

CBSE
Class X Science
Sample Paper 1

Time: 3 hrs

Total Marks: 80

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.
 - (iii) 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.
 - (iv) Section–B - question no. 21 to 26 are short answer type questions, carrying 2 marks each. Answers to these questions should be in the range of 30 to 50 words.
 - (v) Section–C - question no. 27 to 33 are short answer type questions, carrying 3 marks each. Answers to these questions should be in the range of 50 to 80 words.
 - (vi) 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.
 - (vii) 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.
 - (viii) Wherever necessary, neat and properly labelled diagrams should be drawn.
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SECTION A

1. Why is electrolysis of water an endothermic reaction?

OR

Can rancidity be retarded by storing foods away from light? (1)

2. Why are isotopes of an element with different atomic masses placed at the same position in the periodic table? (1)
3. How many electrons do the following elements have in their outermost shells? Give reason for your choice. (1)

9
F
Fluorine
18.9984032

17
Cl
Chlorine
35.453

35
Br
Bromine
79.904

53
I
Iodine
126.90447

- i) 1
- ii) 4
- iii) 2
- iv) 7 (1)

4. Why does the Sun appear white at noon? (1)

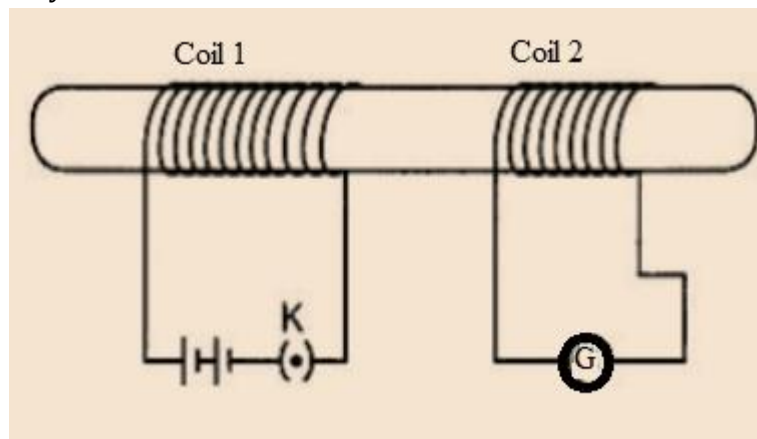
5. Both a spherical mirror and a thin spherical lens have a focal length of (-) 15cm. What type of mirror and lens are these? (1)

6. The image formed by a concave mirror is observed to be real, inverted and larger than the object. Where is the object placed?

OR

Name the part of a lens through which a ray of light passes without suffering any deviation. (1)

7. In the arrangement shown in figure there are two coils wound on a non-conducting cylindrical rod. Initially the key is not inserted in the circuit. Later the key is inserted and then removed shortly after.



What are the two observations that can be noted from the galvanometer reading? (1)

8. Draw the magnetic field lines around a straight current carrying conductor. (1)

9. Two unequal resistances are connected in parallel. If you are not provided with any other parameters (e.g. numerical values of I and R), what can be said about the voltage drop across the two resistors? (1)

OR

Some work is done to move a charge Q from infinity to a point A in space. The potential of the point A is given as V. What is the work done to move this charge from infinity in terms of Q and V? (1)

10. Veins are thin walled and have valves. Justify. (1)

11. How is the wall of small intestine adapted for performing the function of absorption of food?

OR

Out of a goat and a tiger, which one will have a longer small intestine? Justify your answer. (1)

12. Explain how ozone being a deadly poison can still perform an essential function for our environment. (1)

OR

Give reason why a food chain cannot have more than four trophic levels. (1)

13. State the role of pancreas in digestion of food. (1)

For question numbers 14, 15 and 16, two statements are given- one labeled Assertion (A) and the other labeled 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. (1)

14. Assertion: According to Mendeleev, periodic properties of elements are periodic function of their atomic number.
Reason: Atomic number is equal to the number of protons. (1)

15. Assertion: Food chain is responsible for the entry of harmful chemicals in our bodies.
Reason: The length and complexity of food chains vary greatly.

OR

Assertion: Greater number of individuals are present in lower trophic levels.
Reason: The flow of energy is unidirectional. (1)

16. Assertion: A geneticist crossed a pea plant having violet flowers with a pea plant with white flowers, he got all violet flowers in first generation.
Reason: White colour gene is not passed on to next generation. (1)

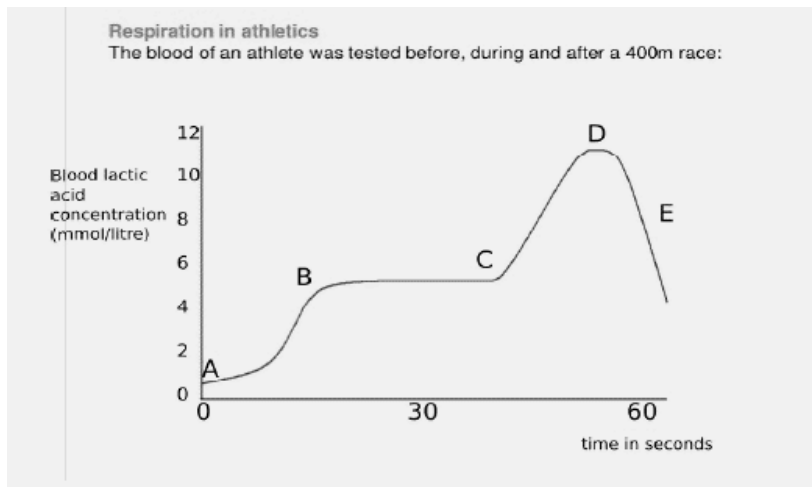
Answer Q. No 17 - 20 contain five sub-parts each. You are expected to answer any four subparts in these questions.

17. Read the following and answer any four questions from 17 (i) to 17 (v). (1×4)
All living cells require energy for various activities. This energy is available by the breakdown of simple carbohydrates either using oxygen or without using oxygen.

- (i) Energy in the case of higher plants and animals is obtained by
a) Breathing

- b) Tissue respiration
- c) Organ respiration
- d) Digestion of food

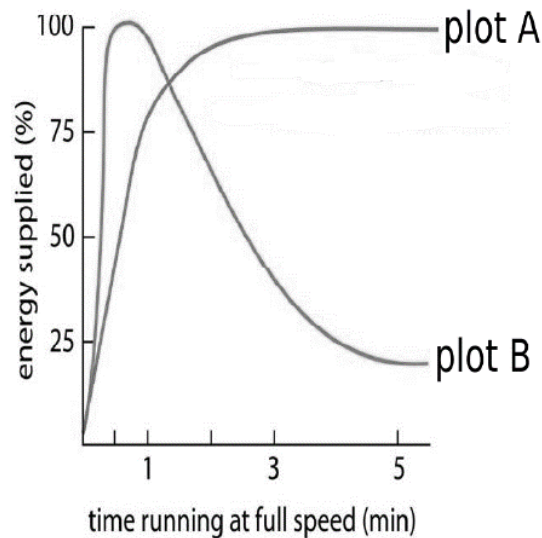
(ii) The graph below represents the blood lactic acid concentration of an athlete during a race of 400 m and shows a peak at point D.



Lactic acid production has occurred in the athlete while running in the 400 m race. Which of the following processes explains this event?

- e) Aerobic respiration
- f) Anaerobic respiration
- g) Fermentation
- h) Breathing

(iii) Study the graph below that represents the amount of energy supplied with respect to the time while an athlete is running at full speed.



Choose the correct combination of plots and justification provided in the following table.

	Plot A	Plot B	Justification
a)	Aerobic	Anaerobic	Amount of energy is low and inconsistent in aerobic and high in anaerobic
b)	Aerobic	Anaerobic	Amount of energy is high and consistent in aerobic and low in anaerobic
c)	Anaerobic	Aerobic	Amount of energy is high and consistent in aerobic and low in anaerobic
d)	Anaerobic	Aerobic	Amount of energy is high and inconsistent in anaerobic and low in aerobic

(iv) The characteristic processes observed in anaerobic respiration are

- i) presence of oxygen
 - ii) release of carbon dioxide
 - iii) release of energy
 - iv) release of lactic acid
- a) i) ,ii) only
 - b) i), ii), iii) only
 - c) ii), iii), iv) only
 - d) iv) only

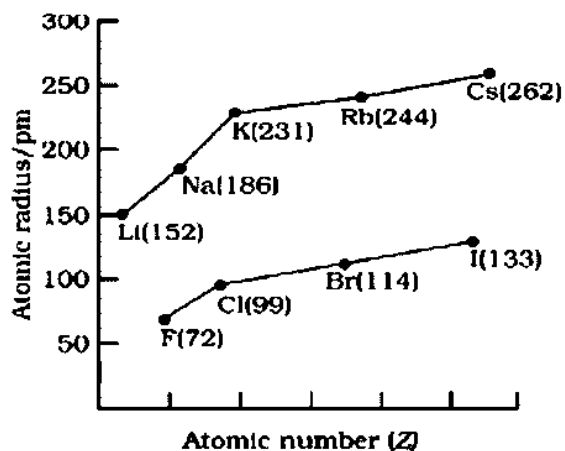
(v) Study the table below and select the row that has the incorrect information.

		Aerobic	Anaerobic
a)	Location	Cytoplasm	Mitochondria
b)	End Product	CO ₂ and H ₂ O	Ethanol and CO ₂
c)	Amount of ATP	High	Low
d)	Oxygen	Needed	Not needed

18. Read the following and answer any four questions from 18 (i) to 18 (v). (1×4)

Metallic Character The ability of an atom to donate electrons and form positive ion (cation) is known as electro positivity or metallic character. Down the group, metallic character increases due to increase in atomic size and across the period, from left to right electro- positivity decreases due to decrease in atomic size.

Non-Metallic Character The ability of an atom to accept electrons to form a negative ion (anion) is called non-metallic character or electronegativity. The elements having high electro-negativity have a higher tendency to gain electrons and form anion. Down the group, electronegativity decreases due to increase in atomic size and across the period, from left to right electronegativity increases due to decrease in atomic size.



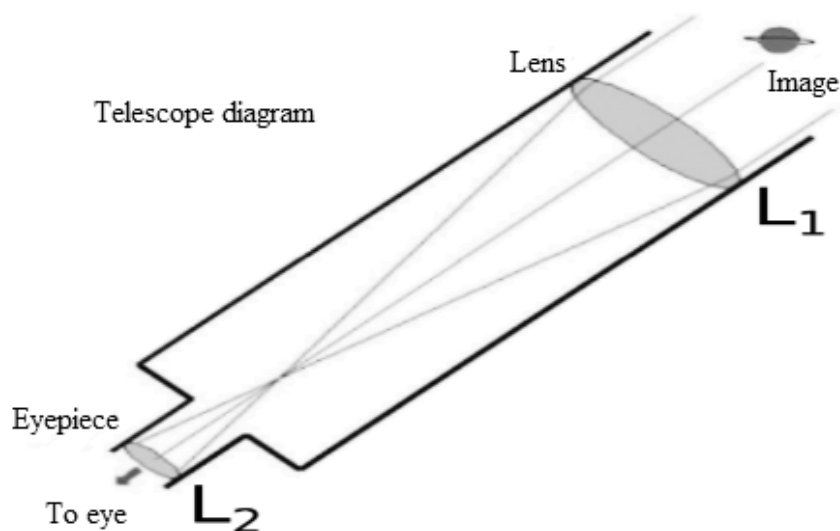
- (i) Which of the following correctly represents the decreasing order of metallic character of Alkali metals plotted in the graph?
- Cs>Rb>Li>Na>K
 - K>Rb>Li>Na>Cs
 - Cs>Rb>K>Na>Li
 - Cs>K>Rb>Na>Li
- (ii) Hydrogen is placed along with Alkali metals in the modern periodic table though it shows non-metallic character
- as Hydrogen has one electron & readily loses electron to form negative ion
 - as Hydrogen can easily lose one electron like alkali metals to form positive ion
 - as Hydrogen can gain one electron easily like Halogens to form negative ion
 - as Hydrogen shows the properties of non-metals
- (iii) Which of the following has highest electronegativity?
- F
 - Cl
 - Br
 - I
- (iv) Identify the reason for the gradual change in electronegativity in halogens down the group.
- Electronegativity increases down the group due to decrease in atomic size
 - Electronegativity decreases down the group due to decrease in tendency to lose electrons
 - Electronegativity decreases down the group due to increase in atomic radius/ tendency to gain electron decreases
 - Electronegativity increases down the group due to increase in forces of attractions between nucleus & valence electrons
- (v) Which of the following reason correctly justifies that "Fluorine (72pm) has smaller atomic radius than Lithium (152pm)"?

- a) F and Li are in the same group. Atomic size increases down the group
- b) F and Li are in the same period. Atomic size increases across the period due to increase in number of shells
- c) F and Li are in the same group. Atomic size decreases down the group
- d) F and Li are in the same period and across the period atomic size/radius decreases from left to right.

19. Read the following and answer any four questions from 19 (i) to 19 (v) (1×4)

Sumati wanted to see the stars of the night sky. She knows that she needs a telescope to see those distant stars. She finds out that the telescopes, which are made of lenses, are called refracting telescopes and the ones which are made of mirrors are called reflecting telescopes.

So she decided to make a refracting telescope. She bought two lenses, L1 and L2. out of which L1 was bigger and L2 was smaller. The larger lens gathers and bends the light, while the smaller lens magnifies the image. Big, thick lenses are more powerful. So to see far away, she needed a big powerful lens. Unfortunately, she realized that a big lens is very heavy. Heavy lenses are hard to make and difficult to hold in the right place. Also since the light is passing through the lens, the surface of the lens has to be extremely smooth. Any flaws in the lens will change the image. It would be like looking through a dirty window.



- (i) Based on the diagram shown, what kind of lenses would Sumati need to make the telescope?
 - a) Concave lenses
 - b) Convex lenses
 - c) Bifocal lenses
 - d) Flat lenses

- (ii) If the powers of the lenses L1 and L2 are in the ratio of 4:1, what would be the ratio of the focal length of L1 and L2?
 - a) 4:1
 - b) 1:4

- c) 2:1
- d) 1:1

(iii) What is the formula for magnification obtained with a lens?

- a) Ratio of height of image to height of object
- b) Double the focal length.
- c) Inverse of the radius of curvature.
- d) Inverse of the object distance.

(iv) Sumati did some preliminary experiment with the lenses and found out that the magnification of the eyepiece (L2) is 3. If in her experiment with L2 she found an image at 24 cm from the lens, at what distance did she put the object?

- a) 72 cm
- b) 12 cm
- c) 8 cm
- d) 6 cm

(v) Sumati bought not-so-thick lenses for the telescope and polished them. What advantages, if any, would she have with her choice of lenses?

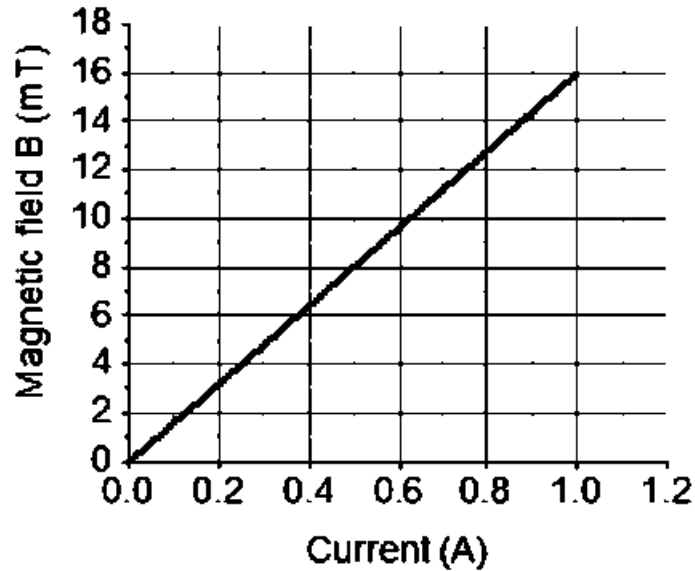
- a) She will not have any advantage as even thicker lenses would give clearer images.
- b) Thicker lenses would have made the telescope easier to handle.
- c) Not-so-thick lenses would not make the telescope very heavy and also allow considerable amount of light to pass.
- d) Not-so-thick lenses will give her more magnification.

20. Read the following and answer any 4 questions from 20 (i) to 20 (v). (1×4)

A solenoid is a long helical coil of wire through which a current is run in order to create a magnetic field. The magnetic field of the solenoid is the superposition of the fields due to the current through each coil. It is nearly uniform inside the solenoid and close to zero outside and is similar to the field of a bar magnet having a north pole at one end and a south pole at the other depending upon the direction of current flow. The magnetic field produced in the solenoid is dependent on a few factors such as, the current in the coil, number of turns per unit length etc.

The following graph is obtained by a researcher while doing an experiment to see the variation of the magnetic field with respect to the current in the solenoid.

The unit of magnetic field as given in the graph attached is in milli-Tesla (mT) and the current is given in Ampere.



- (i) What type of energy conversion is observed in a linear solenoid?
- Mechanical to Magnetic
 - Electrical to Magnetic
 - Electrical to Mechanical
 - Magnetic to Mechanical
- (ii) What will happen if a soft iron bar is placed inside the solenoid?
- The bar will be electrocuted resulting in short-circuit.
 - The bar will be magnetised as long as there is current in the circuit.
 - The bar will be magnetised permanently.
 - The bar will not be affected by any means.
- (iii) The magnetic field lines produced inside the solenoid are similar to that of ...
- a bar magnet
 - a straight current carrying conductor
 - a circular current carrying loop
 - electromagnet of any shape
- (iv) After analysing the graph a student writes the following statements.
- The magnetic field produced by the solenoid is inversely proportional to the current.
 - The magnetic field produced by the solenoid is directly proportional to the current.
 - The magnetic field produced by the solenoid is directly proportional to square of the current.
 - The magnetic field produced by the solenoid is independent of the current.
- Choose from the following which of the following would be the correct statement(s).
- Only IV
 - I and III and IV
 - I and II

d) Only II

(v) From the graph deduce which of the following statements is correct.

- a) For a current of 0.8 A the magnetic field is 13 mT
- b) For larger currents, the magnetic field increases non-linearly.
- c) For a current of 0.8 A the magnetic field is 1.3 mT
- d) There is not enough information to find the magnetic field corresponding to 0.8A current.

SECTION B

21. Bile juice does not have any digestive enzyme but still plays a significant role in the process of digestion. Justify the statement. (2)

OR

In birds and mammals the left and right side of the heart are separated. Give reasons.

22. State the events occurring during the process of photosynthesis. Is it essential that these steps take place one after the other immediately? (2)

23. Give a test that can be used to confirm the presence of carbon in a compound. With a valency of 4, how is carbon able to attain noble gas configuration in its compounds?

OR

The number of carbon compounds is more than those formed by all other elements put together. Justify the statement by giving two reasons. (2)

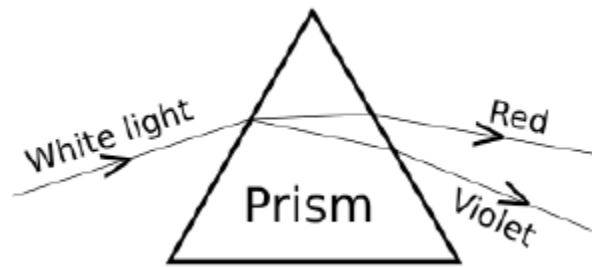
24. The following observations were made by a student on treating four metals P, Q, R and S with the given salt solutions:

Sample	MgSO ₄ (aq)	Zn(NO ₃) ₂ (aq)	CaSO ₄ (aq)	Na ₂ SO ₄ (aq)
P	No reaction	Reaction occurs	Reaction occurs	No reaction
Q	Reaction occurs	Reaction occurs	Reaction occurs	Reaction occurs
R	No Reaction	Reaction Occurs	No Reaction	No Reaction
S	No Reaction	No Reaction	No Reaction	No Reaction

Based on the above observations:

- (a) Arrange the given samples in the increasing order of reactivity
- (b) Write the chemical formulae of products formed when Q reacts with CuSO₄ solution. (2)

25.



A student observes the above phenomenon in the lab as a white light passes through a prism. Among many other colours, he observed the position of the two colours Red and Violet. What is the phenomenon called? What is the reason for the violet light to bend more than the red light? (2)

26. A student has two resistors- $2\ \Omega$ and $3\ \Omega$. She has to put one of them in place of R_2 as shown in the circuit. The current that she needs in the entire circuit is exactly $9A$. Show by calculation which of the two resistors she should choose. (2)

SECTION C

27. After self-pollination in pea plants with round, yellow seeds, following types of seeds were obtained by Mendel:

Seeds	Number
Round, yellow	630
Round, green	216
Wrinkled, yellow	202
Wrinkled, green	64

Analyse the result and describe the mechanism of inheritance which explains these results.

OR

In humans, there is a 50% probability of the birth of a boy and 50 % probability that a girl will be born. Justify the statement on the basis of the mechanism of sex-determination in human beings. (3)

28. Plastic cups were used to serve tea in trains in early days- these could be returned to the vendors, cleaned and reused. Later, Kulhads were used instead of plastic cups. Now, paper cups are used for serving tea. What are the reasons for the shift from Plastic to Kulhads and then finally to paper cups? (3)

29. Explain where and how urine is produced? (3)

30.

- (a) How is plaster of Paris chemically different from gypsum? How are they interconverted? Write one use of plaster of Paris.
- (b) State the relation between hydrogen ion concentration of an aqueous solution and its pH. Provide the formula to show the relation between hydrogen ion concentration and pH. (3)

31. No chemical reaction takes place when granules of a solid A are mixed with the powder of another solid B. However, when the mixture is heated, a reaction takes place between its components. One of the products, C, is a metal and settles in the molten state, while the other product D floats over it. It was observed that the reaction is highly exothermic.

Based on the given information, make an assumption about A and B and write a chemical equation for the chemical reaction indicating the conditions of reaction, physical state of reactants and products and thermal states of the reaction. Mention any two types of reactions under which the above chemical reaction can be classified. (3)

32.

- (a) The pH of a cold drink is 5. What will be its action on blue and red litmus solutions?
- (b) The pH values of three acids A, B and C having equal molar concentrations are 5.0, 2.8 and 3.5, respectively. Arrange these acids in the order of increasing acid strengths. (3)

33. Refractive index of water with respect to air is 1.33 and that of diamond is 2.42.

- (i) In which medium does the light move faster, water or diamond?
- (ii) What is the refractive index of diamond with respect to water? (3)

SECTION D

34. Give reason why (5)

- (a) Metals are good conductors, whereas non-metals are bad conductors of electricity.
- (b) Metals replace hydrogen from acids, whereas non-metals do not.
- (c) An iron nail dipped in a blue copper sulphate solution turns the blue solution light green.
- (d) Sodium is kept under kerosene.
- (e) Carbon cannot reduce the oxides of sodium or aluminium.

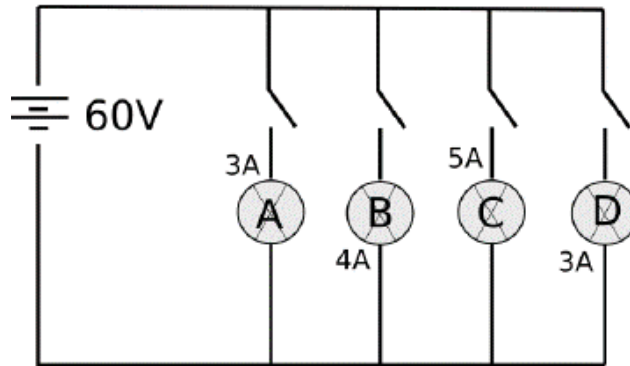
OR

Explain with an example how metal X (which is low in the reactivity series) and metal Y (which is high in the reactivity series) are obtained from their compounds by the reduction process.

- (a) Write the electronic configurations of sodium and chlorine. Show the formation of sodium chloride from sodium and chlorine by the transfer of electrons.
- (b) List any two observations when a highly reactive metal is dropped in water. (5)

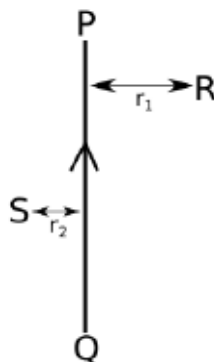
35. Trace the changes that take place in a flower from gamete formation to fruit formation. (5)

36. In the given circuit, A, B, C and D are four lamps connected with a battery of 60V. Analyse the circuit to answer the following questions.



- (i) What kind of combination are the lamps arranged in (series or parallel)?
- (ii) Explain with reference to your above answer, what are the advantages (any two) of this combination of lamps?
- (iii) Explain with proper calculations which lamp glows the brightest?
- (iv) Find out the total resistance of the circuit.

OR



PQ is a current carrying conductor in the plane of the paper as shown in the figure below.

(5)

- (i) Find the directions of the magnetic fields produced by it at points R and S?
- (ii) Given $r_1 > r_2$, where will the strength of the magnetic field be larger? Give reasons.
- (iii) If the polarity of the battery connected to the wire is reversed, how would the direction of the magnetic field be changed?
- (iv) Explain the rule that is used to find the direction of the magnetic field for a straight current carrying conductor.

CBSE
Class X Science
Sample Paper 1 – Solution

SECTION A

1. Electrolysis of water to form oxygen and hydrogen is an endothermic reaction because electrical energy is absorbed during this reaction.

OR

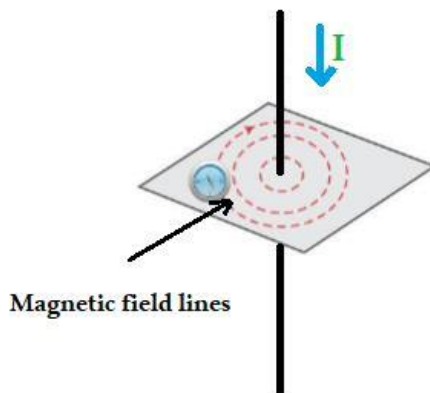
In the absence of light, the oxidation of fats and oils present in food is slowed down and hence the development of rancidity is retarded.

2. All isotopes of an element have the same number of protons, and hence, they have the same atomic number. Hence, they can be placed at the same position in the periodic table.
3. (iv) The given elements belong to the 17th group of the Modern Periodic Table. All these elements have 7 electrons in their outermost shell.
4. The Sun is nearly overhead at noon. The sunlight has to pass through much smaller portion of the Earth's atmosphere. The scattering is much less and thus, Sun looks white.
5. Concave mirror and concave lens.
6. Object is placed between focus and centre of curvature.

OR

Optical centre

7. When key is inserted small monetary deflections are observed which returns to zero in a while. When key is removed the deflections are seen in opposite direction.
8. For straight current carrying conductor, the magnetic field lines are concentric circles.



9. For resistance connected in parallel, the voltage – drop is same across both the resistors

OR

Work done, $W = QV$

10. Veins collect the blood from different organs and bring it back to the heart. The blood is no longer under pressure so the walls are thin with valves to ensure that blood flows only in one direction. They have valves to ensure blood flows in one direction only.

11. The small intestine has millions of tiny finger-like projections called villi. These villi increase the surface area for more efficient food absorption. Within these villi, many blood vessels are present that absorb the digested food and carry it to the bloodstream. From the bloodstream, the absorbed food is delivered to each and every cell of the body.

OR

Goat is a herbivore which feeds on grass. It will have a longer small intestine to allow the cellulose to be digested properly.

12. The ozone layer is a thin part of the Earth's atmosphere that absorbs almost all of the sun's harmful ultraviolet light. It protects earth from the ultraviolet radiations which come from the sun.

OR

Only 10% of the energy gets transferred from one trophic level to the next. So after 3 or 4 trophic levels, the energy available for passing on is too less to support another trophic level. Very little usable energy remains after 4 trophic levels. Hence the number of trophic levels in a food chain is limited.

13. The pancreas secretes digestive juice which contains enzymes like trypsin for digesting proteins and lipase for the breakdown of emulsified fats.

14. (d) A is false, but R is true.

According to Mendeleev, physical and chemical properties of elements are periodic function of their atomic weights (atomic masses). Atomic number is equal to the number of protons. It is also equal to the number of electrons present in the neutral atom.

Assertion is incorrect but Reason is correct.

15. b) Both Assertion and Reasoning are correct, and reason is not correct explanation of assertion.

If any harmful chemical enters the food chain, it gets magnified as it moves along the food chain to higher trophic levels. The length and complexity of food chains vary greatly. Some food chains are shorter with three trophic levels while some are longer with more than three trophic levels.

OR

b) Both Assertion and Reasoning are correct, and reason is not correct explanation of assertion.

Lower trophic levels contain more number of individuals. The flow of energy in a food chain is unidirectional.

16. a) Both Assertion & Reasoning are correct & Reason is the correct explanation of Assertion.

Violet coloured flowers are dominant over white coloured flowers. Mendel's law of dominance states that dominant character expresses itself in the first generation and masks the expression of the recessive character.

17.

(i) b) Tissue respiration. Cellular respiration occurs to breakdown food to release energy.

(ii) b) Anaerobic respiration. In the absence of oxygen, the body respire anaerobically and produces lactic acid.

(iii)

b)	Aerobic	Anaerobic	Amount of energy is high and consistent in aerobic and low in anaerobic
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(iv) c) ii), iii), iv) only

(v)

a)	Location	Aerobic -Cytoplasm	Anaerobic Mitochondria
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18.

(i) c) Cs>Rb>K>Na>Li

(ii) b) As Hydrogen can easily lose one electron like alkali metals to form positive ion

(iii) a) F

(iv) c) Electronegativity decreases down the group due to increase in atomic radius/ tendency to gain electron decreases.

(v) d) F and Li are in the same period and across the period atomic size/radius decreases from left to right.

19.

(i) b) Convex lens

(ii) b) 1:4

$$P=1/f$$

$$P_1=1/f_1 \text{ and } P_2=1/f_2$$

$$P_1/P_2=4/1, \text{ hence } (1/f_1)/(1/f_2) = 4/1$$

$$\text{Hence } f_1/f_2=1/4$$

$$f_1: f_2 = 1:4$$

(iii) a) Ratio of height of image to height of object

(iv) c) 8 cm

$$\text{Magnification, } m= \text{image distance/ object distance} = v/u$$

$$3=24/u$$

$$\text{Hence } u = 8 \text{ cm}$$

(v) c) Not-so-thick lenses would not make the telescope very heavy and also allow considerable amount of light to pass through them.

20.

- i) c) Electrical to Mechanical
- ii) b) The bar will be magnetised as long as there is current in the circuit.
- iii) a) A bar magnet
- iv) d) Only II
- v) a) For a current of 0.8 A the magnetic field is 13 mT

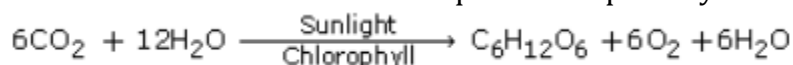
SECTION B

21. Bile juice makes the acidic food coming from the stomach alkaline for the action of pancreatic enzymes. Bile salts bring about emulsification of fats. They break down the large globules of fat in the small intestine to smaller globules increasing the efficiency of enzyme action.

OR

In birds and mammals the left and right side of the heart are separated because the separation keeps oxygenated and deoxygenated blood from mixing allowing a highly efficient supply of oxygen to the body. This is useful in animals that have high energy needs such as birds and mammals which constantly use energy to maintain their body temperature.

22. Below is the balanced chemical equation for photosynthesis-



Steps in photosynthesis:

- Absorption of light energy by chlorophyll.
- Conversion of light energy to chemical energy and splitting of water molecules into hydrogen and oxygen.
- Reduction of carbon dioxide to carbohydrates.

These steps need not take place one after the other immediately. For example, desert plants take up carbon dioxide at night and prepare an intermediate which is acted upon by the energy absorbed by the chlorophyll during the day.

23. Burn compound in air/ oxygen; Gas evolved turns lime water milky

- By sharing its four valence electrons with other elements.

OR

- Due to self-linking ability of carbon/catenation
- Since carbon has a valency of four it can form bonds with four other atoms of carbon or atoms of some other mono-valent element.
- Due to small size of carbon it forms very strong and (or) stable bonds with other elements

24.

(a) $S > R > P > Q$

(b) Cu and QSO_4

25. The phenomenon is called dispersion.

Speed of violet light inside the prism is slowest and that of red is highest. Hence, deviation of violet light is maximum and that of red is minimum.

26. The overall current needed = 9A. The voltage is 12V

Hence by Ohm's Law $V = IR$,

The resistance for the entire circuit = $12/9 = 4/3 \Omega$

R_1 and R_2 are in parallel.

Hence, $R = (R_1 R_2) / (R_1 + R_2) = 4R_2 / (4 + R_2) = 4/3$

$R_2 = 2\Omega$

SECTION C

27. The ratio obtained is 9:3:3:1 in which parental as well as new combinations are observed. This indicates that progeny plants have not inherited a single whole gene set from each parent. Every germ cell takes one chromosome from the pair of maternal and paternal chromosomes. When two germ cells combine, segregation of one pair of characters is independent of other pair of characters.

OR

In human beings, the genes inherited from the parents decide whether the child born will be a boy or a girl. Women have a perfect pair of sex chromosomes (XX). But, men have a mismatched pair (XY) of sex chromosomes. All children will inherit an X chromosome from their mother regardless of whether they are boys or girls. Thus, the sex of the children will be determined by what they inherit from their father. A child who inherits an X chromosome from her father will be a girl, and one who inherits a Y chromosome from him will be a boy.

28. Use of plastic cups raised the concern towards hygiene, and thus they were replaced by disposable plastic cups. Plastic cups are non-biodegradable and harm the environment. They were thus replaced by *Kulhads*. Making *Kulhad* made of clay on a large scale resulted in the loss of top fertile soil. Now, disposable paper cups are used because paper can be recycled, it is biodegradable and is eco-friendly material which does not cause environmental pollution.

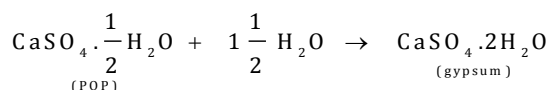
29. Blood passes through filtration units in the kidney called the nephron. It first passes through glomerulus in the Bowman's capsule by the process of ultrafiltration. The filtrate initially has glucose, amino acids, water, salts and nitrogenous waste. Then reabsorption occurs in which water (as per the need of the body), glucose and amino acids are all

reabsorbed. The final step is secretion where excess water, salts and urea (nitrogenous waste) which makes up the urine are finally excreted out of the body.

30.

- (a) Plaster of Paris has the chemical formula $\text{CaSO}_4 \cdot 1/2\text{H}_2\text{O}$. It is produced by heating gypsum (with the chemical formula $\text{CaSO}_4 \cdot 2\text{H}_2\text{O}$) at 373 K.

The reaction is



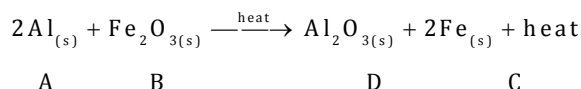
Use of plaster of Paris: In surgical bandages for supporting fractured bones in the right position.

- (b) The pH of a solution is the negative of the logarithm (exponent) to the base 10 of the hydrogen ion concentration (expressed as moles per litre).

$$\text{pH} = -\log_{10}[\text{H}^+]$$

31.

- (a) 'A' is aluminium, and 'B' is iron (III) oxide.



- (b) The reaction is highly exothermic. It is a displacement reaction and redox reaction.

32.

- (a) The cold drink turns blue litmus red because of its acidic nature. It will have no action on red litmus.

- (b) $A < C < B$

B will have maximum acid strength because pH is inversely proportional to the concentration of hydrogen ions in a solution.

33.

- (i) Refractive index = speed of light in vacuum / speed of light in medium.

The refractive index of diamond is more.

Thus, the speed of light is lesser in diamond.

Hence, the light moves faster in water than in diamond.

- (ii) Let speed of light in water be v_w and that in diamond be v_d .

Refractive index of diamond w.r.t water is given as,

$\mu = \text{Speed of light in water} / \text{speed of light in diamond}$.

$$\mu = v_w / v_d$$

$$\mu = (v_w / c) \div (v_d / c)$$

$$\mu = 2.42 / 1.33 = 1.82$$

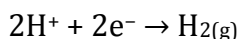
SECTION D

34.

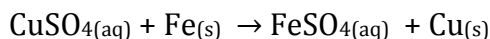
- (a) Metals have free electrons which help them in the conduction of electricity, whereas non-metals have no free electrons, which make them a poor conductor of electricity. Moreover, when electricity is passed through a metallic wire, these free electrons move in a particular direction to conduct the flow of charges which helps in the conduction of electricity.

However, there are exceptions. Graphite being a non-metal is a good conductor of electricity and is also used as an electrode.

- (b) A non-metal cannot supply electrons to convert H^+ to H_2 , whereas metals can provide electrons.



- (c) When an iron nail is placed in a copper sulphate solution, the blue colour of CuSO_4 fades away slowly and a reddish brown copper metal is formed.



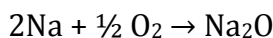
However, if a strip of copper metal is placed in iron (II) sulphate, no reaction occurs because copper is less reactive than iron and therefore cannot displace iron from iron (II) sulphate.

- (d) Sodium is a highly reducing metal ($\text{Na} \rightarrow \text{Na}^+ + \text{e}^-$, $E^\circ = +2.71$); thus, it will give away its electrons to atoms of elements less reducing than itself (which is most substances).

The practical upshot of this is that it will react with moisture in the air:



And with oxygen:



Sodium is kept in liquids which are not so easily reduced (long-chain hydrocarbons like kerosene, where the carbon is already in a very low formal oxidation state) which also expels moisture.

- (e) The two metals sodium and magnesium are more reactive than carbon. They are above carbon in the reactivity series, and thus, they have a higher affinity for oxygen compared to carbon and thus cannot be reduced by it.

OR

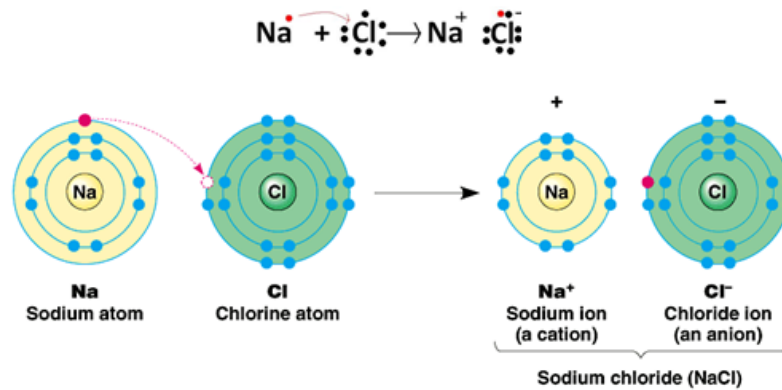
Metals in the low reactivity series are obtained by heating their oxides alone.

Mercury is obtained by heating mercurous oxide. Metals high up in the reactivity series are obtained by electrolytic reduction. Sodium is obtained by the electrolysis of its molten chlorides.

(a) Electronic configuration of sodium (Na) = 2, 8, 1

Electronic configuration of chlorine (Cl) = 2, 8, 7

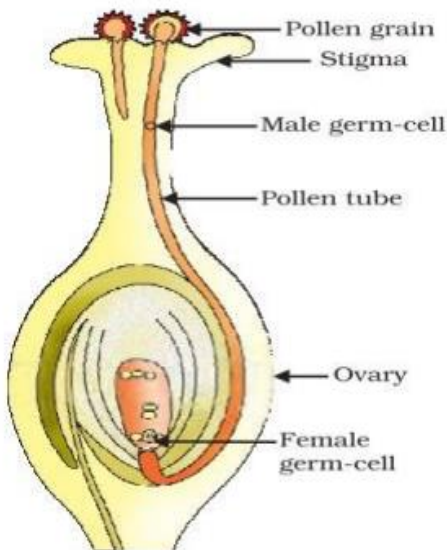
Formation of sodium chloride by the transfer of electrons



(b) (i) Highly exothermic;

(ii) the metal starts floating

35. Changes that take place in a flower from gamete formation to fruit formation:



Germination of pollen on stigma

- Stamen is the male reproductive part of the flower and it produces pollen grains.
- The ovary contains ovules and each ovule has an egg cell.
- The pollen needs to be transferred from the stamen to the stigma.
- If this transfer of pollen occurs on the same flower, it is referred to as self-pollination.
- On the other hand, if the pollen is transferred from one flower to another, it is known as cross-pollination.

- After the pollen lands on a suitable stigma, it has to reach the female germ cells which are in the ovary. For this, a tube grows out of the pollen grain and travels through the style to reach the ovary.
- The male germ cell produced by pollen grain fuses with the female gamete present in the ovule. This fusion of the germ cells or fertilisation gives the zygote.
- After fertilisation, the zygote divides several times to form an embryo within the ovule.
- The ovule develops a tough coat and is gradually converted into a seed.
- The ovary grows rapidly and ripens to form a fruit.
- Meanwhile, the petals, sepals, stamens, style and stigma may shrivel and fall off.

36.

- (i) The lamps are connected in parallel.
- (ii) **Advantages of parallel combination:**
- If one lamp stops working, it will not affect the working of the other lamps.
 - Potential difference across each lamp will be same.
- (iii) The lamp with the highest power will glow the brightest.

$$P=VI$$

Even if the potential difference across all the lamps are same, lamp C has the highest current.

$$\text{Hence, for Lamp C } P=5 \times 60 \text{ Watt} = 300 \text{ W.}$$

Thus, lamp C glows the brightest.

- (iv) The total current in the circuit = $3+4+5+3 \text{ A} = 15\text{A}$

$$\text{Voltage} = 60 \text{ V}$$

$$V=IR \text{ and hence } R = V/I$$

$$= 60/15 \text{ A} = 4 \text{ A}$$

OR

- (i) The magnetic field lines produced is into the plane of the paper at R and out of it at S.
- (ii) Field at S > Field at P
- Magnetic field strength for a straight current carrying conductor is inversely proportional to the distance from the wire.
- (iii) If polarity is reversed, the current will go from top to bottom in the wire and the magnetic field lines goes in the clockwise direction on the plane which is perpendicular to the wire carrying current.
- (iv) According to the Right-Hand thumb rule, the thumb is aligned to the direction of the current and the direction in which the fingers are wrapped around the wire will give the direction of the magnetic field.