Sample Paper 16

Class X 2022-23

Science (086)

Time: 3 Hours **Max. Marks: 80**

General Instructions:

1. This question paper consists of 39 questions in 5 sections.
2. All questions are compulsory. However, an internal choice is provided in some questions. A student is expected to attempt only one of these questions.
3. Section A consists of 20 Objective Type questions carrying 1 mark each.
4. Section B consists of 6 Very Short questions carrying 02 marks each. Answers to these questions should in the range of 30 to 50 words.
5. Section C consists of 7 Short Answer type questions carrying 03 marks each. Answers to these questions should in the range of 50 to 80 words.
6. Section D consists of 3 Long Answer type questions carrying 05 marks each. Answer to these questions should be in the range of 80 to 120 words.
7. Section E consists of 3 source-based/case-based units of assessment of 04 marks each with sub-parts.

SECTION - A **20 MARKS**

(Select and write one most appropriate option out of the four options given for each of the questions 1-20.)

1. Why do we store silver chloride in dark coloured bottles?

(a) To prevent precipitation of silver chloride

(b) To prevent decomposition of silver chloride

(c) To promote decomposition of silver chloride

(d) All of these 1

2. What is the difference in the molecular mass of any two adjacent homologues?

(a) 14 amu (b) 15 amu

(c) 16 amu (d) 17 amu 1

3. Iqbal was confused and did not know how to draw the correct figure for geotropism. So, he has drawn three figures, as shown below.

(I)

(II)

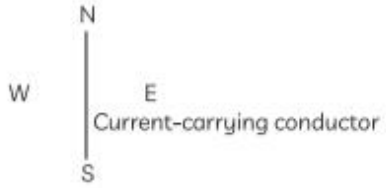
(III)

Which appears more accurate and why?

(a) (I), (II) (b) (I) only

(c) (II), (III) (d) (II) only 1

4. A current-carrying conductor is held as shown :



In which direction should current be passed in the conductor in order to produce a clockwise magnetic field around the conductor?

(a) North to South (b) South to North

(c) East to West (d) West to East 1

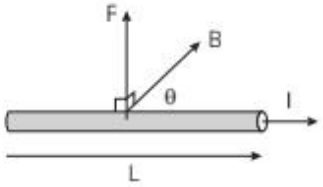
5. What is the focal length of a plane mirror?

(a) Infinity (b) Zero

(c) 1 (d) + 1 1

6. The force experienced by a wire of length l carrying a current I in a magnetic field B is

given by force on a current-carrying wire: F = BIl sin θ.



What will be the magnitude of the force on the current carrying conductor if the flow of electric current is parallel to the magnetic field?

(a) Zero

(b) Infinity

(c) Maximum

(d) Half the original value 1

7. As per Michael Faraday, the forefinger, middle finger and thumb indicate the direction of:

(a) magnetic field, force and current respectively.

(b) magnetic field, current and force respectively.

(c) current, force and magnetic field respectively.

(d) force, magnetic field and current respectively. 1

8. In a study it was found that fused ear lobes were found in more numbers within a population rather than free ear lobes. What can you infer from the above observation with respect to dominant / recessive trait?

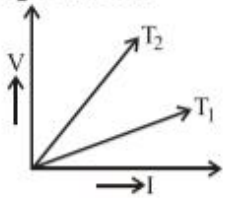
(a) Fused ear lobes – dominant

(b) Free ear lobes – dominant

(c) Fused ear lobes – recessive

(d) Both are dominant 1

9. The voltage-current (V-I) graph of a metallic conductor at two different temperatures T_1 and T_2 is shown:



At which temperature is the resistance higher?

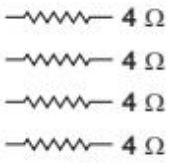
(a) T_2

(b) T_1

(c) Equal at both T_2 and T_1

(d) Can not say 1

10. What is the minimum resistance which can be made using the following resistors ?



(a) 1 Ω (b) 2 Ω

(c) 4 Ω (d) 3 Ω 1

11. Manish's mother was baking cake in the kitchen. When Manish came back from school he detected smell of hot cake from the drawing room. Why?

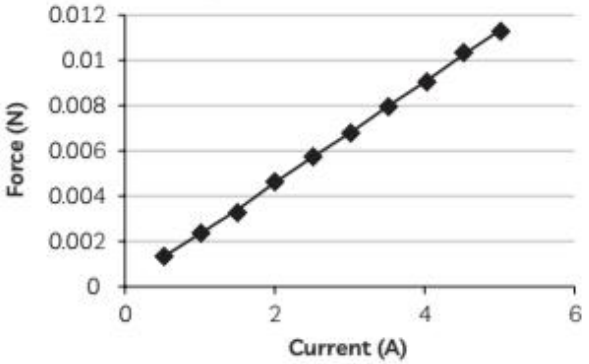
(a) Due to the presence of olfactory receptors in forebrain

(b) Due to the presence of taste buds

(c) Due to the presence of olfactory receptors in midbrain

(d) Due to the presence of olfactory receptors in hindbrain 1

12. The graph below shows the variation of force acting on a conductor with current:



After analyzing the graph, a student noted the following.

Select the correct statement:

(a) The force acting on a conductor increases exponentially with increase in current.

(b) The force acting on a conductor decreases exponentially with increase in current.

(c) The force acting on a conductor increases linearly with increase in current.

(d) The force acting on a conductor decreases linearly with increase in current. 1

13. Which of the following is not the role of decomposers in the ecosystem?

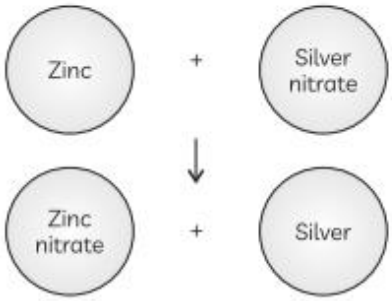
(a) They clean the environment.

(b) They decompose non-biodegradable substances.

(c) They participate in food chain.

(d) They replenish the nutrients in the soil. 1

14. Which of the following a balanced equation for the following chemical reaction:



(a) $Zn + Ag(NO_3)_2 \rightarrow Zn(NO_3)_2 + 2Ag$

(b) $2Zn + 2AgNO_3 \rightarrow Zn(NO_3)_2 + 2Ag$

(c) $Zn + 2AgNO_3 \rightarrow Zn(NO_3)_2 + 2Ag$

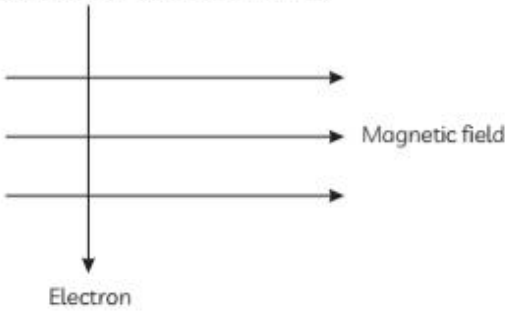
(d) $Zn + AgNO_3 \rightarrow Zn(NO_3)_2 + Ag$ 1

15. Which of the following will turn phenolphthalein pink?

(a) $NaOH_{(aq)}$ (b) $HCl_{(aq)}$

(c) $CH_3COOH_{(aq)}$ (d) H_2O 1

16. An electron enters a magnetic field at right angles to it as shown in fig.



The direction of the force acting on the electron will be:

(a) to the right (b) to the left

(c) out of the page (d) into the page 1

Q. no 17 to 20 are Assertion - Reasoning based questions.
These consist of two statements – Assertion (A) and Reason (R). Answer these questions selecting the appropriate option given below:

(a) Both A and R are true and R is the correct explanation of A

(b) Both A and R are true and R is not the correct explanation of A

(c) A is true but R is false

(d) A is false but R is true

17. Assertion (A): Non-biodegradable substances are those substances which cannot be broken down into simpler harmless substances in nature.

Reason (R): Non-biodegradable substances can cause air pollution and make the air poisonous when burnt. 1

18. Assertion (A): The effect of root pressure in transport of water is more important during daytime.

Reason (R): Transpiration pull is the major driving force in movement of water during the day. 1

19. Assertion (A): The opening and closing of the pore is a function of the guard cells.

Reason (R): Stomatal pores are the site for exchange of gases by diffusion. 1

20. Assertion (A): In a series circuit, the current is constant throughout the electric circuit.

Reason (R): All electric devices need equal currents to operate properly. 1

SECTION - B

12 MARKS

(Q. no. 21 to 26 are very short answer questions.)

21. (A) What is the unit of current? Express it in terms of charge and time.

(B) The following table gives the value of resistivity of some materials:

Material	Resistivity (Ohm-m)
A	44×10^{-6}
B	$10^{10} - 10^{12}$
C	1.62×10^{-6}
D	$10^{15} - 10^{17}$

Which material would you suggest to be used in electric heating devices? Give reason for your choice.

OR

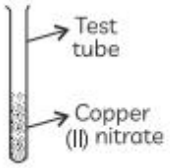
(A) On what factors does the resistance of a conductor depend?

(B) Calculate the resistance of an aluminium cable of length 10 km and diameter 2.0 mm if the resistivity of aluminium is 2.7×10^{-8} Ωm. 2

22. Neha did not wanted to have a child. So she went to a doctor who suggested her

to adopt contraceptive methods. What are the reasons for adopting contraceptive methods? 2

23. Observe the given figure:



What happens when the tube is heated?

(A) Write a balanced chemical equation of the reaction.

(B) Identify the brown gas X evolved. 2

24. Why does carbon become stable after sharing four electrons? What type of bond is formed by sharing?

OR

Why are covalent compounds are poor conductors of electricity? Why do covalent compounds have low melting and boiling points? 2

25. What are the differences between the transport of materials in xylem and phloem? 2

26. Why is the sun visible to us 2 minutes before actual sunrise and 2 minutes after actual sunset? 2

SECTION - C

21 MARKS

(Q.no. 27 to 33 are short answer questions.)

27. (A) Describe how a squirrel uses its hormonal system to react to a dangerous situation.

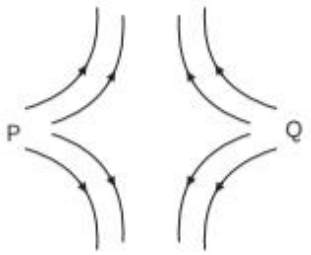
(B) How do sensory and motor neurons differ from one another? 3

28. Mention any three information given by a chemical equation.

OR

State the law of conservation of mass as applicable in a chemical reaction. Illustrate with an example. 3

29. (A) Determine whether the P and Q-marked poles in the following diagram represent the North or South pole. Why did you choose that response?



(B) Imagine that you are sitting in a chamber with your back to one wall. An electron beam, moving horizontally from back wall towards the front wall, is deflected by a strong magnetic field to your right side. What is the direction of magnetic field?

OR

State the rule to determine the direction of a (A) magnetic field produced around a straight conductor-carrying current and (B) force experienced by a current-carrying straight conductor placed in a magnetic field which is perpendicular to it. 3

30. Give reasons for the following:

(A) Ionic compounds have high melting and boiling point

(B) Ionic compounds conduct electricity in molten state

(C) Ionic compounds are solid at room temperature and are somewhat hard. 3

31. (A) What is an ecosystem? List its two main components.

(B) 'The number of trophic levels in a food chain is limited'. Justify the statement. 3

32. Sahil took five solutions A, B, C, D and E and tested with universal indicator showed pH as 4, 1, 11, 7 and 9 respectively. Which solution is:

(A) Neutral

(B) Strongly alkaline

(C) Strongly acidic

(D) Weakly acidic

(E) Weakly alkaline ?

Arrange the pH in increasing order of hydrogen ion concentration. 3

33. Can two people with brown eyes have a blue eyed baby? Explain. 3

SECTION - D

15 MARKS

(Q.no. 34 to 36 are long answer questions.)

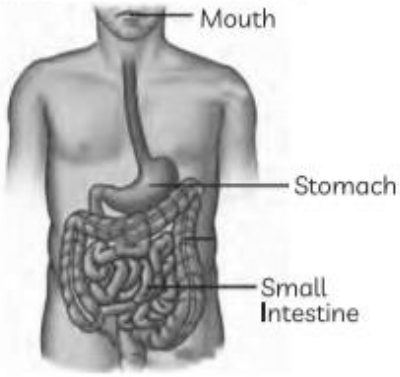
34. (A) An organic compound X with a molecular formula C undergoes oxidation in presence of alkaline $KMnO_4$ to form a compound Y. X on heating in presence of conc. H_2SO_4 at 443 K gives Z, which on reaction gives back 'X'. Identify X, Y and Z and write the reactions involved.

(B) With hard water, "A" compound functions well. The production of shampoos and other cleaning products uses it. A causes water pollution and isn't entirely biodegradable. Hard water makes 'B' less effective. There is no water pollution because it is 100 percent biodegradable. Identify 'A' and 'B'.

(C) A cyclic compound 'X' has molecular formula. It is unsaturated and burns with sooty flame. Identify 'X' and write its structural formula. Will it decolourize bromine water or not and why?

(D) An organic compound 'A' is a constituent of antifreeze and has the molecular formula C_2H_6O. Upon reaction with alkaline $KMNO_4$ the compound 'A' is oxidized to another 'B' identify the compound A' and 'B'. Write the chemical equation for the reaction which leads to the formulation of 'B'. 5

35. Name three different glands associated with the structures labelled in digestive system as shown in figure. Also write their secretions and their functions.



OR

(A) Define excretion.

(B) Name the basic filtration unit present in the kidney.

(C) Draw excretory system in human beings and label the following organs of excretory system which perform following functions:

(i) form urine.

(ii) is a long tube which collects urine from kidney.

(iii) store urine until it is passed out. 5

36. A student wants to project the image of a candle flame on a screen 60 cm in front of a mirror by keeping the candle flame at a distance of 15 cm from its pole.

(A) Which type of mirror should the student use?

(B) Find the magnification of the image produced.

(C) Find the distance between the object and its image.

(D) Draw a ray diagram to show the image formation in this case and mark the distance between the object and its image.

OR

(A) Name the lens which can be used as a magnifying glass. For which position of the object a convex lens form:

(i) a real and inverted image of the same size as that of the object?

(ii) a virtual and erect image?

Draw ray diagram to justify your answer in each case.

(B) One half of a convex lens is covered with a black paper. Will this lens produce a complete image of the object? Draw ray diagram to justify your answer. 5

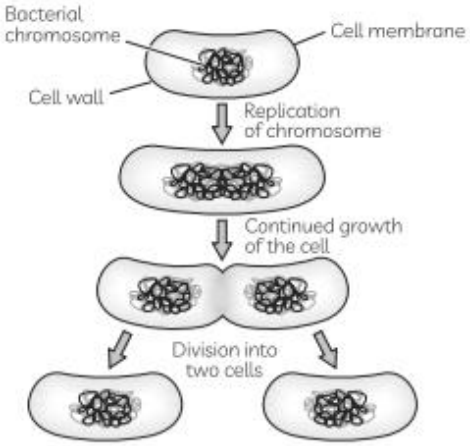
SECTION - E

12 MARKS

(Q.no. 37 to 39 are case - based/data -based questions with 2 to 3 short sub - parts. Internal choice is provided in one of these sub-parts.)

37. *Bacteria follow an asexual mode of reproduction, called binary fission. A single bacterium divides into two daughter cells. These are identical to the parent cell as well as to each other. Replication of DNA within parent bacterium marks the beginning of the fission. Eventually, cell elongates to form two daughter cells.*

The diagram shows the process of binary fission in bacteria.



The rate and timing of reproduction depend upon the conditions like temperature and availability of nutrients. When there is a favourable condition, E. coli or Escherichia coli produces about 2 million bacteria every 7 hours. 4

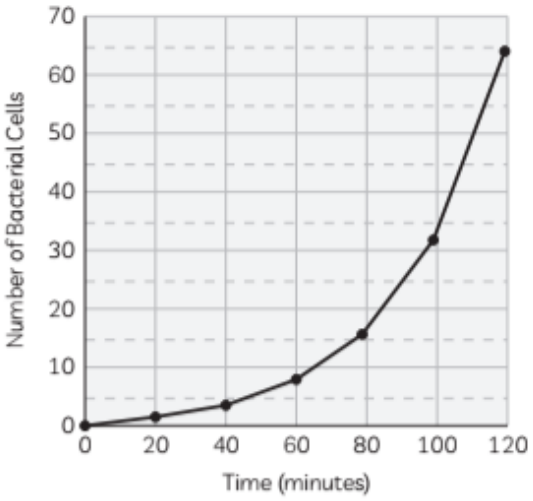
(A) (i) What is the process of the division of a cell into several cells during reproduction in *Plasmodium*?

(ii) A *Planaria* worm is cut horizontally in the middle into two halves P and Q such that the part P contains the whole head of the worm. Another *Planaria* worm is cut vertically into two halves R and S in such a way that both the cut pieces R and S contain half head each. Which of the cut pieces of the two *Planaria* worms could regenerate to form the complete respective worms?

(B) The rapid spreading of bread would on slices of bread is due to spore formation. Explain spore formation.

OR

(B) Suppose a bacterium reproduces by binary fission every 20 minutes. The new cells survive and reproduce at the same rate. The graph below shows how the bacterial population would grow from a single bacterium.



What do you conclude ?

38. *Compounds containing oxygen are of great interest in the field of chemistry. Because of oxygen's high reactivity, it is most often found in compounds. Oxygen reacts rapidly with group 1 elements. All alkali metal oxides form basic solutions when dissolved in water. The principal combustion product is the most stable product with respect to the reactants. For example, with careful control of oxygen, the oxide M2O (where M represents any alkali metal) can be formed with any of the alkali metals.*

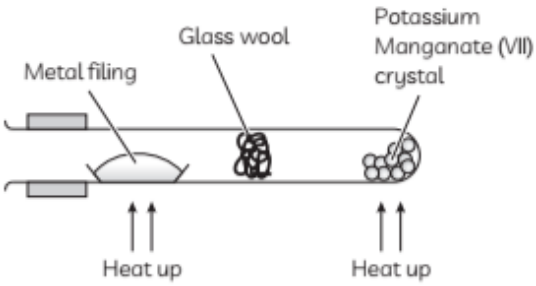
When a metal reacts with oxygen to form a metal oxide, a redox reaction occurs.

Metal + Oxygen → Metal oxide

Different metals burn in oxygen with different rates depending on their differing activeness.

The more reactive metal towards oxygen, the brighter and faster the combustion of the metal.

Given figure below shows the experiment is conducted to build the reactivity series of metals. Oxygen that is used in combustion of other metals is provided by heating solid potassium manganate (VII). When heated, lithium, sodium, potassium, rubidium, and cesium ignite through combustion reactions with oxygen.



4

(A) Which metals do not react with oxygen even at high temperature?

(B) What happens when copper metal is heated in air?

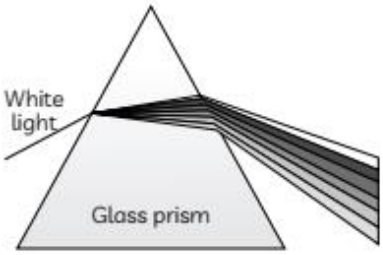
(C) Almost all metals combine with oxygen to form metal oxides. Is this statement true ?

OR

(C) Which metal oxides are soluble in water? Explain.

39. *Dispersion of light occurs when white light is separated into its different constituent colors because of refraction and Snell's law. From*

Snell's law it can be seen that the angle of refraction of light in a prism depends on the refractive index of the prism material.



Color	λ(nm)	Freq. (Hz)
Red	760–647	4.3×10^{14}
Orange	647-585	4.3×10^{14}
Yellow	585-575	5.2×10^{14}
Green	575-491	5.6×10^{14}
Blue	491-424	6.6×10^{14}
Violet	424-380	7.3×10^{14}

Since the refractive index varies with wavelength, the angle that the light is refracted by will also vary with wavelength, causing an angular separation of the colors known as angular dispersion.

For visible light, refraction indices n of most transparent materials (e.g., air, glasses) decrease with increasing wavelength λ:

Colour	Wavelength (nm)	Crown glass	Flint glass
Violet	396.9	1.533	1.663
Blue	486.1	1.523	1.639
Yellow	589.3	1.517	1.627
Red	656.3	1.515	1.622

Most often seen in recently made puddles on the sides of roads, the oil refracts light much the same way a rainbow does. Simply put, the thin layer of oil floating on top of the water refracts the light which then bounces back up off the water underneath, splitting the light rays creating a pool of rainbow colours. 4

(A) Which ray is least deviated by a prism?

(B) Which colour of light which has the minimum velocity in the glass prism ?

(C) Which optical phenomenon is involved in formation of rainbow?

OR

(C) What is the angle of deviation (Δ) of a prism?

SOLUTION

SAMPLE PAPER - 7

SECTION - A

1. *(b) To prevent decomposition of silver chloride*

Explanation: We store silver chloride in dark coloured bottles to prevent the decomposition of silver chloride into silver and chlorine gas in the presence of sunlight.

The decomposition of silver chloride to form silver and chlorine gas in the presence of sunlight is given by the equation:

$$\underset{\text{Silver chloride (grey)}}{2AgCl_{(s)}} \xrightarrow{\text{Sunlight}} \underset{\text{Silver (white)}}{2Ag_{(s)}} + \underset{\text{Chlorine}}{Cl_{2(g)}}$$

2. *(a) 14 amu*

Explanation: Two successive homologues would differ by one carbon atom and two hydrogen atoms in terms of atoms in their molecules and thus differ by 14 amu in terms of molecular mass.

Related Theory

➥ *For example, C_4H_8 and C_5H_{10} are successive compounds. These two differ by $—CH_2$*

Atomic mass of carbon = 12 amu

Atomic mass of Hydrogen = 1 amu

Molecular mass of $—CH_2$ group = (1 × 12) + (2 × 1)

= 14 amu

3. *(b) (I) only*

Explanation: Figure (I) is more appropriate because in a plant, shoots grow upward because they are negatively geotropic, and roots grow downward because they are positively geotropic.

4. *(a) North to South*

Explanation: The direction of current in the conductor should be from top to bottom *i.e.*, from North to South direction.

It is given that the current-carrying conductor is held in exactly vertical direction. In order to produce a clockwise magnetic field around the conductor, the current should be passed in the conductor from top to bottom. It is concluded by applying right-hand thumb rule.

5. *(a) Infinity*

Explanation: The focal length of a plane mirror is infinity. The focal length of a plane mirror is infinity as the image can be formed at infinite distance inside the mirror. This is due to the parallel rays after reflection through a plane mirror meet again at infinity.

6. *(a) Zero*

Explanation: The force acting on the current carrying conductor will be zero if the current and the magnetic field are parallel to each other.

7. *(b) magnetic field, current and force respectively*

Explanation: The direction of force experienced by a current carrying conductor placed in a magnetic field is given by Fleming's left hand rule which states that "Stretch the forefinger, the central finger and the thumb of your left hand mutually perpendicular to each other. If the forefinger shows the direction of the field and the central finger that of the current, then the thumb will point towards the direction of motion of the conductor, *i.e.*, force."

8. *(a) Fused ear lobes – dominant*

Explanation: It can be inferred from the observation that fused ear lobes is a dominant trait whereas free ear lobes is a recessive trait.

9. *(a)* T_2

Explanation: Resistance is the slope of VI graph. The slope of graph at T_2 > slope of graph at T_1. Therefore, resistance is higher at T_2.

10. *(a)* $1\ \Omega$

Explanation: The minimum resistance can be obtained by connecting resistances in parallel. When four resistors each of resistance 4 Ohms are connected in parallel, we get,

$$\frac{1}{R} = \frac{1}{4}+\frac{1}{4}+\frac{1}{4}+\frac{1}{4}$$

$$\frac{1}{R} = \frac{4}{4} = 1\Omega$$

Therefore, minimum resistance = 1 Ohm.

11. *(a) Due to the presence of olfactory receptors in forebrain*

Explanation: Our nose contain olfactory receptors that can recognise the aroma of hot food. The olfactory lobes of the forebrain receive this information via nerve impulse and interpret it.

12. *(c) The force acting on a conductor increases linearly with increase in current.*

Explanation: The graph between the force and current is a straight line which shows that force varies linearly with current.

13. *(b) They decompose non-biodegradable substances.*

Explanation: Decomposers are the microorganisms which breakdown complex organic substances into simple inorganic substances. They are very important in the ecosystem as:

(1) They decompose biodegradable substances into useful substances like manure. They thus clean the environment.

(2) Decomposed substances go back to the soil and can be used by the plants again. Thus, decomposers participate in the food cycle by replenishing the nutrients of the soil.

14. *(c)* $Zn + 2AgNO_3 \rightarrow Zn(NO_3)_2 + 2Ag$

Explanation: The balanced chemical equation for the reaction is :

Zinc + Silver nitrate ⟶ Zinc nitrate + Silver

$Zn + 2AgNO_3 \longrightarrow Zn(NO_3)_2 + 2Ag$

15. *(a)* $NaOH_{(aq)}$

Explanation: Phenolphthalein solution is a colourless indicator which gives pink colour in basic solution. Phenolphthalein solution remains colourless in acidic solution as well as in neutral solution.

Caution

Student usually get coufused and mark wrong answers. In the given options, only NaOH is basic in nature, HCl and CH_3COOH are acidic while H_2O is neutral). Therefore, if we add a few drops of sodium hydroxide solution, the mixture will become basic and pink colour will appear.

16. *(d) into the page.*

Explanation: The direction of force is perpendicular to the direction of the magnetic field and the current as given by Fleming's left hand rule.

17. *(b) Both A and R are true and R is not the correct explanation of A.*

Explanation: Non-biodegradable substances are the substances that cannot be broken down into simpler substances by biological processes. They persist in the environment for a long time and may cause harm to the various members of the ecosystem.

Non-biodegradable substances like plastic can cause air pollution when they are burnt.

18. *(d) A is false but R is true.*

Explanation: The effect of root pressure in transport of water is more important during night time as during the day, when stomata are open, the transpiration pull becomes the major driving force in the transport of water in the xylem.

19. *(b) Both A and R are true and R is not the correct explanation of A.*

Explanation: Both statements are correct but the given reason does not explain how guard cells open and close stomatal pores. Each stomatal pore is surrounded by a pair of guard cells. When water flows into the guard cells, they swell and cause the pore to open. Similarly when the guard cells lose water, they shrink and the stomatal pore closes.

20. *(c) A is true but R is false.*

Explanation: Current is constant in a series circuit as there is only one path for flow of current. But different devices connected in a circuit have different power ratings and therefore draw different amounts of currents.

SECTION - B

21. (A) The SI unit of current is Ampere. Current (I) can be expressed in terms of the charge (Q) flowing in time (t) as: $I = \frac{Q}{t}$

(B) As materials used in electric heating devices are generally made up of alloys having resistivity in the range of 10^{-8} Ohm m to 10^{-6} Ohm–m, material A will be used for electric heating devices as it's resistivity is more than that of C, which is a metal since its resistivity is very low. B and D are insulators as they have very high resistivity.

OR

(A) Resistance of a conductor depends on the following factors:

(1) Length of the conductor

(2) Area of cross section of the conductor

(3) Nature of material of the conductor

(4) Temperature of the conductor

(B) Given: l = 10 km = 10000 m; d = 2 mm; r = 1 mm = 10^{-3} m; $\rho = 2.7 \times 10^{-8}\ \Omega$ m

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

$$= 2.7 \times 10^{-8} \times \frac{10000}{3.4 \times (10^{-3})^2}$$

$$= 0.859 \times 10^2\ \Omega$$

$$\approx 86\ \Omega \text{ approximately}$$

22. Contraceptive methods are mainly adopted:

(1) To avoid unwanted pregnancies.

(2) To keep the population of a country under control.

(3) To limit the number of children a couple wants to have.

(4) To maintain adequate gap between two consecutive children.

(5) To prevent the transmission of sexually transmitted diseases.

23. (A) Balanced equation for the reaction taking place on heating copper (II) nitrate in a boiling tube is given below:

$$\underset{\text{Copper (II) nitrate}}{2Cu(NO_3)_2} \rightarrow \underset{\substack{\text{Copper (II) oxide}\\ \text{(Black)}}}{2CuO} + O_2 + \underset{\substack{\text{Nitrogen dioxide}\\ \text{(X)}}}{4NO_2}$$

(B) The brown gas X evolved is nitrogen dioxide gas (NO_2).

24. The atomic number of carbon is 6 and its electronic configuration is 2, 4. It is tetravalent as it has 4 valence electrons. It can neither gain nor lose 4 electrons to acquire the nearest noble gas configuration. Only way is to share the four valence electrons with the electrons of other atoms. The type of bond formed by sharing of electrons is covalent bond.

OR

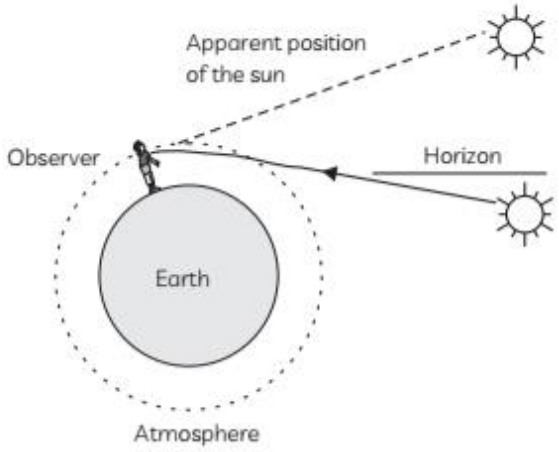
Covalent compounds are poor conductors of electricity as they do not have charged particles since the electrons are shared between atoms.

Covalent compounds have low melting and boiling points as they have weak inter molecular forces due to which little energy is required in changing state by overcoming the force of attraction.

25.

S.No.	Xylem	Phloem
(1)	Xylem conducts water and dissolved minerals from roots to leaves and other parts.	Phloem conducts prepared food material from leaves to other parts of plant in dissolved form.
(2)	In xylem, transport of material takes place through vessels and tracheids.	In phloem, transport of material takes place with the help of companion cells.
(3)	In xylem, upward movement of water and dissolved materials is mainly achieved by transpiration pull. It is caused due to sunction created by evaporation of water molecules from the stomata of a leaf.	In translocation, material is transferred into phloem tissue using energy from ATP. This increases the osmotic pressure that moves the material in the phloem to the tissues which have less pressure.
(4)	Movement of water is achieved by simple physical forces. There is no expenditure of energy. So, ATP molecules are not required.	The translocation in phloem is an active process and requires energy. This energy is taken from ATP molecules.

26. We are able to see the sun 2 minutes before actual sunrise and 2 minutes after actual sunset because sun rays undergo atmospheric refraction as they travel from an optically rarer medium to an optically denser medium when they enter the earth's atmosphere due to which they are refracted downwards and hence appear to be above the horizon.



SECTION - C

27. (A) The hormone adrenaline is released into a squirrel's blood when it detects danger, increasing heart rate and blood flow to tissues. As a result, its cells and tissues receive energy more quickly, allowing it to flee dangerous situations.

(B) Sensory neurons transmit impulses to the central nervous system after receiving information from receptors. In order for a muscle, gland, or organ to respond, motor neurons carry messages from the control nervous system to those tissues.

28. A balanced chemical equation tells:

(1) The number of atoms and molecules of reactants and products involved.

(2) The chemical formula of reactants and products involved.

(3) The catalyst involved in the reaction if any.

OR

The law of conservation of mass states that matter can neither be created nor destroyed in a chemical reaction. The mass of the products in a chemical reaction is equal to the mass of the reactants.

Example to illustrate the law of conservation of mass:

In the reaction $CaCO_3 \longrightarrow CaO + CO_2$,

The molecular mass of $CaCO_3$

$= 1 \times 40 + 1 \times 12 + 3 \times 16 = 100$ u

Molecular mass of CaO

$= 1 \times 40 + 1 \times 16 = 56$ u and

molecular mass of $CO_2 = 1 \times 12 + 2 \times 16 = 44$ u

Mass of the reactant = 100 u

Mass of the product = 56 u + 44 u = 100 u.

As the mass of the reactant is equal to the mass of the products, law of conservation of mass is verified.

29. (A) Both P and Q are North poles. Magnetic field lines emerge from North pole.

(B) Movement of electron beam from back wall to front wall is equivalent to the flow of electric current from front wall to the back wall. Now the deflection of the beam towards right means direction of force is towards the right side. According to Fleming's left hand rule, the magnetic field inside the chamber is in downward direction i.e. perpendicular to the plane of the paper and directed inwards.

OR

(A) The rule to determine the direction of magnetic field produced around a straight conductor-carrying current is Right hand thumb rule which states that that if one holds a straight current carrying conductor with right hand such that the thumb points towards the direction of current, then fingers will wrap around the conductor in the direction of field lines of the magnetic field.

(B) The rule to determine the direction of force experienced by a current-carrying straight conductor placed in a carrying straight conductor placed in a magnetic field which is perpendicular to it's Fleming's Left Hand Rule, which states that if the first finger points in the direction of magnetic field and second finger in the direction of current, then the thumb will point in the direction of motion or the force acting on the conductor.

30. (A) Ionic compounds have high boiling and melting point due to the presence of strong bond between cations and anions. To break or overcome these strong forces of attraction, a large amount of energy is required.

(B) Ionic compounds conduct electricity in molten state. Conductivity depends on the presence of number of free ions. Solid ionic compounds cannot conduct electricity because of the absence of ions (electrons) in the crystal structure. When the ionic compound is present in molten state,crystal structure deforms and they can easily conduct electricity with the free ions.

(C) Ionic compounds are solid at room temperature and are somewhat hard. Due to the presence of strong force of attraction between the positive and negative ions a solid ionic compound formed becomes hard and solid at room temperature.

31. (A) Ecosystem: It is the structural and functional unit of biosphere. It is a self-sustaining system where energy and matter are exchanged between living and non-living components. The main components of ecosystem are biotic and abiotic components. Biotic components comprise of living organisms: plants, animals, human beings and micro-organisms. Abiotic components comprise of non-living part of the environment: air, water, soil, minerals, sunlight etc.

(B) When green plants are eaten by primary consumers, a great deal of energy is lost as heat to the environment. Some amount goes into digestion and in doing work and the rest goes towards growth and reproduction. Only 10 percent of the energy received by them is converted into their body mass which is available for the organisms of the next trophic levels. The longer the food chain, the less is the energy available to the final members of the food chain and that energy will be insufficient for their survival.

32. Given pH for the solutions are

A = 4, B = 1, C = 11, D = 7, E = 9.

Hydrogen ions concentration increases with decrease in pH value and thus strength of acid increases with decrease in pH value from 7 to 0.

On the other hand, hydroxide ion's concentration decreases with increase in pH value and thus strength of bases increases with increase in pH value from 7 to 14.

While neutral solution has pH value = 7.

Therefore,

(A) Solution D is neutral having pH value equal to 7.

(B) Solution C is strongly alkaline as its pH value is equal to 11

(C) Solution B is strongly acidic as its pH value is equal to 1

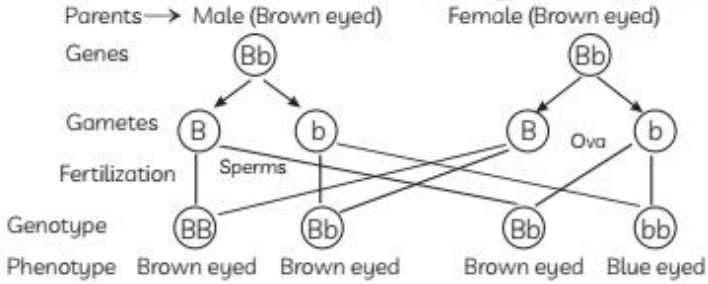
(D) Solution A is weakly acidic as its pH value is equal to 4

(E) Solution E is weakly alkaline as its pH value is equal to 9

Hence arrangement of given pH value in increasing order of hydrogen ion concentration:

C (11) < E (9) < D (7) < A (4) < B(1)

33. Two people with brown eyes can have a blue eyed baby but the chances are only 25% provided both the parents are heterozygous (Bb). Brown eye colour (B) is dominant and blue eye colour (b) is recessive.



Genotypic ratio : 1 : 2 : 1

Phenotypic ratio : 3 : 1

The child who inherits 'B' chromosome even from one parent will have brown eyes. The child who inherits 'b' chromosomes from both the parents will have blue eyes so the chances of brown eyed parents to have blue eyed baby is only 25%.

SECTION - D

34. (A) $CH_3—CH_2OH \xrightarrow[K_2Cr_4O_4 + Heat]{Alkaline\ KMnO_4 + Heat}$ CH_3COOH

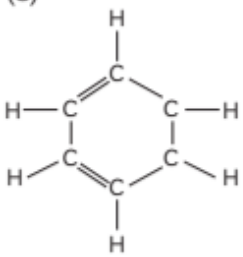
(X) (Y)

$CH_3—CH_2OH \xrightarrow[H_2SO_4]{Hot\ conc.} CH_2 = CH_2 + H_2O$

(Z)

(B) 'A' is detergent and 'B' is soap

(C)



Benzene—C_6H_6

It does not decolourize bromine water because it does not undergo addition reaction.

(D) $CH_3 — CH_2OH \xrightarrow[K_2Cr_2O_3 + Heat]{Alkaline\ KMnO_4 + Heat}$

Ethanol (A) CH_3COOH Acetic acid (B)

35. The different glands, their secretions and functions associated with the human digestive system are tabulated below:

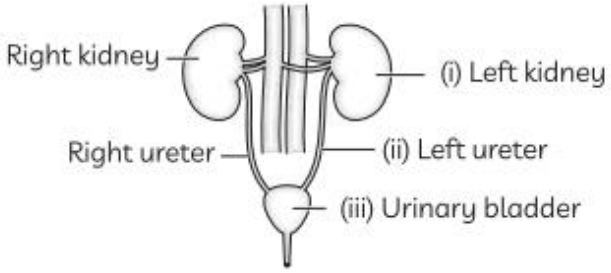
Organ	Gland	Secretion	Enzymes	Action of Enzyme
Mouth	Salivary gland	Saliva	Salivary amylase	Breaks down starch to sugar
Stomach	Gastric glands	Gastric juices	1. Pepsin	Breaks down protein-peptone.
			2. HCl	Kills germs, creates acidic medium.
			3. Mucus	Protects the walls of stomach from the action of HCl acid.
Small Intestine	Liver	Bile Juice		Emulsification of fats and creates alkaline medium.

OR

(A) Excretion is defined as the biological process of removal of harmful nitrogenous wastes like urea and uric acid from our body which are produced as by products of the various metabolic processes taking place in our body.

(B) The basic filtration unit present in the kidney is the nephron.

(C) The human excretory system is drawn here:



The organs performing the following functions have been labelled in the diagram.

(i) form urine: Kidneys
(ii) is a long tube which collects urine from kidney: Ureter
(iii) stores urine until it is passed out: Urinary bladder

36. (A) The student should use a concave mirror, as it forms a real image on the same side of the mirror.

(B) Object distance, u = –15 cm

Image distance, v = –60 cm

Magnification,

$$m = -\frac{v}{u} = -\left(\frac{-60}{-15}\right) = -4$$

(C) Distance of image from the object

= v – u = – 60 – (–15) = – 60 + 15 = –45

The image is formed at a distance of 45 cm from the object.

(D) By applying mirror formula,

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

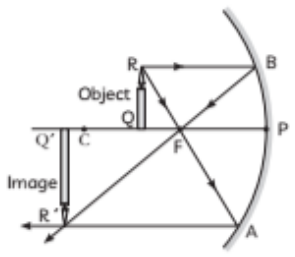
$$\frac{1}{f} = \frac{1}{-60} + \frac{1}{-15}$$

$$= \frac{-1-4}{60} = \frac{-5}{60} = \frac{-1}{60}$$

$f = -12$ cm

$C = -24$ cm.

Object will be between *F* and *C* and the image will be formed beyond *C* (centre of curvature). Image will be 4 times magnified, real and inverted.

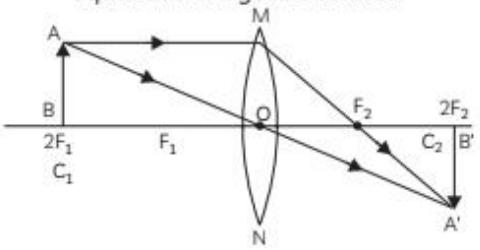


OR

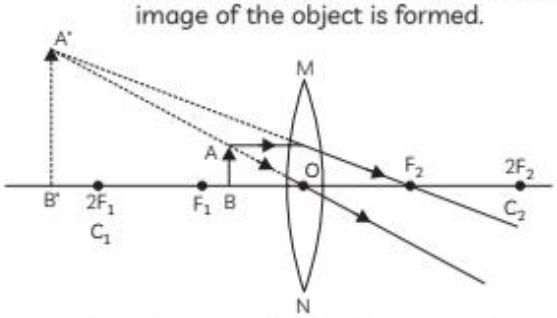
(A) Convex lens can be used as a magnifying glass,

Position of the object:

(i) When an object is placed at centre of curvature, a real, inverted and equal size image is obtained.

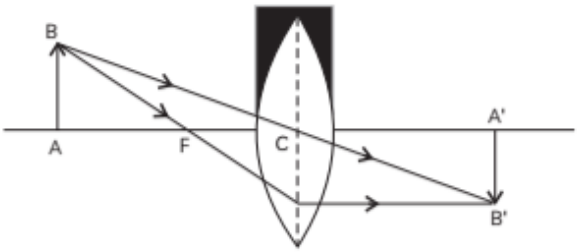


(ii) When an object is placed between the focus and the optical centre of a convex lens, a virtual and erect image of the object is formed.

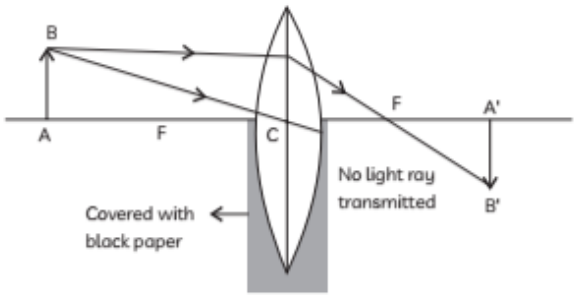


(B) Even when one half of the convex lens is covered with a black paper, the complete image of the object will be formed. When the upper half of the lens is covered: In this situation, rays of light coming from the object will be refracted by the lower half of the lens. These rays meet at the other side of the lens to form the image of the given object, as shown in the following figure. When the lower half of the lens is covered: In this situation, rays of light coming from the object will be refracted by the upper half of the lens. These rays meet at the other side of the lens to form the image of the given object, as shown in the following figure. We will get a sharp image but the brightness of the image will be less now.

(i)



(ii)



SECTION - E

37. (A) (i) *Plasmodium* reproduces by multiple fission whereby a single cell divides into a large number of cells.

Related Theory

- *In fragmentation, organisms like spirogyra simply break up into several pieces or fragments on attaining maturity and each fragment grows to form a new organism. In budding, a small outgrowth is formed due to repeated cell division at one specific site.*

Caution

- *Students usually get confused and write option (d) as answer. They do not understand the difference between the two types of fission. In binary fission, a cell divides into two cells. Whereas in multiple fission, a cell divides into multiple cells.*

(ii) P, Q, R and S

Each piece or fragment of *Planaria* grows into new individual by the method of regeneration. It is carried out by specialised cells.

(B) Spore formation is a common method of asexual reproduction. The hyphae develop sporangia. The nucleus of each sporangium divides several times. Each nucleus gets surrounded by a bit of cytoplasm and develops into spore. Upon maturation, the sporangium ruptures and spores disperse to grow on to new substratum.

OR

(B) The growth of bacteria population increases exponentially with time.

The variation of time and number of bacterial cells is not linear, as the graph is not a straight line. The growth pattern is an exponential increase in number of bacterial cells with time.

38. (A) Metals such as silver and gold do not react with oxygen even at high temperatures as they are relatively inert.

Related Theory

- *Different metals show different reactivity's towards oxygen.*
- *At ordinary temperature, the surfaces of metals such as magnesium, aluminium, zinc, lead, etc., are covered with a thin layer of oxide, which prevents the metal from further oxidation and is therefore a protective layer.*
- *Iron does not burn on heating but iron filings burn vigorously when sprinkled in the flame of a burner.*
- *Copper does not burn, but the hot metal is coated with a black coloured layer of copper (II) oxide.*

(B) Copper does not burn but is coated with black coloured copper oxide.

When heated, copper does not burn, but the hot copper metal is coated with a black coloured layer of copper (II) oxide.

$$2Cu + O_2 \rightarrow 2CuO$$

(C) Almost all metals combine with oxygen to form metal oxides.

$$\text{Metal} + \text{Oxygen} \longrightarrow \text{Metal oxide}$$

Some metal oxides, such as sodium oxide and potassium oxide, dissolve in water to form alkalis:

Moreover, some metal oxides, such as aluminium oxide and zinc oxide, show both acidic and basic nature and are known as amphoteric oxides.

OR

(C) The metal oxides sodium oxide and potassium oxide dissolve in water to form alkalis as follows:

$$Na_2O_{(s)} + H_2O_{(l)} \longrightarrow 2NaOH_{(aq)}$$

$$K_2O_{(s)} + H_2O_{(l)} \longrightarrow 2KOH_{(aq)}$$

39. (A) Red ray is least deviated by a prism as the refractive index of glass is least for red.

(B) Violet has the least wavelength among the colours of the visible spectrum. It has the minimum velocity.

(C) Formation of rainbow is due to dispersion of sunlight by the tiny droplets of water present in the atmosphere. Twinkling of stars and early sunrise are due to atmospheric refraction.

OR

(C) The angle between the emergent ray and the incident ray is known as the angle of deviation of a prism as shown in the following figure: