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SAMPLE TEST PAPER 01 FOR CLASS X BOARD EXAM 2021
(SAMPLE ANSWERS)

SUBJECT: SCIENCE	**MAX. MARKS : 80**
CLASS : X	**DURATION : 3 HRS**

General Instructions:

(i) *The question paper comprises four sections A, B, C and D. There are 36 questions in the question paper. All questions are compulsory.*

(ii) *Section–A - question no. 1 to 20 - all questions and parts thereof are of one mark each. These questions contain multiple choice questions (MCQs), very short answer questions and assertion - reason type questions. Answers to these should be given in one word or one sentence.*

(iii) *Section–B - question no. 21 to 26 are short answer type questions, carrying 2 marks each. Answers to these questions should in the range of 30 to 50 words.*

(iv) *Section–C - question no. 27 to 33 are short answer type questions, carrying 3 marks each. Answers to these questions should in the range of 50 to 80 words.*

(v) *Section–D – question no. - 34 to 36 are long answer type questions carrying 5 marks each. Answer to these questions should be in the range of 80 to 120 words.*

(vi) *There is no overall choice. However, internal choices have been provided in some questions. A student has to attempt only one of the alternatives in such questions.*

(vii) *Wherever necessary, neat and properly labeled diagrams should be drawn.*

SECTION – A

1. What would you observe when you put some aluminium pieces in copper sulphate solution?
Ans: When we put some aluminium pieces in blue coloured copper sulphate solution, blue colour disappears and solution becomes colourless.

2. When the lightning strikes, 100 C of charge flow in 0.02 s. What is the current?
Ans: Current, $I = Q/t = 100/0.02 = 5000A$

3. Filament type electric bulbs are not power efficient. Explain.
Ans: Filament type bulbs consume more electrical power to glow bright that is why they are less efficient.

4. Name any two biodegradable pollutants.
Ans: Paper and vegetable peels

OR

List four common solid waste disposal methods.
Ans: Landfills, pyrolysis, composting and incineration.

5. Write any two characteristics of food web.
Ans: Characteristics of food web are:
(i) Unlike food chains, food webs are never straight. Instead, each food web is formed by interlinking of various food chains.
(ii) A food web provides alternative pathways of food availability.

6. Out of the three elements P, Q and R having atomic numbers 11, 17 and 19 respectively, which two elements will show similar properties and why?
Ans: Electronic configuration of P(11) = 2, 8, 1
Electronic configuration of Q(17) = 2, 8, 7
and for R(19) = 2, 8, 8, 1

Thus, P and R belongs to group 1 as both have one valence electron and therefore they have similar properties.

OR

List any two properties of the elements belonging to the first group of the Modern Periodic Table.
Ans: Two properties of the elements belonging to the first group:
(i) Valency of these elements is one.
(ii) They are electropositive in nature.

7. A current carrying conductor is placed in a magnetic field. List the factors on which the magnitude of force experienced by conductor depends.
Ans: When a current carrying wire is placed in a magnetic field, it experiences a magnetic force that depends on
(i) current flowing in the conductor
(ii) strength of magnetic field
(iii) length of the conductor

8. A wire having a resistance of 10 W is bent to form a circle. What is the effective resistance between the two points along any diameter of the circle?

Ans: The wire is thus turned into a parallel combination of two resistances of 5 Ω each. So, equivalent resistance between two points A and B along any diameter of the circle is

$$\frac{1}{R} = \frac{1}{5} + \frac{1}{5} = \frac{2}{5} \Rightarrow R = \frac{5}{2}\Omega = 2.5\,\Omega$$

OR

Write the relation between resistance (R) of filament of a bulb, its power (P) and a constant voltage V applied across it.
**Ans:** The relation between resistance (R), power (P) and voltage (V) of a bulb is, P= V²/R

9. State the effect of magnetic field on the path of a charged particle moving in it.
Ans: A charged particle moving in a magnetic field may experience a force in the direction perpendicular to direction of magnetic field and direction of motion of particle. This force deflects the charged particle from its path.

10. Draw ray diagrams to show the principal focus of a concave mirror.
Ans:
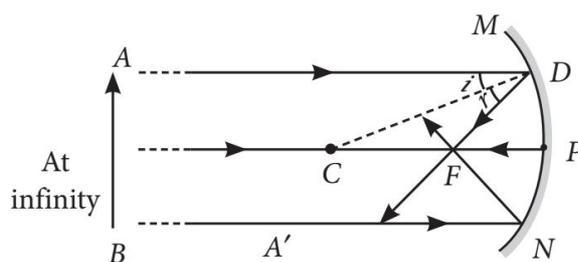
OR

Explain why a ray of light passing through the centre of curvature of a concave mirror gets reflected along the same path.
Ans: A ray passing through centre of curvature of a concave mirror gets reflected along the same path because it falls along normal to the surface of mirror, and we know that any ray passing through normal reflects along the same path.

11. Why plastic bags and containers should not be disposed off by burning? Give reason.
Ans: It is so because plastic, when burnt, gives off noxious fumes which pollute the air.

12. Name the cartilaginous flap which doses the glottis to check the entry of food into it during swallowing.

Ans: Epiglottis

OR

Define variations.

Ans: Variations are differences that occur between the organisms of the same species inspite of the same basic features.

13. Define food chain.

Ans: The sequential interlinking of organisms involving the transfer of food energy from the producers, through a series of organisms with repeated eating and being eaten is called food chain.

For question numbers 14-16, 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.

14. Assertion: The twinkling of stars is due to the fact that refractive index of the earth's atmosphere fluctuates.

Reason: When light propagates from one medium to another its direction of propagation changes.

Ans: (a): The continuously changing atmosphere is able to cause variation in the light coming from a point-sized star because of which the star appears to be twinkling.

15. Assertion: Reactivity series is an arrangement of element based on their reactivity.

Reason: Reactivity series is used to separate elements based on their reactivity.

Ans: (b)

OR

Assertion: Different metals have different reactivities with water and dilute acids.

Reason: Reactivity of a metal depends on its position in the reactivity series.

Ans: (a): The metals placed at the top of the series are most reactive.

**16. Assertion:** Ozone is present in the layer of earth's atmosphere.

Reason: Ozone is a gas released by burning fuels.

Ans: (c): Ozone layer is present in the stratosphere of the atmosphere. It is formed by photochemical reactions. The UV radiations spilt some molecular oxygen (O_2) apart into free oxygen atom (O + O). These atoms then combine with molecular oxygen to form ozone.

Answer Q. No 17-20 contain five sub-parts each. You are expected to answer any four subparts in these questions.

17. Read the following and answer any four questions from 20(i) to 20(v).

Reproduction is a process by which living organisms are able to produce young ones of their new kind. Living organisms reproduce by two ways - asexual reproduction and sexual reproduction. Asexual reproduction involves the production of an offspring from a single parent without the fusion of gametes. This mostly occurs in unicellular organisms, some plants and certain multicellular organisms. There are various types of asexual reproduction.
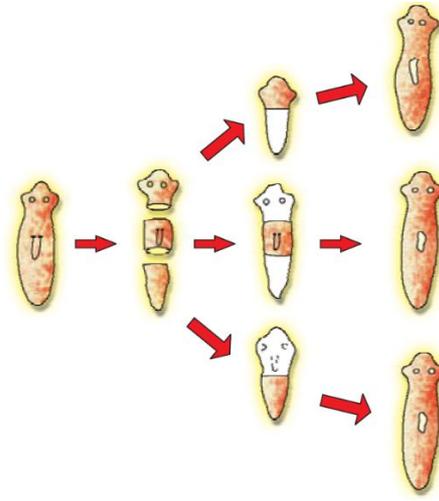
(i) The type of reproduction shown in the figure is
(a) budding   (b) fragmentation   (c) regeneration   (d) fission.

(ii) Which of the following is correct example of the process shown in the given figure?
(a) Hydra   (b) Planaria   (c) Amoeba   (d) Both (a) and (b)

(iii) A feature of reproduction that is common to Amoeba, yeast and bacteria is that
(a) they are all unicellular   (b) they are all multicellular
(c) they reproduce only sexually (d) they reproduce asexually.

(iv) Asexual reproduction is
(a) a fusion of specialised cells
(b) a method by which all types of organism reproduce
(c) a method producing genetically identical offspring
(d) a method in which more than one parent are involved.

(v) From the given list of organisms, those which reproduce by the asexual method are:
(i) Aspergillus (ii) Dog (iii) Papaya (iv) Paramecium
(a) (i) and (ii)   (b) (ii) and (iii)   (c) (i) and (iv)   (d) (ii), (iii) and (iv)

Ans: (i) (c): Regeneration is the process by which small cut parts of body organism grow to form whole new organisms.
(ii) (d): Simple animals like Hydra and Planaria can be cut into any number of pieces and each piece grows into a complete organism by regeneration.
(iii) (d)
(iv) (c): In asexual reproduction, the young one receives all its genes from one parent, so offspring produced are genetically identical to the parents.
(v) (c): Aspergillus and Paramecium reproduce by spore formation and fission respectively. All these are methods of asexual reproduction. Dog and papaya reproduces through sexual methods.

18. Read the following and answer any four questions from 18(i) to 18(v).
Acetic acid was added to a solid 'X' taken in a test tube. A colourless and odourless gas was evolved. The gas was passed through lime water which turned milky. Thistle funnel Colourless and odourless gas Acetic acid Test tube Delivery tube Test tube Limewater (Calcium hydroxide solution) Solid 'X' Cork Stand.
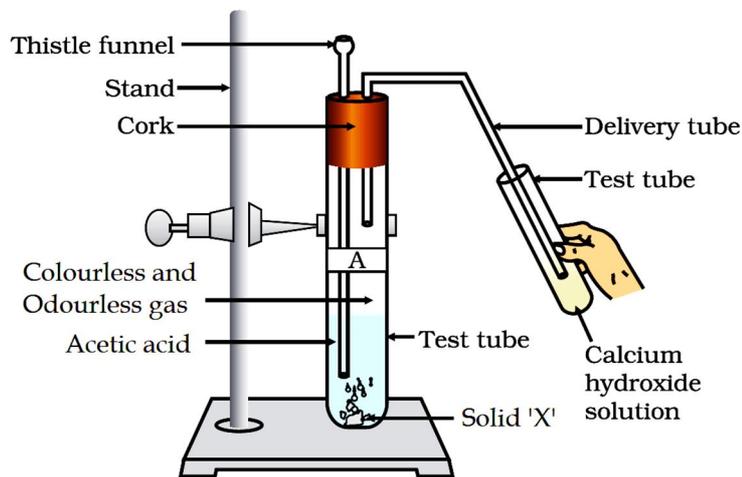
(i) The solid 'X' is
(a) sodium hydroxide   (b) sodium bicarbonate
(c) sodium acetate   (d) sodium chloride.

(ii) The gas evolved is
(a) CO_2 (b) SO_2 (c) Cl_2 (d) H_2

(iii) When evolved gas is passed through lime water, it turns milky due to formation of
(a) calcium hydroxide   (b) calcium bicarbonate
(c) calcium oxide   (d) calcium carbonate.

(iv) When excess of carbon dioxide gas is passed through lime water, milkiness disappear due to formation of
(a) $CaCl_2$ (b) $CaCO_3$ (c) $Ca(HCO_3)_2$ (d) $NaHCO_3$

(v) The evolved gas is also produced when metal carbonates react with
(a) magnesium oxide   (b) sodium hydroxide
(c) hydrogen chloride   (d) zinc sulphate.

Ans:
(i) (b): 'X' is sodium bicarbonate, NaHCO3.
(ii) (a):

$$CH_3COOH_{(aq)} + NaHCO_{3(s)} \rightarrow CH_3COONa_{(s)} + H_2O_{(l)}$$

(iii) (d):

$$Ca(OH)_{2(aq)} + CO_{2(g)} \rightarrow CaCO_{3(s)}\downarrow$$

Lime water   Carbon   Calcium
               dioxide   carbonate
                       (white ppt.)
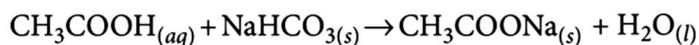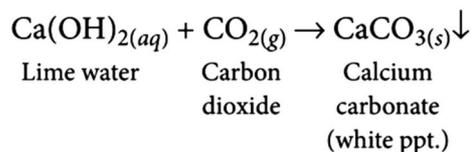
(iv) (c): When excess of CO_2 gas is passed through lime water, the white ppt. of $CaCO_3$ dissolves due to formation of soluble salt of calcium bicarbonate.

$$CaCO_{3(s)}\downarrow + CO_{2(g)} + H_2O_{(l)} \rightarrow Ca(HCO_3)_{2(aq)} + H_2O$$

Calcium   Carbon   Water   Caclium bicarbonate
carbonate   dioxide   (Soluble in water)
(white ppt.)   (clear solution)
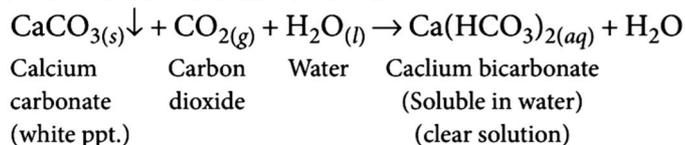
(v) (c): Metal carbonates give CO_2 gas on reaction with acids.

$$CaCO_3 + 2HCl \rightarrow CaCl_2 + H_2O + CO_2$$

19. Read the following and answer any four questions from 18(i)-18(v).

Sample pieces of five metals, A, B, C, D and E are added to the tabulated solutions separately. The results observed are shown in the table given below:

Metals	Solution				
	FeSO$_4$	CuSO$_4$	ZnSO$_4$	AgNO$_3$	Al$_2$(SO$_4$)$_3$
A	No change	No change	No change	A coating on metal	No change
B	Grey deposit	Brown coating	No change	A coating on metal	No change
C	No change	No change	No change	No change	No change
D	No change	--	No change	A coating on metal	No change
E	--	Brown coating	New coating	New coating	No change

Based on the observations recorded in the table answer the following questions:

(i) Which is the most reactive metal?
(a) B (b) C (c) D (d) E
Ans: (d): The most reactive metal is E.

(ii) Which is the least reactive metal?
(a) A (b) C (c) E (d) B
Ans: (b): The least reactive metal is C.

(iii) Activity series of elements is
(a) the arrangement of elements in increasing order of reactivity.
(b) the arrangement of elements in decreasing order of reactivity.
(c) the arrangement of oxides of elements in increasing order of reactivity.
(d) none of these.
Ans: (b) the arrangement of elements in decreasing order of reactivity.

(iv) Which of the following metal is least reactive?
(a) Gold (b) Copper (c) Platinum (d) Tin
Ans: (c) Platinum

(v) Decreasing order of reactivity is
(a) A > B > C > D > E (b) B > E > C > D > A
(c) E > B > D > A > C (d) D > C > B > E > A
Ans: (c) E > B > D > A > C

20. Read the following and answer any four questions from 19(i) to 19(v).

The current in the conductor is directly proportional to the potential difference across the conductor provided physical conditions of the conductor i.e., temperature, length, cross-sectional area and material, does not change.

$$i \propto V$$

Putting the proportionality constant (R), we get i = V/R or V = iR, where R is a constant called resistance of conductor

Substance which follow Ohm's law are called ohmic substance or a linear conductor. For ohmic substances, the slope of i versus V graph is a constant. Substances which do not follow Ohm's law are called non-ohmic substance or non-linear conductor. For non-ohmic substances, the slope of i versus V graph is not a constant. A student wants to check experimentally how the resistance of a lamp varies with the length of the wire. Two sets of reading obtained, are shown below.

Ammeter reading, I (A)	Voltmeter, V(V)	Resistance, R(Ω)
0.2	0.4	
1.0	3.2	

(i) Using the table calculate the resistance of the lamp for different currents.
(a) 1, 2   (b) 2.0, 3.2   (c) 4.2, 5.1   (d) 2.2, 2.8
Ans: (b) 2.0, 3.2

Ammeter reading, I (A)	Voltmeter, V(V)	Resistance, R(Ω)
0.2	0.4	2.0
1.0	3.2	3.2

(ii) Before the current flows in the lamp, what is the reading on the voltmeter?
(a) 0 V   (b) 0.4 V   (c) 3.2 V   (d) 0.6 V
Ans: (a): When I = 0, V = 0

(iii) Which of the following I-V graph represents for ohmic conductors?
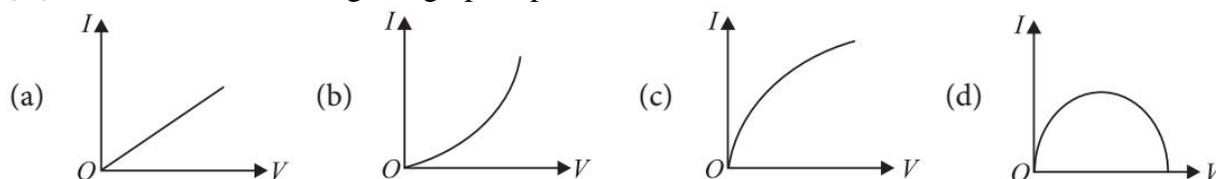
Ans: (a): Ohm's law V = IR is an equation of straight line. Hence, I - V characteristics for ohmic conductors is also a straight line and its slope gives resistance of the conductor.

(iv) The electrical resistance of a conductor depends upon
(a) size of conductor   (b) temperature of conductor
(c) geometry of conductor   (d) all of these.
Ans: (d): The electrical resistance of a conductor depends upon all factors size, temperature and geometry of conductor.

(v) Slope V-I graph gives
(a) resistivity   (b) energy dissipated   (c) power   (d) resistance
Ans: (a): Slope of V-I graph gives resistance (R). For ohmic substance it is constant and for non-ohmic, R is variable.

SECTION – B

21. Why is photosynthesis important?
    Ans: Photosynthesis is important due to following reasons:
    (i) It is the primary source of food on earth.
    (ii) It releases oxygen into the atmosphere which is a vital for living organisms to survive.

22. What is the role of acid in our stomach?
    Ans: Hydrochloric acid (HCl) present in our stomach kills the bacteria ingested with food. It creates an acidic medium of pH about 2, facilitating the action of pepsin enzyme.
<div align="center">**OR**</div>
    (a) What is peristaltic movement?
    (b) In which part of the digestive system is water absorbed?
    Ans: (a) The lining of the alimentary canal has muscles which contract rhythmically in order to push food forward. These movements are called peristaltic movements.
    (b) Large intestine is concerned with the absorption of water.

23. Define covalent bond. Explain with the help of example.

Ans: The bond formed by equal contribution and mutual sharing of electrons between two atoms (same or different) so that both the atoms acquire the stable nearest noble gas configuration i.e., get their octet complete is called covalent bond. For example; formation of a hydrogen molecule (H_2)

$$\dot{H} + \dot{H} \longrightarrow \boxed{H \overset{\cdot\cdot}{} H} \quad \text{or} \quad H\text{—}H$$

24. What is an oxidation reaction? Identify the substance which gets oxidised, the substance which gets reduced, the oxidising agent and the reducing agent in the following reaction:

$$Cu + 2AgNO_3 \rightarrow Cu(NO_3)_2 + 2Ag$$
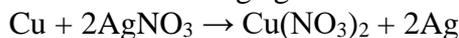
Ans: Oxidation reaction may be defined as a chemical reaction which involves the addition of oxygen to a substance or the removal of hydrogen from a substance.

$Cu + 2AgNO_3 \rightarrow Cu(NO_3)_2 + Ag$
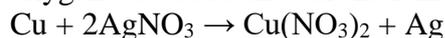
Copper has been oxidised and, therefore, it is a reducing agent.

AgNO3 has been reduced and therefore, it is an oxidising agent.

25. An object of height 6 cm is placed perpendicular to the principal axis of a concave lens of focal length 5 cm. Use lens formula to determine the position, size and nature of the image if the distance of the object from the lens is 10 cm.

Ans: Focal length of given concave lens, $f = -5$ cm

Distance, $u = -10$ cm; object size, $h = 6$ cm

Image distance, $v = ?$

Using lens formula, $\dfrac{1}{f} = \dfrac{1}{v} - \dfrac{1}{u}$

$\dfrac{1}{v} = \dfrac{1}{f} + \dfrac{1}{u} = \dfrac{1}{-5} + \dfrac{1}{-10} = \dfrac{-3}{10}$; $v = -\dfrac{10}{3} = -3.33$ cm

So, the image is located 3.33 cm from the lens.

Magnification (m) of lens is given by

$$m = \frac{v}{u} = \frac{-\dfrac{10}{3}}{-10} = \frac{1}{3} = 0.33$$

m is positive implies that image is virtual and erect.

Also, magnitude of m is less than one implies that image is diminished.

Since, $m = \dfrac{v}{u} = \dfrac{h'}{h} \implies \dfrac{1}{3} = \dfrac{h'}{6}$ or $h' = 2$ cm

26. Draw a labelled circuit diagram showing three resistors R_1, R_2 and R_3 connected in series with a battery (E), a rheostat (Rh), a plug key (K) and an ammeter (A) using standard circuit symbols. Use this circuit to show that the same current flows through every part of the circuit. Also, list two precautions you would observe while performing the experiment.

Ans: By changing the positions of ammeter note the reading of ammeter each time. You will find that all the readings obtained are same. So, the value of the current in the ammeter is the same, independent of its position in the electric circuit. From this we can also conclude that, the current is same in every part of the circuit.
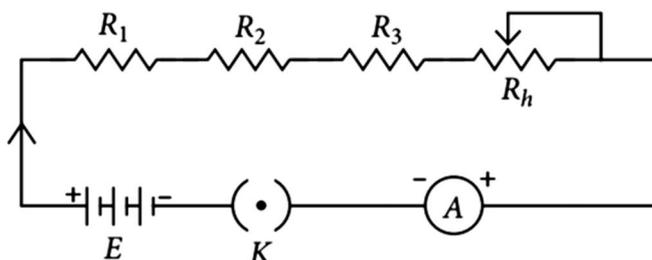
Precautions:
(a) All the connections should be neat and tight.
(b) Ammeter should be connected with the proper polarity, i.e., positive terminal of the ammeter should go to positive terminal and negative terminal of ammeter to the negative terminal of the battery or cell used.

OR

Two identical resistors of resistance R are connected in series with a battery of potential difference V for time t. The resistors are then connected in parallel with the same battery for the same time t. Compare the heat produced in the two cases.

Ans: If resistors are connected in series, then total resistance of the combination would be,

$R_S = R + R = 2R$ ...(i)

Let H_s be the heat produced in series combination.

$$\therefore \quad H_S = I_S^2 R_S t \quad \text{or} \quad H_S = \frac{V^2}{R_S} t$$

$$H_S = \frac{V^2}{2R} t = \frac{1}{2}\left(\frac{V^2}{R} t\right) \qquad \text{[Using (i)]}$$

If resistors are connected in parallel, total resistance (R_P) can be

$$\frac{1}{R_P} = \frac{1}{R} + \frac{1}{R} = \frac{2}{R} \quad \therefore \quad R_P = \frac{R}{2} \qquad \text{...(ii)}$$

Let H_P be the heat produced in parallel combination,

$$H_P = \frac{V^2}{R_P} t = \frac{V^2}{\frac{R}{2}} \times t = 2\frac{V^2}{R} t \qquad \text{[Using (ii)]}$$

So, $H_P = 4H_S$

Thus, heat produced in parallel combination will be four times the heat produced in series.

SECTION – C

27. (i) State four factors on which the strength of magnetic field produced by a current carrying solenoid depends.

   Ans: Strength of magnetic field produced by a current carrying solenoid depends upon the following factors:
   (a) Number of turns in the coil
   (b) Amount of current flowing through it
   (c) Radius of coil
   (d) Material of core of the solenoid.

   (ii) Draw circuit diagram of a solenoid to prepare an electromagnet.

   Ans: A strong magnetic field produced inside a solenoid can be used to magnetise a piece of magnetic material, like soft iron, The magnet so formed is called an electromagnet.
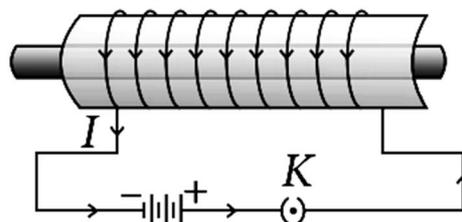
28. What is 'dispersion of white light'? State its cause. Draw a ray diagram to show the dispersion of white light by a glass prism.

Ans: Splitting of white light into its seven constituent colours due to refraction is known as dispersion of white light.

Cause of dispersion: When a beam of white light enters a prism, it gets refracted and splits into seven constituent colours. The splitting of the light ray occurs due to the different bending angle for each colour. Thus, each colour ray while passing through the prism bends at different angles with respect to the incident beam and gives rise to a spectrum.
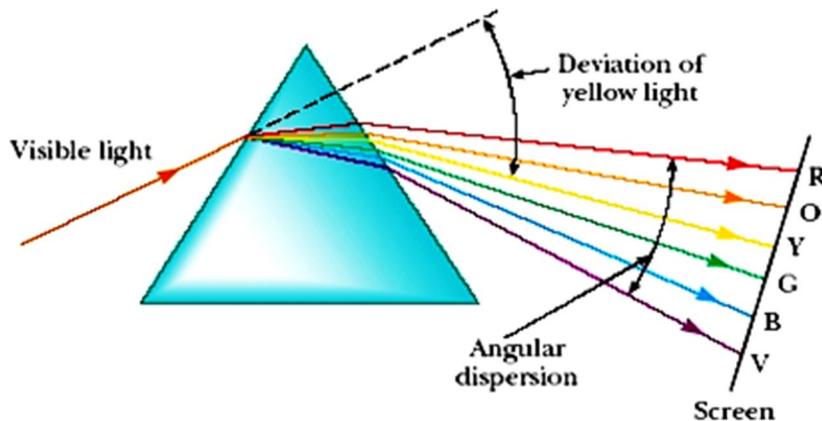
OR

State the difference in colours of the sun observed during sunrise/sunset and noon. Give explanation for each.

Ans: During sunrise or sunset, the Sun's rays pass through a maximum distance of the atmosphere. Most of the blue and shorter wavelength get scattered. Only the red colour of light reaches the observer. That is why the Sun observed during sunset and sunrise appears red. At noon, the distance to be travelled is least. All wavelengths are scattered equally and hence sun appears white.
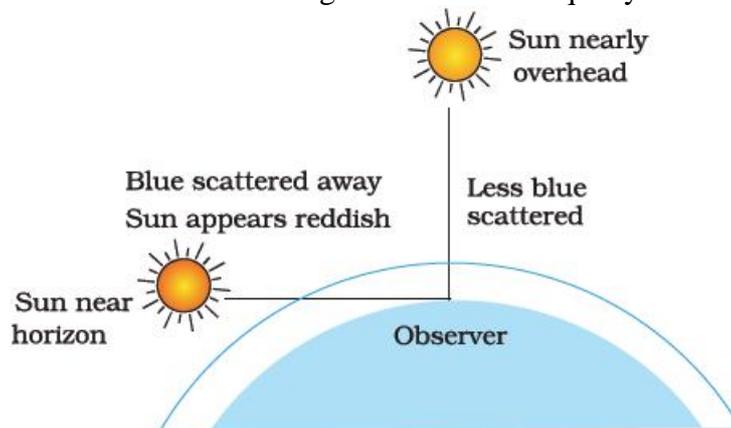
29. State the reason why carbon can neither form C^{4+} cations nor C^{4-} anions, but forms covalent bonds. Also state reasons to explain why covalent compounds (i) are bad conductors of electricity (ii) have low melting and boiling points.

Ans: Carbon which has four electrons in its outermost shell cannot form ionic bonds because

– If carbon forms ionic bonds by gaining four electrons to attain a noble gas configuration then it would be difficult for six protons in the nucleus to hold ten electrons.

– If carbon forms ionic bonds by loss of four electrons then it would require a lot of energy to remove these electrons from outermost shell. Due to these reasons carbon forms covalent bonds by sharing the valence electrons.

(i) Covalent compounds are generally poor conductors of electricity because they do not have free electrons or ions.

(ii) Covalent compounds have low melting and boiling points because the forces of attraction between molecules of covalent compounds are very weak. On applying a small amount of heat these molecular forces break.

30. (a) Name one pair of elements in the Mendeleev's periodic table whose positions were not in increasing order of their atomic masses.
(b) If R is the symbol of an element in the third period and third group of Mendeleev's periodic table then what is the formula of its oxide?
(c) Carbon is a non-metal belonging to group 14. Do you find a metal in this group?
Ans: (a) Co and Ni
(b) R_2O_3
(c) Yes, tin and lead both are metals in group 14.

31. Differentiate between inherited and acquired traits.
**Ans:** Differences between inherited and acquired traits are as follows:

S. No.	Inherited traits	Acquired traits
(i)	These are obtained from the parents.	These are developed during the life of an individual.
(ii)	These are genetic variations.	These are somatic variations.
(iii)	These develop due to crossing over phenomenon and mutations.	These develop due to use and disuse of organs and direct effect of environment.
(iv)	These are passed on from one generation to the other.	These are lost with the death of the individual.

32. Explain determination of sex among human beings, with the help of an illustration.
Ans: Diploid organisms like human beings have separate sexes. In organisms, where sex is determined genetically, a pair of chromosomes called sex chromosomes determines the sex of the individual. All other chromosomes are termed autosomes. In human beings, there are 46 chromosomes. Of these, one pair is of sex chromosomes which are of two types – X chromosome and Y chromosome.
(i) A male individual contains one X chromosome and one Y chromosome, i.e., XY.
(ii) A female contains two X chromosomes, i.e., XX. The sex of the child is determined at the time of fertilisation when male and female gametes fuse to form zygote.
It can be shown as follows:
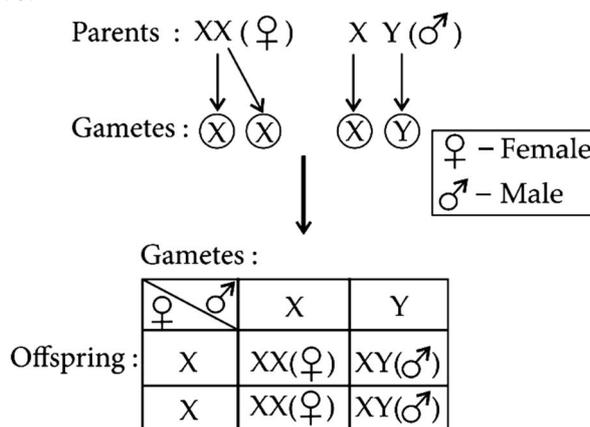
33. (a) Define contraception. What are the different methods of contraception?
(b) Give three examples of sexually transmitted diseases.
Ans: (a) The methods or devices of birth control which deliberately prevent fertilisation are referred to as contraception. Different types of contraceptive methods are:
(i) Barrier methods; (ii) Chemical methods; (ii) IUCD (iv) Natural methods (v) Surgical methods.
(b) Gonorrhea, Syphilis and AIDS.

SECTION – D

34. (a) What will happen:
(i) if a lighted candle is brought near the mouth of gas jar containing hydrogen gas?
(ii) if carbon dioxide gas is passed through lime water?
(b) Give one example each of the reaction involving combination of
(i) an element with another element
(ii) an element with a compound
(iii) a compound with another compound.
Ans: (a) (i) The candle extinguishes with a pop sound and the gas burns with a pale blue flame.
(ii) CO_2 turns lime water milky.

$$\underset{\text{Lime water}}{Ca(OH)_2} + CO_2 \longrightarrow \underset{\substack{\text{White ppt.}\\\text{(milkiness)}}}{CaCO_3}{\downarrow} + H_2O$$

(b) (i) $Fe + S \xrightarrow{\Delta} FeS$
(ii) $2CO + O_2 \longrightarrow 2CO_2$
(iii) $NH_3 + HCl \longrightarrow NH_4Cl$

35. (i) The image of a candle flame placed at a distance of 30 cm from a spherical lens is formed on a screen placed on the other side of the lens at a distance of 60 cm from the optical centre of the lens. Identify the type of lens and calculate its focal length. If the height of the flame is 3 cm, find the height of its image.
(ii) How should a ray of light be incident on a rectangular glass slab so that it comes out from the opposite side of the slab without being displaced?
Ans: (i) Given that $u = -30$ cm, $v = 60$ cm, $h = 3$ cm

Using lens formula,
$$\frac{1}{v} - \frac{1}{u} = \frac{1}{f} ; \therefore \quad \frac{1}{60} - \frac{1}{(-30)} = \frac{1}{f}$$
$$\Rightarrow \quad \frac{1}{f} = \frac{1+2}{60} = \frac{3}{60} = \frac{1}{20} \quad \text{or } f = 20 \text{ cm}$$

As focal length is positive, hence lens is convex lens.

Magnification, $m = \dfrac{v}{u} = \dfrac{h'}{h}$

$$\therefore \quad \frac{60}{-30} = \frac{h'}{3} \text{ or } h' = \frac{-60 \times 3}{30} = -6 \text{ cm}$$

⇒ The height of image is 6 cm and negative sign shows that the image is real and inverted.
(ii) A ray of light should be incident perpendicular to the surface of the rectangular glass slab so that it comes out from the opposite side of the slab without being displaced.

OR

(i) Define focal length of a lens.
(ii) A divergent lens has a focal length of 30 cm forms the image of an object of size 6 cm on the same side as the object at a distance of 15 cm from its optical centre. Use lens formula to determine the distance of the object from the lens and the size of the image formed.
(iii) Draw a ray diagram to show the formation of image in the above situation.
Ans: (i) Distance between the principal focus and the optical centre of a lens is known as its focal length.
(ii) Given: $f = -30$ cm, $v = -15$ cm, $h = 6$ cm. Now, from lens formula

$$\frac{1}{f}=\frac{1}{v}-\frac{1}{u} \quad \Rightarrow \quad \frac{-1}{30}=\frac{-1}{15}-\frac{1}{u}$$

$$\frac{1}{u}=\frac{-1}{15}+\frac{1}{30} \quad \Rightarrow \quad u=-30\,\text{cm}$$

$$\therefore \quad m=\frac{h'}{h}=\frac{v}{u}$$

$$\Rightarrow \quad h'=\left(\frac{v}{u}\right)h \quad \Rightarrow \quad h'=\left(\frac{-15}{-30}\right)\times 6\,\text{cm}=3\,\text{cm}$$

(iii)

36. Describe the components of the transport system in human beings. What are the functions of these components?

Ans: The components of the human transport system are blood vascular system and lymphatic system. Blood vascular system: It consists of heart, blood vessels and blood.

(i) Heart: It is a muscular pumping organ which keeps the circulating medium (blood) in a state of continuous movement.

(ii) Blood vessels: These are channels through which blood flows.

Blood vessels are of three types:

(a) Arteries: They carry oxygenated blood from the heart to different parts of the body.

(b) Veins: They transport deoxygenated blood from different parts of the body back to the heart.

(c) Capillaries: Help in exchange of materials between blood and living cells through tissue fluid.

(iii) Blood: It consists of plasma and corpuscles (RBCs, WBCs and platelets).

(a) Plasma: It is the liquid part of the blood which helps in transport of hormones, nutrients, excretory matter, etc.

(b) RBCs: Help in transport of respiratory gases - O_2 and CO_2.

(c) WBCs: Act as soldiers of the body.

(d) Platelets: Help in blood clotting.

Lymphatic system: It is a network of thin walled vessels. It consists of lymph, lymphatic vessels and lymph nodes.

(i) Lymph: Helps in transport of respiratory gases, fatty acids, glycerol, vitamins, etc., inside body.

(ii) Lymphatic vessels: Collect lymph and transport it to the veins.

(iii) Lymph node: Helps in formation of lymphocytes.

OR

Describe the process of urine formation in the kidney.

Ans: In the kidney, the wastes are converted in urine by three processes:

(i) Ultrafiltration: In it, large amount of water along with certain harmful substances like urea, uric acid, K+, ammonium salts, creatinine, etc., and certain useful substances like glucose, amino

acids, Na+, etc., pass through glomerular capillaries and glomerular membrane into cavity of Bowman's capsule of nephrons under pressure. The filtrate so formed is called nephric filtrate which is moved towards ureter.

(ii) Selective reabsorption: In it, large amount of water and sodium; whole of glucose and amino acids and small amount of urea are passed back from nephric filtrate into blood capillaries. It occurs either by back diffusion (i.e., water and urea) or active transport (i.e., Na+, glucose and amino acids). It generally occurs in PCT of nephrons.

(iii) Tubular secretion: In this, certain harmful chemicals like uric acid, creatinine, K+, etc., are passed from blood capillaries surrounding the nephron into nephric filtrate by active transport. It generally occurs in DCT of nephrons. Now, the fluid is termed as urine and is excreted out of the excretory organs.

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