CLASS X (2019-20)
SCIENCE (CODE 086)
SAMPLE PAPER-7

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. State your observations when a clean magnesium strip is held in a Bunsen flame for sometime. [1]

Ans :

i. Magnesium ribbon catches fire and burns with a dazzling white flame.
ii. A white powdery mass is formed as a product.

2. In the modern periodic table which are the metals amongst the first ten metals. [1]

Ans :

Lithium (Li) and beryllium (Be) are metals.

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

While dealing with the reflection of light by spherical mirrors, we shall follow a set of sign conventions called the New Cartesian Sign Convention. In this convention, the pole (P) of the mirror is taken as the origin. The principal axis of the mirror is take as the x-axis of the coordinate system. In a spherical mirror, the distance of the object from its pole is called the object distance (u). The distance of the image from the pole of the mirror is called the image distance (v). Magnification produced by a spherical mirror gives the relative extent to which the image of an object is magnified with respect to the object size. It is expressed as the ratio of the height of the image to the height of the object. It is usually represented by the letter (m).
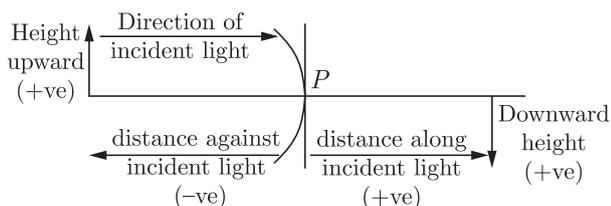
3.1 How can you calculate the magnification of a spherical mirror? [1]

Ans : If h is the height of the object and h' is the height of the image, then the magnification m produced by a spherical mirror is given by

$m =$ Height of the image (h')/Height of the object (h)

$$m = \frac{h'}{h}$$

3.2 What does a negative sign in the value of magnification indicates? [1]

Ans : A negative sign in the value of the magnification indicates that the image is real.

3.3 Find the focal length of a convex mirror whose radius of curvature is 32 cm. [1]

Ans : Radius of curvature (R) of a convex mirror $= 32$ cm.

Radius of curvature $(R) = 2 \times$ Focal length (f).

So, Focal length, $(f) = \frac{R}{2} = \frac{32}{2}$

$$f = 16$$

The focal length of a convex mirror will be 16 cm.

3.4 Why does the height of the object is taken to be positive? [1]

Ans : As the object is usually placed above the principal axis so the height of the object is taken to be positive.

4. Question number 4.1-4.4 are based on the two tables given below. Study this table and answer the questions that follows.

Table A : Normal Blood Pressure		
Systolic Pressure (mm Hg)	**Diastolic Pressure (mm Hg)**	**Pressure Range**
130	85	High Normal Blood Pressure
120	80	Normal Blood Pressure
110	75	Low Normal Blood Pressure

Table B : Approx. Ideal BP According to Age Chart		
Age	**Female**	**Male**
10	111/73	112/73

Table B : Approx. Ideal BP According to Age Chart		
Age	Female	Male
13	117/75	117/76
14	120/75	119/77
15	120/76	120/78
19-24	120/79	120/79
25-29	120/80	121/80
30-35	122/81	123/82
40-45	124/83	125/83
50-55	129/85	128/85
60+	134/84	135/88

4.1 Refer to Table B showing the blood pressure of male and female. Infer the disease which can be diagnosed in a boy of 14 years who have same blood pressure as a 60 year old man. [1]

Ans : Hypertension

4.2 Identify the hormone whose level in the blood is responsible for raise in blood pressure in certain situations. [1]

Ans : Adrenaline

4.3 Which of the following trend in blood pressure range is seen with advancement of age from teenage to old age? [1]
(a) Increase
(b) Remains same
(c) Decrease
(d) Fluctuates

Ans : (a) Increase

4.4 Which of the following is incorrect in case of high blood pressure? [1]
(a) Increased resistance to blood flow.
(b) Decreased resistance to blood flow
(c) Rupture of an artery
(d) Internal bleeding.

**Ans :** (b) Decreased resistance to blood flow

5. Your friend is performing an experiment on determining the focal length of the given convex lens by obtaining the image of a distant object on the screen. Out of the following clearly visible objects which one you suggest to use as the object for his experiment to get best results. [1]
(a) A lighted candle kept at the other end of the laboratory table
(b) Any distant tree
(c) Window grill in the laboratory
(d) A well illuminated distant tree

Ans : (d) A well illuminated distant tree

or

Which statement best describes the property of light waves illustrated in the diagram below? [1]
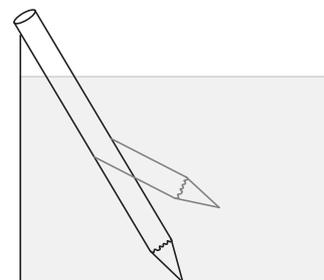
(a) some materials absorb light waves.
(b) Some materials refracted by some materials.
(c) Light waves are refracted by some materials.
(d) Light waves are emitted by some materials.

Ans : (c) Light waves are refracted by some materials.

6. A student connects a circuit to study Ohm's law using a resistor of 3 Ohms and a battery eliminator of 6 V. Which of the ammeter should be chosen to read the value of current for this circuit, if the ammeters available in the laboratory have the following ranges? [1]
(a) 0 – 200 mA
(b) 0 – 100 mA
(c) 0 – 1A
(d) 0 – 2A

Ans : (d) 0 – 2A

7. When sodium sulphate solution and barium chloride solution are mixed together, the colour of precipitate formed is : [1]
(a) yellow
(b) green
(c) white
(d) red

Ans : (c) white

8. A colourless solution is kept in a test tube. This solution could be : [1]
(a) ferrous sulphate
(b) copper sulphate
(c) aluminium sulphate
(d) potassium permanganate

Ans : (c) aluminium sulphate

or

The function of KOH in the experimental set-up to show that CO_2 is released during respiration is [1]
(a) to enhance respiration
(b) to release oxygen for respiration
(c) to absorb carbon dioxide released by germinating seeds
(d) to remove water vapour from the flask

Ans : (c) to absorb carbon dioxide released by germinating seeds

9. A student observed that when he applied to soap to cloth made wet with a given sample of water, scum's were formed. He discusses his observation with his four friends. Their opinion is that soap forms a scum in : [1]
(A) hard water
(B) soft water
(C) distilled water
(D) potable water
Correct opinion is of :

(a) A   (b) B

(c) C   (d) D

Ans : (a) A

10. In the binary fission method of multiplication : [1]
    (a) only one parent is involved
    (b) no gametes are formed
    (c) fertilisation does not take place
    (d) all the above statements are true

    Ans : (d) all the above statements are true

11. To prepare a good temporary mount of leaf peel showing many stomata, a student should take the peel from the [1]
    (a) petiole
    (b) midrib
    (c) lower surface of the leaf
    (d) upper surface of the leaf

    Ans : (c) lower surface of the leaf

12. Which is the first enzyme to mix with food in the digestive tract? [1]
    (a) Pepsin   (b) Cellulose
    (c) Amylase   (d) Trypsin

    Ans : (c) Amylase

or

Choose the incorrect statement about insulin [1]
(a) It is produced from pancreas
(b) It regulates growth and development of the body.
(c) It regulates blood sugar level
(d) Insufficient secretion of insulin will cause diabetes.

Ans : (b) It regulates growth and development of the body.

(Q.no 13 to 14) In each of the following questions, a statement of Assertion is given by the corresponding statement of Reason. Of the statements, mark the correct answer as.
(a) If assertion is true and reason is correct explanation of assertion.
(b) If assertion is true but reason is false.
(c) If assertion is false but reason is true.
(d) If both are false.

13. **Assertion :** Carbon and its compound are used as fuels for most applications.
    Reason : Carbon and its compounds can easily burn in air at a moderate rate, produce large amount of heat energy and pollute the atmosphere marginally [1]

    Ans : (a) If assertion is true and reason is correct explanation of assertion.

14. **Assertion :** Offspring formed by asexual reproduction exhibit remarkable similarity.
    Reason : In asexual reproduction, the younger ones are genetically identical to the parents and another young ones as they possess exact copies of DNA. [1]

    Ans : (a) If assertion is true and reason is correct explanation of assertion.

Section B

15. Given below are some elements of the modern periodic table: $_4Be$, $_9F$, $_{14}Si$, $_{19}K$, $_{20}Ca$

    i. Select the element that has one electron in the outermost shell and write its electronic configuration.
    ii. Select two elements that belong to the same group. Give reason for your answer.
    iii. Select two elements that belong to the same period. Which one of the two has bigger atomic size ? [3]

    Ans :

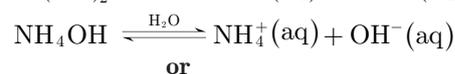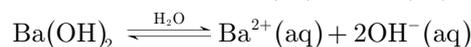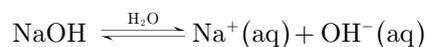   The electronic configurations of given elements are shown below.

    $_4Be \rightarrow 2,2$, $_9F \rightarrow 2,7$, $_{14}Se \rightarrow 2,8,4$

    $_{19}K \rightarrow 2,8,8,1$, $_{20}Ca \rightarrow 2,8,8,2$
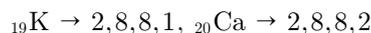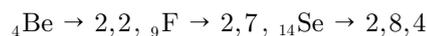
    i. $_{19}K$ has one electron in the outermost shell and its electronic configuration is 2, 8, 8, 1.
    ii. As $_4Be$ and $_{20}Ca$ has same number of electrons 2 in their valence shells, so they belong to group 2 of the periodic table.
    iii. As $_{19}K$ and $_{20}Ca$ has same number of shells 4, so they belong to period 4 of the periodic table. In these two elements $_{19}K$ has bigger atomic size.

16. Write ionic equations to show the presence of ions in aqueous solutions of :
    (i) Sodium hydroxide,
    (ii) Barium hydroxide,
    (iii) Ammonium hydroxide. [3]

    Ans :

    $$NaOH \underset{}{\overset{H_2O}{\rightleftharpoons}} Na^+(aq) + OH^-(aq)$$
    $$Ba(OH)_2 \underset{}{\overset{H_2O}{\rightleftharpoons}} Ba^{2+}(aq) + 2OH^-(aq)$$
    $$NH_4OH \underset{}{\overset{H_2O}{\rightleftharpoons}} NH_4^+(aq) + OH^-(aq)$$

    or

    Arrange the following salts as acidic, basic and neutral. $NaCl, K_2CO_3, Na_2SO_3, Cu(NO_3)_2, MgCl_2$ and K_2SO_4

    Ans :

    Acidic : $Cu(NO_3)_2$ and $MgCl_2$

    Basic : K_2CO_3 and Na_2SO_3

    Neutral : $NaCl$ and K_2SO_4

17. i. Differentiate between alkanes and alkenes. Name and draw the structure of one member of each.
   ii. Alkanes generally burn with clean flame. Why ? [3]

    Ans :

    i. Alkanes are saturated hydrocarbons, in which valencies of carbon atoms are satisfied by single covalent bonds. Their general formula is C_nH_{2n+2}. While alkenes are unsaturated hydrocarbons, characterised by the presence of double covalent bond $(-C=C-)$ in the straight chain of carbon atoms. Their general formula is C_nH_{2n}.
    Structures of alkane and alkene are shown below:

$$H-\underset{\underset{H}{|}}{\overset{\overset{H}{|}}{C}}-H \qquad H-\underset{\underset{H}{|}}{C}=\underset{\underset{H}{|}}{C}-H$$
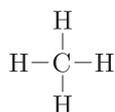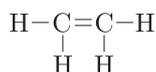
Alkane (Methane)   Alkene (Ethene)

ii. Alkanes generally give clean and a non-luminous flame because of the complete combustion of carbon atoms in them.

18. Tabulate two distinguishing features between acquired traits and inherited traits with one example of each. [3]

Ans :

Differences between Acquired and Inherited Traits :

	Acquired Traits	Inherited Traits
1.	These are somatic variations.	These are genetic variations.
2.	Acquired traits develop due to the effects of environmental factors, use and disuse of organs and special (conscious) efforts.	Inherited traits develop due to reshuffling of genetic material and mutations.
3.	These traits develop throughout the lifetime of an individual, and die with the death of that individual.	These traits are transferred (inherited) by the parents to their offspring. They do not die and are passed on to the next generation.
4.	Example-Learning of dance, music, etc., and muscular body of a wrestler.	Example — Attached or free earlobe and curly hair.

or

Write two examples each of sexually transmitted diseases caused by virus, (ii) bacteria. Explain how the transmission of such diseases be prevented ?   [3]

Ans :

Sexually transmitted diseases caused by
(i) Virus– (a) HIV—AIDS (b) Warts
(ii) Bacteria– (a) Gonorrhoea (b) Syphilis.

These diseases can be prevented by using a covering by the males called condom.

19. During Tsunami (a kind of natural disaster) at Japan, the nuclear reactors were damaged and the hazardous radiations affected the large area.
Answer the following questions based on above information
i. What would be the reason for this damage?   [1]
ii. How did it affect the people and environment? [2]

Ans :

i. Enormous heat evolved during nuclear fission.
ii. Following are some effects on people and environment :
   (a) Severely damage to property and life.
   (b) Genetical disorder
   (c) Infertile soil

20. What is 'phototropism'? How does it occur in plants ?

Describe an activity to demonstrate phototropism. [3]

Ans :

Movement of a plant or its parts in response to light is called phototropism. Shoots generally grow towards light and said to be positively phototropic while roots grow away from light and are said to be negatively phototropic. This growth is controlled by the auxin hormone of plants.

The concentration of auxin stimulates the cells to grow longer on the side of the shoot (stem and branches) which is away from light. Thus, the plant appears to bend towards light.

Activity to Demonstrate Phototropism
Keep a potted plant in an enclosed box open from one side. Place the pot in a room with the open side of the box facing the window. You will see that the plant bends and starts growing towards light.
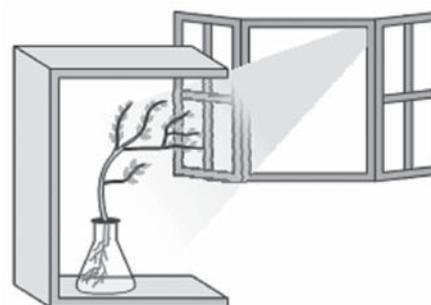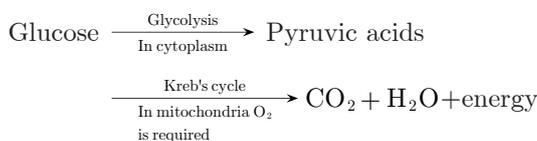

21. Explain the process of break down of glucose in a cell (i) in the presence of oxygen (ii) in the absence of oxygen.   [3]
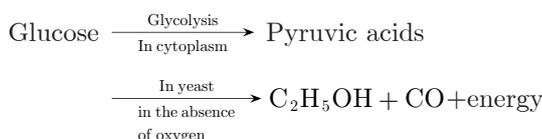
Ans :

i. **In the presence of oxygen :**
   In all the pathways, the first step is break down of glucose, a six carbon molecule, into a three carbon molecule called pyruvate. This process occurs in the cytoplasm of the cell.
   In aerobic respiration break down of pyruvate using oxygen takes place in mitochondria. It breaks up the three carbon pyruvate molecule to give three molecules of carbon dioxide, water and lots of energy as compared to anaerobic respiration
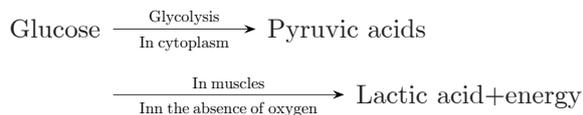
   Glucose $\xrightarrow[\text{In cytoplasm}]{\text{Glycolysis}}$ Pyruvic acids

   $\xrightarrow[\substack{\text{In mitochondria O}_2 \\ \text{is required}}]{\text{Kreb's cycle}}$ $CO_2 + H_2O$ +energy

ii. **In the absence of oxygen :**
   In the absence of oxygen pyruvate may be converted into ethanol and carbon dioxide which is referred to as fermentation that takes place in yeast.

   Glucose $\xrightarrow[\text{In cytoplasm}]{\text{Glycolysis}}$ Pyruvic acids

   $\xrightarrow[\substack{\text{in the absence} \\ \text{of oxygen}}]{\text{In yeast}}$ $C_2H_5OH + CO$ +energy

   Sometime anaerobic respiration also occurs in our muscle cells, when there is lack of oxygen, i.e., during vigorous muscular activities. At that time pyruvate is converted into lactic acid which is also a three carbon molecule. This build-up of lactic acid in our muscles causes fatigue or

muscular cramps.

Glucose $\xrightarrow[\text{In cytoplasm}]{\text{Glycolysis}}$ Pyruvic acids

$\xrightarrow[\text{Inn the absence of oxygen}]{\text{In muscles}}$ Lactic acid+energy

22. What is meant by "electrical resistance" of a conductor? State how resistance of a conductor is affected when
  i. a low current passes through it for a short duration;
  ii. a heavy current passes through it for about 30 seconds. [3]

Ans :

Electrical resistance is the property of a conductor by virtue of which it opposes the flow of current through it. It is equal to the ratio of the potential difference applied across its ends to the current flowing through it.

$$R = \frac{V}{I}$$

  i. When a low current is passed for a short duration, through a conductor, heat produced is almost negligible and hence no appreciable change in its resistance.
  ii. When heavy current is passed through the conductor for 30 s. Conductor may be get heated and its resistance and resistivity change.

23. An electric iron of resistance 20 Ω takes a current of 5 A. Calculate the heat developed in 30 s. [3]

Ans :

Power of the electric iron,

$$P = I^2 \times R = (5)^2 \times 20$$
$$= 500 \text{ W}$$

Heat developed in 30 s,

$$H = P \times t = 500 \text{ W} \times 20 \text{ s}$$
$$= 10000 \text{ J}$$

24. An object of height 5 cm is placed perpendicular to the principal axis of a concave lens of focal length 10cm. Use lens formula to determine the position, size and nature of the image if the distance of the object from the lens is 20 cm. [3]

Ans :

Given, Height of the object $(h_0) = 5$ cm

Focal length of the concave lens, $f = -10$ cm
Distance of the object from concave lens

$$(u) = -20 \text{ cm}$$

Applying the lens formula.

$$\frac{1}{f} = \frac{1}{v} - \frac{1}{u} \Rightarrow \frac{1}{-10} = \frac{1}{v} - \left(\frac{1}{-20}\right)$$

$$\frac{1}{v} = -\frac{1}{10} - \frac{1}{20} = -\frac{3}{20}$$

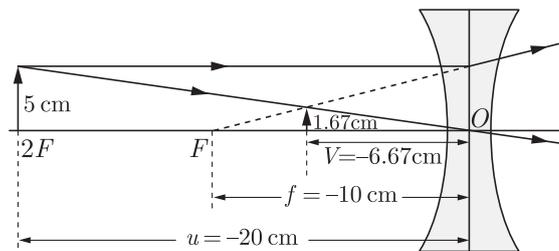$$v = -\frac{20}{3} \text{ cm} = -6.67 \text{ cm}$$

Also, $\frac{h_i}{h_0} = \frac{v}{u} \Rightarrow h_i = \frac{v}{u} \times h_0$

$$= \frac{-20}{3 \times -20} \times 5 = \frac{1}{3} \times 5$$

$$= 1.67 \text{ cm}$$

Thus, the image is erect and formed in front of concave lens at a distance of 6.67 cm from the lens and measures 1.67 cm.

The ray diagram is shown.

or

Mention the types of mirrors used as (i) rear view mirrors, (ii) shaving mirrors. List two reasons to justify your answers in each case. [3]

Ans :

  i. Convex mirror is used as rear view mirror in automobiles because–
    (a) It can cover a very wide field behind the driver and hence enables to see the traffic behind him without turning his head.
    (b) It forms an erect image of an object, hence object become easily identified.
  ii. Concave mirror is used as a shaving mirror. The reason being that —
    (a) When the face of a person is between pole and focus of concave mirror, an erect, enlarged and virtual image is formed behind the mirror.
    (b) It forms enlarged erect image, so it becomes helpful for shaving.

Section C

25. K; Na; Ca; Mg; Al; Zn; Fe; Sn; Pb; Cu; Hg; Ag; Au constitute the metal reactivity series.
Answer the following questions and write chemical equations :
  i. Name the metal which on heating reacts with steam, but the reaction is reversible.
  ii. Name a metal which burns with a yellow flame and reacts with cold water
  iii. Name a metal which does not react with water or steam, but reacts with hydrochloric acid.
  iv. Name a metal which does not react with cold water, but reacts with boiling hot water
  v. Name a metal which does not react with water or HC1. [5]

Ans :

  i. Iron metal : $3\text{Fe} + 4\text{H}_2\text{O} \rightleftharpoons \text{Fe}_3\text{O}_4 + 4\text{H}_2(\text{g})$

  ii. Sodium metal : $2\text{Na} + 2\text{H}_2\text{O} \longrightarrow 2\text{NaOH} + \text{H}_2(\text{g})$
  iii. Tin metal : $\text{Sn} + 2\text{HCl} \longrightarrow \text{SnCl}_2 + \text{H}_2(\text{g})$
  iv. Magnesium metal :
    $\text{Mg} + 2\text{H}_2\text{O} \xrightarrow[100°\text{C}]{\text{heat}} \text{Mg(OH)}_2 + \text{H}_2$

  v. Copper metal : No reaction takes place.

or

  i. What happens chemically when quicklime is added to water ?

ii. Balance the following chemical equation
$MnO_2 + HCl \longrightarrow MnCl_2 + Cl + H_2O$

iii. What is decomposition reaction? Explain it with suitable example. [5]

Ans :

i. Quicklime reacts vigorously with water to form calcium hydroxide (slaked lime), with the release of energy.

$$\underset{\text{Quickime}}{CaO(s)} + H_2O(l) \longrightarrow \underset{\text{Slaked lime}}{Ca(OH)_2(aq)} + \Delta$$

ii. $MnO_2 + 4HCl \longrightarrow MnCl_2 + Cl_2 + 2H_2O$

iii. When a chemical compound decomposes on heating or absorbing some kind of energy, so as to form two or more substances (elements or compounds), then the chemical reaction that takes place is called a chemical decomposition reaction or a chemical de-combination reaction.

$$\underset{Compound}{AB} \longrightarrow \underset{(A \text{ and } B \text{ could be elements or compounds})}{A + B}$$
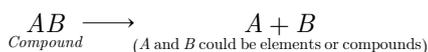
Example:
In this reaction a single reactant (ferrous sulphate crystals), breaks down to three products as illustrated by the equation below.

26. i. Define the term 'isomers'.
ii. Draw two possible isomers of the compound with molecular formula C_3H_{60} and write their names.
iii. Give the electron dot structures of the above two compounds. [5]
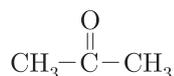
Ans :

i. **Isomers :** Organic compound having the same molecular formula but different structural formulae, and hence, different physical and chemical properties, are called isomers.

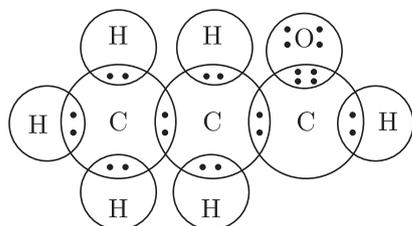ii. Two possible isomers of the compound with molecular formula C_3H_6O

(a) Propanal

$$CH_3 - CH_2 - \overset{\overset{O}{\|}}{C} - H$$

(b) Propanone

$$CH_3 - \overset{\overset{O}{\|}}{C} - CH_3$$
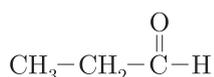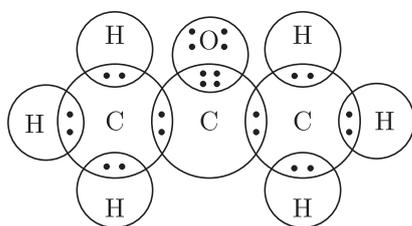
iii. Electron dot structures of propanal and propanone.

Propanal

Propanone

27. What are fossils ? How are they formed? Describe in brief two methods of determining the age of fossils. State any one role of fossils in the study of the process of evolution. [5]

Ans :

Fossils are preserved remains or impressions of pre-historic organisms in the different strata of the earth's crust.

Fossils are dead remains of animals and plants from remote past.

Fossils are formed when dead organisms are not completely decomposed. The organisms may get trapped in resins of tree, lava of volcanoes or hot mud which when hardens, retains the animal's parts thus, forming fossils.

Two methods of determining the age of fossils :

i. Relative method: By estimating the age of the layer of earth's crust where the fossil is found. Fossils near the surface are recent and those in the deeper layers are more ancient.

ii. Radio-carbon dating method: By detecting the ratios of different isotopes of carbon in the fossils.

Fossils help in determining the connecting links between various groups and their origin from their primitive ones, e.g., archaeopteryx.

28. i. Write the function of placenta in human females.
ii. List four ways of preventing pregnancy. State two advantages of using such preventive methods. [5]

Ans :

i. The organ by which the embryo is attached to the wall of the uterus is called placenta. The nutritional, respiratory and excretory needs of developing foetus are met by the placenta. The placenta contains villi on the embryo's side of the tissue. The blood spaces are on the mother's side which surround the villi. This provides a large surface area for glucose and oxygen to pass from the mother to embryo. The waste substances generated by embryo can be removed by transferring them into the mother's blood through the placenta.

ii. The following are four methods of contraception used by hum

(a) Mechanical barrier method includes condoms, femidom and diaphragm.

(b) Foam tablets, jellies, creams and spermicides are common chemicals used by females.

(c) Ovulation and fertilization can be prevented by changing hormonal balance of the body by taking oral pills.

(d) Surgical methods include vasectomy and tubectomy. It prevents the sperms from coming out in first case and in second case it prevents the egg to enter the fallopian tube. These methods have been developed to prevent and regulate child birth. This has greatly improved the health of women in rural areas. Contraception methods keep spacing between successive birth and prevention of unwanted pregnancies. Increasing population makes it harder to improve everybody's standard of living. Population control

involves by which fertilization is prevented.
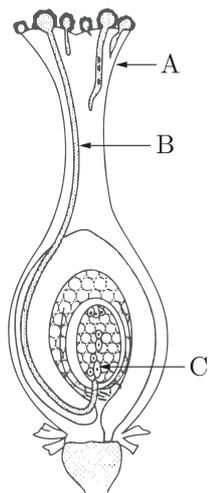
or

i. Identify A, B and C in the given diagram and write their functions.

ii. Mention the role of gamete and zygote in sexually reproducing organisms. [5]

Ans :

i. In given diagram A is stigma. Stigma may be knob-like or flattened, sticky or feathery, adapted to receive the pollen grain, the middle elongated part style which support stigma connects it to the ovary. After the pollen grains are deposited on the stigma, the pollen grains absorb water and sugar from the surface of stigma and swell up. The pollen grains produce a fine tube called pollen tube.

In given diagram B is pollen tube. The pollen tube carrying two male gametes enters the ovule and embryo sac through the micropile and its tip dissolves. Inside the ovule, the pollen tube releases two male gametes into the embryo sac.

In the given diagram C is female germ-cell (egg cell). In female egg-cell one male gamete fuses with egg to form zygote. The other male gamete fuses with the secondary nucleus to form the endosperm, which provides nourishment to the growing embryo.

ii. Two male gametes are liberated inside the embryo sac. One male gametes fuses with the egg to form zygote which grows into an embryo and finally into a new plant. The other male gamete fuses with secondary nucleus (two polar nuclei) to form the endosperm which provides nourishment to the growing embryo. The fusion male gamete with the female gamete is called syngamy.

29. How will you infer with the help of an experiment that the same current flows through every part of the circuit containing three resistances in series connected to a battery ? [5]

Ans :

i. Take three resistors r_1, r_2 and r_3 of resistances $1\Omega, 2\Omega$ and 3Ω, respectively, and connect them in series with a battery, a plug key, and an ammeter as shown in Figure. Connect a voltmeter in parallel in between points P and S.

ii. Insert the key in the plug and record the current

flowing in the circuit from the ammeter and potential difference from voltmeter.

iii. Now disconnect ammeter from position X and reconnect it in series anywhere between the resistors r_1, r_2, and r_3. Record the current in circuit. You will observe that current remains same irrespective of the position where the ammeter is connected.

iv. Having recorded the potential difference from the voltmeter in between points P and S, connect it in between points:
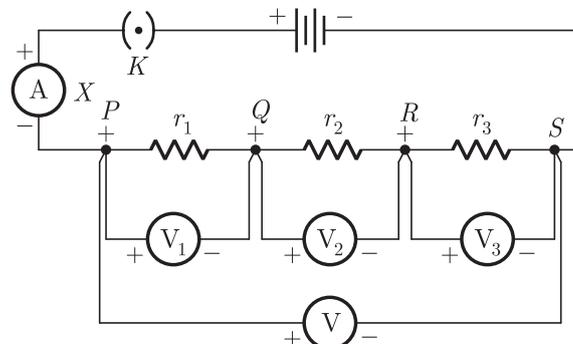
(a) P and Q, (b) Q and R, (c) R and S, and record the potential difference in each case. Let the potential difference between points:

(a) P and S is V (b) P and Q is V_1 (c) Q and R is V_2 (d) R and S is V_3

You will notice that:

$$V = V_1 + V_2 + V_3$$

30. State Snell's law of refraction of light. Write an expression to relate refractive index of a medium with speed of light in vacuum.

The refractive index of a medium 'a' with respect to medium 'b' is 2/3 and the refractive index of medium 'b' with respect to medium 'c' is 4/3. Find the refractive index of medium 'c' with respect to medium 'a'. [5]

Ans :

Snell's law of refraction of light :

i. The incident ray, the refracted ray and the normal to the surface of the separation of two media at the point of incidence, all lie in the same plane.

ii. The ratio of sine of angle of incidence to the sine of angle of refraction is a constant, for the light of given colour for the given pair of media.

Refractive index of a medium and speed of light in vacuum.

Light has a constant speed of $3 \times 10^8 \, \text{ms}^{-1}$ for all colours or the wavelengths in vacuum. However, if the light travels through any other optical medium, it is slowed down. The extent of slowing down depends upon:

(a) The optical density of the medium.

(b) The colour or wavelength of the light.

It is this slowing down of light, which is responsible for the phenomenon of refraction. It has been found experimentally that the refractive index of a given optical material is the ratio between the speed of light in vacuum and speed of light in a given optical medium.

Thus,

$$\mu = \frac{\text{Speed of light in vacuum } (c)}{\text{Speed of light in a given optical medium } (v)}$$

The refractive index of a medium 'a' with respect to medium 'b' $({}^b\mu_a) = \frac{2}{3}$

The refractive index of a medium 'b' with respect to medium 'c' $({}^c\mu_b) = \frac{4}{3}$

Then, $\quad {}^b\mu_a \times {}^c\mu_b = \frac{2}{3} \times \frac{4}{3} \Rightarrow {}^c\mu_a = \frac{8}{9}$

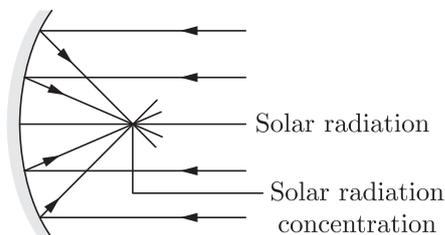Thus, $\qquad {}^a\mu_c = \frac{1}{{}^c\mu_a} = \frac{1}{\frac{8}{9}} = \frac{9}{8}$

The refractive index of a medium 'c' with respect to medium 'a' $= \frac{9}{8}$.

or

i.   Define real image of an object.
ii. Name the mirror that
    (a) can give real as well as virtual image of an object.
    (b) will always give virtual image of same size of an object.
    (c) will always give virtual and diminished image of an object.
    (d) is used by a doctor in examining teeth.
iii. With the help of a ray diagram explain the use of concave mirror as solar concentrators. [5]

Ans :

i.   Real image of an object is the image formed due to actual intersection of light rays coming from object through an optical device. It can always be taken on screen.
ii. (a) concave mirror
    (b) plane mirror
    (c) convex mirror
    (d) concave mirror
iii. Concave mirrors can concentrate parallel light rays (from distant object e.g. sun) at focus. This property of the concave mirror is used in solar concentrators as high concentration of the sun rays generate high amount of heat farther can be used as a heat source. This diagram below shows the concentration of sun ray.

Solar radiation

Solar radiation concentration