germ cells with only half the number of chromosomes are formed. When these germ cells from two individuals combine to form a new individual, the original number of chromosome is restored. Example : In humans, the parents father and mother both have 46 or 23 pairs of chromosomes. In the gametes - the sperm and egg both have half the number of chromosomes i.e., 23 when the sperm and the egg fuse, the zygote has 46 or 23 pairs of chromosomes.

So, the chromosome number remains constant.

19. Out of the elements H(1), Be(4), Na(11) and Mg(12).
a. Write the pair of elements having similar chemical properties.
b. State the group number of each pair,
c. Name one another element belonging to each of these groups. [3]

Ans :

a. Be(4) and Mg(12) have similar chemical properties. H(1) and Na(11) have similar chemical properties.
b. Be and Mg belong to group 2, H and Na belong to group 1.
c. K belongs to group 1 and Ca belongs to group 2

20. What are covalent compounds? Why are they different from ionic compounds? List their three characteristic properties. [3]

Ans :

Covalent compounds are those compounds which are formed by sharing of electrons between two atoms and thus containing covalent bonds.

These compounds are different from ionic compounds because the ionic compounds are formed by the transference of electrons while covalent compounds by sharing of electrons.

Characteristics of covalent compounds :
a. They have generally low melting and boiling points.
b. They are generally insoluble or less soluble in water but soluble in organic solvents like ethanol.
c. They do not conduct electricity.

21. Why does the sun appear reddish early in the morning? Will this phenomenon be observed by an observer on the moon? Justify your answer with a reason. [3]

Ans :

Early in the morning, the sun is near the horizon, sunlight reaches us after covering a longer distance through thick layers of atmosphere. So the most of the blue light and other light of shorter wavelengths are scattered away by the particles in the atmosphere. The light that reaches us is of longer wavelengths such as red light thus giving a reddish appearance.

This phenomenon will not be observed by an observer on the moon because of the absence of atmosphere on the moon.

22. Suggest three contraceptive methods to control the size of human population which is essential for the health and prosperity of a country. State the basic principle involved in each. [3]

Ans :

Three contraceptive methods are following :
a. **Barrier method or mechanical method :** Condom or diaphragm is used to prevent the meeting of sperms and ova.
b. **Chemical method :** Oral pills change the hormonal balance of the female partner so that the eggs are not released.
c. **Surgical method :** It is used to block the vas deferens in males or the fallopian tube (oviduct) in females, to prevent the transfer of sperms or eggs and hence no fertilization takes place.

23. Draw the following diagram, in which a ray of light is incident on a concave convex mirror, on your answer sheet. Show the path of this ray, after reflection, in each case. [3]

(i) (ii) (iii)

Ans :

(i) (ii) (iii)
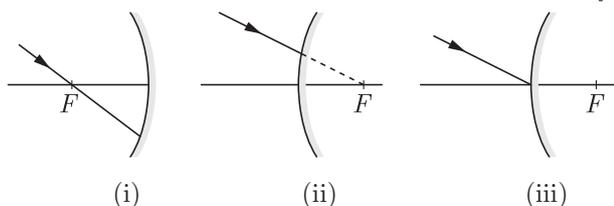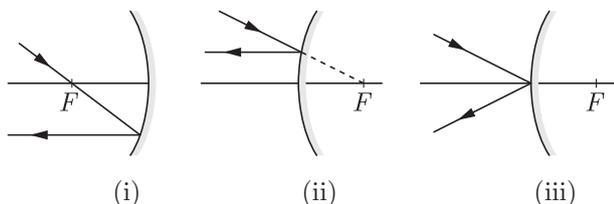
24. a. State the function of 'a fuse' in a circuit. How is it connected in the domestic circuit?
b. An electric fuse of rating 3A is connected in a circuit in which an electric iron of power 1 kW is connected which operates at 220 V What would happen? Explain. [3]

Ans :

a. It prevents damage to the appliance and the circuit due to overloading.
It is connected in series with the household circuit.

b. $$I = \frac{P}{V} = \frac{1\,kW}{220\,V} = \frac{1000\,W}{220\,V} = 4.55\,A$$

The electric current flowing/required by the electric iron is more than the current that can flow through the fuse without its melting.
Hence, the fuse wire will melt. The circuit will break and the electric iron will not work.

or

a. List the factors on which the resistance of a conductor in the shape of a wire depends.
b. Why are metals good conductors of electricity whereas glass is a bad conductor of electricity? Give reason.
c. Why are alloys commonly used in electrical heating devices? Give reason.

Ans :

a. Factors on which resistance of a wire depends:
(i) Resistance is directly proportional to length.
(ii) Resistance is inversely proportional to area of cross-section.

$$R \propto l,\ R \propto \frac{1}{A}$$

$$R \propto \frac{l}{A}\ or\ R = \rho \frac{l}{A}$$

b. Metal are good conductor due to having large number of free electrons and their low resistivity.
Glass is a bad conductor because it has no free electrons and its resistivity is higher.

c. Alloys are commonly used in electrical heating devices due to their high resistivity and high melting point which produces more heat.

Section C

25. a. Give a chemical test to distinguish between saturated and unsaturated hydrocarbon.
b. Name the products formed when ethane burns in air. Write the balanced chemical equation for the reaction showing the types of energies liberated.
c. Why is reaction between methane and chlorine in the presence of sunlight considered a substitution reaction? [5]

Ans :

a. **Chemical test to distinguish saturated and unsaturated hydrocarbons :** Pass the vapours of the samples of saturated and unsaturated hydrocarbons into bromine water taken in two separate test tubes. The one which discharges the colour of bromine water is that of unsaturated hydrocarbon and rest of the other represents saturated hydrocarbon.

b. On burning ethane in air, the products obtained are carbon dioxide and water, with heat and light.
$$2C_2H_6(g) + 7O_2(g) \longrightarrow 4CO_2(g) + 6H_2O(l)$$
$$+ Heat + Light$$

c. It is considered a substitution reaction because the hydrogen atoms of methane (CH_4) are replaced by chlorine atoms one by one successively.

or

Account for the following.
a. Dry HCl gas does not change the colour of dry blue litmus paper
b. Antacid tablets are used by a person suffering from stomach pain.
c. Toothpaste is used for cleaning teeth.

Ans :

a. Dry HCl gas on coming in contact with dry blue litmus paper does not produce H^+ ions and hence, the colour of litmus paper does not change.

b. Antacid tablets generally consists of magnesium hydroxide and aluminium hydroxide, which are mild bases. They react chemically with the hydrochloric acid produced in stomach and neutralise it.

c. All toothpaste contain some substances that are basic in nature and hence neutralise acids. So the best way to avoid cavities is to brush your teeth with some toothpaste.

26. Translate the following statements into chemical equations and then balance them.
a. Hydrogen gas combines with nitrogen gas to form ammonia gas.
b. Hydrogen sulphide gas burns in air to give water and sulphur dioxide gas.
c. Barium chloride reacts with aluminium sulphate to give aluminium chloride and a precipitate of barium sulphate.
d. Potassium metal reacts with water to give potassium hydroxide and hydrogen gas.
e. Zinc metal reacts with dilute sulphuric acid to give zinc sulphate solution and hydrogen gas [5]

Ans :

a. $$H_2(g) + N_2(g) \longrightarrow NH_3(g)\ \ Skeletal\ equation$$
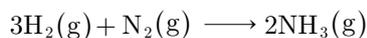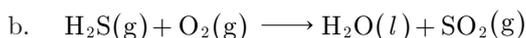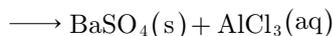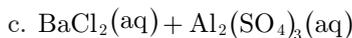
$$3H_2(g) + N_2(g) \longrightarrow 2NH_3(g)$$

<div align="right">Balanced equation</div>

b. $H_2S(g) + O_2(g) \longrightarrow H_2O(l) + SO_2(g)$

<div align="right">Skeletal equation</div>

$$2H_2S(s) + 3O_2(g) \longrightarrow 2H_2O(l) + 2SO_2(g)$$

<div align="right">Balanced equation</div>

c. $BaCl_2(aq) + Al_2(SO_4)_3(aq)$

$$\longrightarrow BaSO_4(s) + AlCl_3(aq)$$

<div align="right">Skeletal equation</div>

$$3BaCl_2(aq) + Al_2(SO_4)_3(aq)$$
$$\longrightarrow 3BaSO_4(s) + 2AlCl_3(aq)$$

<div align="right">Balanced equation</div>

d. $K(s) + H_2O(l) \longrightarrow KOH(aq) + H_2(g)$

<div align="right">Skeletal equation</div>

$$2K(s) + 2H_2O(l) \longrightarrow 2KOH(aq) + H_2(g)$$

<div align="right">Balanced equation.</div>

e. $Zn(s) + H_2SO_4(aq) \longrightarrow ZnSO_4(aq) + H_2(g)$
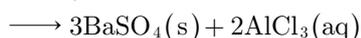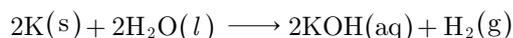
<div align="right">Balanced equation.</div>

27. a. Draw a neat diagram of an excretory unit of a human kidney and label the following parts.
(i) Bowman's capsule
(ii) Renal artery
(iii) Glomerulus
(iv) Collecting duct
b. Give one advantage of having a large number of these highly coiled structures in our kidneys.
c. Mention any two substances which are selectively reabsorbed as the filtrate flows along the tubular part of this unit.   [5]

Ans :

a.
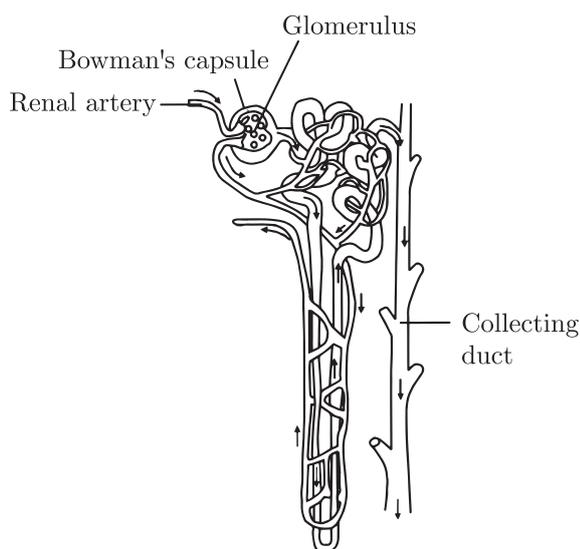
b. These help in increasing the surface area for filtration and proper re-absorption of useful substances.
c. Glucose, amino acids, salts, water (any two).

28. a. Differentiate between pollen grain and ovule.
b. State in brief functions of the following parts of the human female reproductive system.
(i) Ovary

(ii) Fallopian Tube
(iii) Uterus   [5]

Ans :

a.

	Pollen grain	**Ovule**
1.	It is male reproductive structure.	It is female reproductive structure.
2.	Pollen grain is a structure contained in the pollen sac.	Ovule is a structure contained in the ovary.
3.	Inside the pollen grain the male gamete is present.	Inside the ovule, embryo sac containing the female gamete (or egg) is present.

b.

(i) **Ovary :** Ovary produces ova or eggs. Ovary also secrete a hormone oestrogen which helps in the development of secondary sexual characters like breast development.
(ii) **Fallopian tube :** Fallopian tube conveys the egg from the ovary to the uterus and provides the appropriate environment for its fertilisation.
(iii) **Uterus :** After fertilisation, the embryo develops in uterus.

<div align="center">or</div>

a. Differentiate between germination and fertilisation.
b. State in brief the functions of the following parts of the human male reproductive system :
(i) Scrotum
(ii) Testes
(iii) Vas deferens

Ans :

a.

	Fertilisation	**Germination**
1.	It is the fusion of male and female gametes.	In it the food reserves present in a seed are broken down and the embryo start to grow.
2.	It occurs in plants and animals of various types.	It occurs only in seed plants.
3.	It actually brings about fusion of gametes.	During it, seeds convert into seedling.
4.	Fertilisation occurs only after pollination when the pollen grain has germinated and sent the male gametes to the ovule.	It begins when a seed starts to absorb water.

b.

(i) **Scrotum :** It contains and supports the testes. It is situated outside the body cavity and allow sperm to develop at the optimum temperature, which is slightly lower than body temperature.
(ii) **Testes :** The formation of male germ cells or

sperms takes place in it. Leydig cells of testes secrete hormone testosterone which brings about changes in appearance seen in boys at the time of puberty.

(iii) **Vas deferens :** It ascends into the abdomen, passes over the urinary bladder and receives duct from the seminal vesicles behind the urinary bladder to form the ejaculatory duct.

29. A current of 1 ampere flows in a series circuit containing an electric lamp and a conductor of $5\,\Omega$ when connected to a 10 V battery. Calculate the resistance of the electric lamp. Now if a resistance of 10Ω is connected in parallel with this series combination, what change (if any) in current flowing through $5\,\Omega$ conductor and potential difference across the lamp will take place? Give reason. Draw circuit diagram. [5]

Ans :

The potential difference across the lamp
$$= 10 - 1 \times 5 = 5\,\text{V}$$
Resistance of the electric lamp,
$$R = \frac{V}{I} = \frac{5}{1} = 5\,\Omega$$
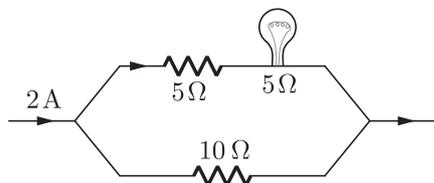
The equivalent resistance of the series combination of 5Ω resistance and 5Ω lamp $= 5\Omega + 5\Omega = 10\Omega$
When a 10Ω resistance is connected in parallel to this combination. The equivalent resistance of the circuit becomes
$$= \frac{10 \times 10}{10 + 10} = \frac{100}{20}$$
$$= 5\,\Omega$$
The current in the circuit $= \frac{10}{5} = 2\,\text{A}$

The current in 5Ω resistance $= 1\,\text{A}$
(current equally distributed).
No change in current flowing through 5Ω.
Potential difference across the lamp will also remain same.

30. a Define the following terms in the context of spherical mirrors:
    (i) Pole
    (ii) Centre of curvature
    (iii) Principal axis
    (iv) Principal focus
    b Draw ray diagrams to show the principal focus of a :
    (i) Concave mirror
    (ii) Convex mirror
    c Consider the following diagram in which M is a mirror and P is an object and Q is its magnified image formed by the mirror
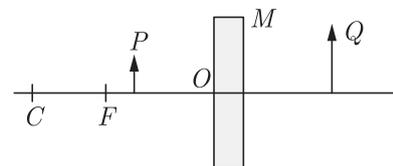

State the type of the mirror M and one characteristic property of the image Q. [5]

Ans :

a.
  (i) **Pole :** The centre of the reflecting surface of the mirror is called pole.
  (ii) **Centre of curvature :** The centre of the hollow sphere of which the reflecting surface of mirror forms a part is called centre of curvature.
  (iii) **Principal axis :** The imaginary line passing through the pole and the centre of curvature of a spherical mirror is called principal axis.
  (iv) **Principal focus :** When incident rays parallel to principal axis, after reflection, either converge to or appear to diverge from a fixed point on the principal axis called principal focus.

b. (i) Concave mirror
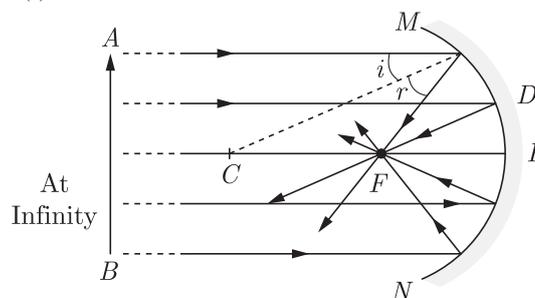
(ii) Convex mirror
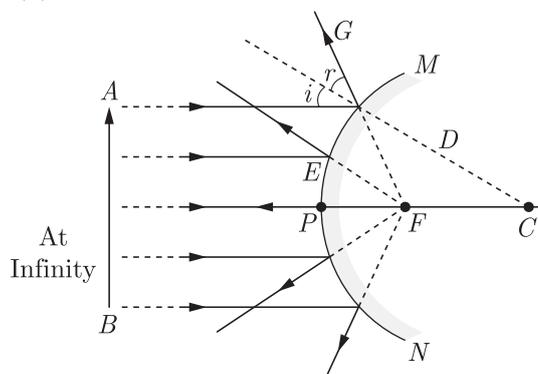
c. Concave mirror
   Image formed is virtual and erect.

or

a. Draw a ray diagram to show the formation of image by a convex lens when an object is placed in front of the lens between its optical centre and principal focus.
b. In the above ray diagram mark the object-distance (u) and the image-distance (v) with their proper signs (+ve or −ve as per the new Cartesian sign convention) and state how these distances are related to the focal length (f) of the convex lens in the case.
c. Find the power of a convex lens which forms a real, and inverted image of magnification −1 of an object placed at a distance of 20 cm from its

optical centre.

Ans :

a.
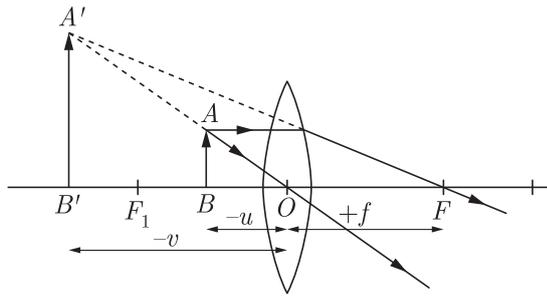
b. Relation between object-distance (u), image-distance (v) and focal length (f):

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

c. Here, $m = -1;\ u = -20$ cm; $v = ?$ $f = ?$

$$m = \frac{v}{u} \Rightarrow -1 = \frac{v}{-20} \ \therefore\ v = 20 \text{ cm}$$

$$\frac{1}{f} = \frac{1}{v} - \frac{1}{u} = \frac{1}{20} - \frac{1}{-20}$$

$$= \frac{1}{20} + \frac{1}{20} = \frac{2}{20} = \frac{1}{10}$$

$$f = 10 \text{ cm}$$

Thus, Power of the lens, $P = \dfrac{100}{f\,(\text{in cm})}$

$$= \frac{100}{10} + 10 \text{ D}$$

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