CBSE
Class X Science
Sample Paper 6 – Solution

Section A

1. Solar cells are used for providing electricity in artificial satellites and space probes.

2. The SI unit of electric charge is Coulomb.

3.

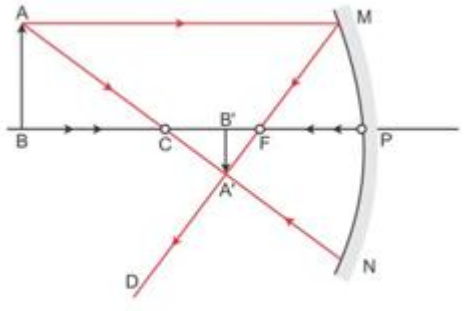
(a)

(i) Pituitary gland. It is located at the base of the mid-brain below the hypothalamus.

(ii) The pituitary gland is referred to as the master gland because it controls the functioning of the other endocrine glands.

(b)

(i)



Object beyond C

(ii) We know,

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

v = ?, f = - 5 cm (focal length of concave mirror)

u = - 20 cm

$$\therefore \frac{1}{v}=\frac{1}{f}-\frac{1}{u}=\frac{1}{-5}-\frac{1}{-20}=\frac{-15}{100}$$

$$\therefore v = -6.67 \text{ cm}$$

Thus, the image is formed at a distance of 6.67 cm between the centre of curvature and the focus.

4.

(a) Bauxite, $Al_2O_3.2H_2O$

(b) Aluminium is deposited at the cathode, and oxygen is formed at the anode.

(c) Sodium, magnesium and calcium

(d) Metals placed at the bottom of the activity series are very unreactive. Oxides of these metals can be reduced to metals by heating.

5. (iv) $\frac{4}{6}$

By the principle of reversibility,

$${}_{a}\mu_{g} = \frac{1}{{}_{g}\mu_{a}}$$

$$\therefore {}_{g}\mu_{a} = \frac{1}{\frac{3}{2}} = \frac{2}{3} \text{ or } \frac{2}{3} \times \frac{2}{2} = \frac{4}{6}$$

$$\therefore {}_{g}\mu_{a} = \frac{4}{6}$$

OR

(i) +5 D

As the lens is converging, the focal length is positive.

We know,

$$P = \frac{1}{f(\text{in metre})} = \frac{1}{+0.2\ \text{m}} = +5\ \text{D}$$

6. (iii) one-fourth

When the diameter of the wire is doubled, its resistance becomes one-fourth.

7. (ii) 2 A

The fuse used for an electrical appliance should be slightly larger than the normal current drawn by it. Thus, the suitable fuse for a TV set is of 2 A.

8. (c) Primary consumer to secondary consumer

Energy in a food chain flows from producers to primary consumers to secondary consumers to tertiary consumers and finally to decomposers. Grasshopper is a primary consumer, while frog is a secondary consumer.

OR

(b) Lead battery-manufacturing factory

Acid spillage from a lead battery-manufacturing factory can lower the pH of river water.

9. (b) DNA

Chromosomes present in the nucleus of a cell contain the information for the inheritance of features from parents to the next generation in the form of DNA molecules. DNA bears the information for making proteins. Hence, DNA is the blueprint of body design and function.

10. (ii) Articles made of silver metal on exposure to air become black. This black layer is due to the formation of silver sulphide.

11. (iv)The solution of K_2CO_3 will have a pH more than 7.

12. (a) Disposal of unburnt corpses into water

Coliform bacteria are mainly present in human excreta. They can be present in unburnt corpses. Wastes from the other given options does not contain human excreta.

OR

(b) (ii) and (iii)

Small check dams or temporary dams across flooded gullies help to prevent the adverse effects of flooding on nearby areas and land and prevents soil erosion. It also helps to recharge groundwater.

13. (ii) Both A and R are true, but R is not the correct explanation of the assertion.

Heredity explains the inheritance or passing of traits from one generation to another. Evolution explains the process of gradual changes in organisms.

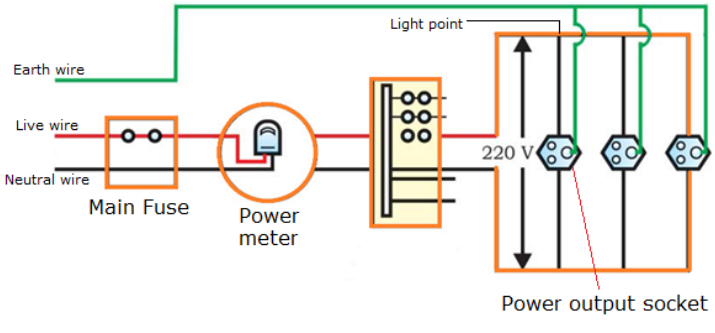
14. (iii) A is true, but R is false.

When the objects are observed through hot air, the objects appear to be moving slightly as the light refracts due to atmospheric refraction. This refraction occurs because hotter air is optically rarer and colder air is optically denser.

Section B

15.

(a) Domestic wiring circuit:



(b) The fuse wire needs to have a very low melting point so that it can disconnect itself when the supply exceeds the standard range of input voltage.

The melting point of copper wire is 1083°C; if copper wire is used as a fuse wire, then it will allow a huge value of voltage to enter the domestic circuit and that will destroy the electrical appliance.

That is why an alloy of lead is used instead of copper wire.

16. Secretion of the stomach is known as gastric juice. It contains hydrochloric acid, the enzyme pepsin and mucus. The wall of the stomach releases mucus which helps to protect itself from the action of highly acidic HCl. In the absence of mucus, hydrochloric acid will cause the erosion of the inner lining of the stomach leading to the formation of ulcers in the stomach.

17.

(i) Double displacement reaction
(ii) Combination reaction
(iii) Decomposition reaction

18. Because zinc displaces iron, it is more reactive than iron. However, iron displaces copper, so iron comes above copper in the reactivity series. Similarly, copper displaces silver, i.e. silver is the least reactive.

Ag < Cu < Fe < Zn

OR

Thermite reaction: The reduction of a metal oxide to form a metal by using aluminium powder as a reducing agent is called a thermite reaction.

It is an exothermic reaction in which a large amount of heat is evolved. This reduction property of aluminium is used in thermite welding for joining the broken pieces of heavy iron objects like girders, railway tracks or cracked machine parts.

Example: A mixture of iron (III) oxide and aluminium powder is ignited with a burning magnesium ribbon. Aluminium reduces iron oxide to produce molten iron metal with the evolution of heat.

$Fe_2O_{3(s)} + 2Al_{(s)} \rightarrow 2Fe_{(l)} + Al_2O_{3(s)} + Heat$

The molten iron produced is then poured between the broken iron pieces to weld them.

19. The cross between blue-flowered plant (BB) and white-flowered plant (bb) is a monohybrid cross which involves a single trait, i.e. colour of the flower under study.

(a) All the F_1 generation plants would be blue.
(b) If flowers of F_1 plants are self-pollinated, then we would have 75% plants with blue flowers and 25% plants with white flowers in the F_2 generation.
(c) The expected ratio of the genotypes BB and Bb in the F_2 progeny is 1:2.

20.

(a) As the resistors are connected in parallel, the voltage across each resistor is the same. Hence, the current through each resistor is

$$I_5 = \frac{V}{5} = \frac{12}{5} = 2.4 \text{ A}$$

$$I_{20} = \frac{V}{20} = \frac{12}{20} = 0.6 \text{ A}$$

(b) Total current in the circuit is

$$I = I_5 + I_{10} + I_{20} + I_{15}$$

But,

$$I_{10} = \frac{V}{10} = \frac{12}{10} = 1.2 \text{ A}$$

$$I_{15} = \frac{V}{15} = \frac{12}{15} = 0.8 \text{ A}$$

$$\therefore I = 2.4 + 1.2 + 0.6 + 0.8$$

$$\therefore I = 5 \text{ A}$$

(c) The resistance is connected in parallel with each other in the given circuit.

$$\frac{1}{R_P} = \frac{1}{5} + \frac{1}{10} + \frac{1}{20}$$

$$\therefore R_P = 2.85 \ \Omega$$

But when the same value resistors are connected in series, their equivalent resistance is given by

$$R_s = 5 + 10 + 20$$

$$\therefore R_s = 35 \ \Omega$$

Thus, when the resistors are connected in series, the resistance of the entire circuit increases and the amount of current flowing in the circuit decreases.

OR

Rating of the electrical appliance is 220 V–1 kW.

Therefore, the resistance of the appliance is

$$P = \frac{V^2}{R}$$

$$\therefore R = \frac{V^2}{P} = \frac{220^2}{1000}$$

$$\therefore R = 48.4 \ \Omega$$

Total power consumed by 3 bulbs will be 3 kW.

Hence, for a six-hour operation, the energy consumed is

$$E = Pt$$

$$\therefore E = 3000 \times 6 = 18000 \text{ Wh} = 18 \text{ kWh}$$

Cost of electricity per unit is Rs 5.20.

Hence, the total cost is

$$\text{Cost} = 18 \times 5.20 = \text{Rs. } 93.6$$

21. Ozone depletion generally refers to the process in which the ozone layer undergoes thinning continuously over a period of time.

The major cause of depletion of the ozone layer is the release of harmful chlorofluorocarbons such as methane and oxides of nitrogen into the atmosphere. These particles are released from vehicles, air conditioners etc. and produce active chlorine in the presence of UV rays. These rays destroy the ozone and thus cause ozone depletion.

OR

The accumulation or increasing concentration of a substance such as a toxic chemical in the body of living organisms at different trophic levels in a food chain is called biological magnification.

Yes, the concentration of these harmful chemicals will be different at different levels of the ecosystem. It will be maximum at the last trophic level which is mostly occupied by the top carnivores (quaternary consumers).

22. Due to ozone layer depletion, ultraviolet rays reach the Earth and cause certain ill-effects which are harmful for us as well as for crops. Some damages caused by ozone layer depletion are as follows:

- Exposure to UV rays can lead to greater incidence of skin cancer, cataracts or other damages to the eye and immune deficiency.
- An excess of ultraviolet light decreases crop yield and reduces the population of phytoplankton, zooplankton and certain fish larvae which are important constituents of aquatic food chains.
- It may also disturb global rainfall, cause ecological imbalance and bring about reduction in global food supplies.

23.

(a) Having two eyes has the following advantages over having just one eye:

(i) Reduces the degree of parallax from our field of view

(ii) Allows us to see farther into the distance with higher resolution

(iii) Provides us with proper eyesight even if one of our eyes is damaged

(iv) Gives organisms a wider field of view and the perception of depth

(b) The iris controls the size of the pupil. Thus, when our eye encounters bright light, the iris contracts the pupil and protects the retina from damage.

(c) If a person is wearing spectacles of power +1 D, the lens has a positive focal length which indicates that he is wearing a convex lens. Hence, it can be concluded that he is suffering from hypermetropia or long-sightedness.

For a person wearing spectacles of power -1 D, the lens has a negative focal length which indicates that he is wearing a concave lens. Hence, it can be concluded that he is suffering from myopia or short-sightedness.

24.

(a) It will not undergo any colour change because the solution of Na_2SO_4 (sodium sulphate) in water is almost neutral.

(b) Concentrated sulphuric acid is highly hygroscopic. It absorbs moisture from air and gets diluted. Since the volume increases, the acid starts flowing out of the bottle.

Section C

25.

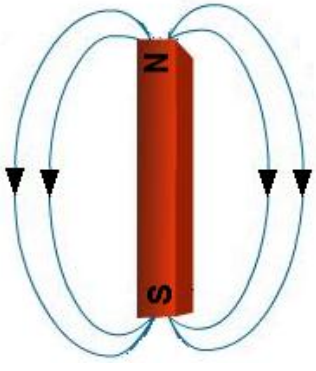
(a) The space around a magnet in which the force of attraction and repulsion due to the magnet can be detected is called the magnetic field. The direction of the magnetic field is taken to be the direction in which a North Pole of the compass needle moves inside it.

(i) Field lines originate from the North Pole and end at the South Pole.

(ii) Magnetic field lines come closer to one another near the poles of a magnet, but they are widely separated at other places.

(iii) Field lines do not intersect each other.

(b) Magnetic field lines



Magnetic field lines arise from the North Pole and complete a closed curved path at the South Pole.

(c) No, magnetic field strength varies at every point around it.
Magnetic field strength depends on the number of field lines per unit area.
If the field lines per area is more, then the magnetic strength in that area is strong, and if the field lines per area is less, then the magnetic strength is weak.
As the magnetic field lines per unit area is maximum at the poles, the magnetic strength is also maximum in that region.

26. From the electronic configuration, it is clear that the compound is calcium (Ca).

(a) Atomic number: 12

(b) Sodium is a metal.

(c) Mg, as it belongs to the same group as the element calcium.

(d) The compound is sodium chloride $Ca(HCO_3)_2$ which is also known as baking soda or baking powder.

(e) The compounds are calcium bicarbonate $Ca(HCO_3)_2$, which causes temporary hardness of water, and calcium sulphate $CaSO_4$, which causes permanent hardness of water.

OR

(a) The modern periodic law states that the properties of elements are periodic functions of their atomic numbers.

The arrangement of elements in the modern periodic table is based on their electronic configuration. The elements are arranged in the order of increasing atomic numbers.

In increasing order of atomic number, hydrogen can be placed in Group 1 with alkali metals as well as with halogens in Group 17. Hence, its position is anomalous.

(b) Two compounds formed:

$X(NO_3)_2$, $X_3(PO_4)_2$

X belongs to Group 2.

X will form ionic compounds because it is a metal, and the radicals are of non-metals.

27. Darwin's theory of evolution:

(a) Within any population, there is natural variation. Some individuals have more favourable variations than others.

(b) Even though all the species produce a large number of offspring, populations remain fairly constant naturally.

(c) This is due to the struggle between members of the same species and different species for food, space and mates.

(d) Struggle for survival within populations eliminates unfit individuals. The fit individuals possessing favourable variations survive and reproduce. This is called natural selection.

(e) Individuals having favourable variations pass on these variations to their progeny from generation to generation.

(f) These variations when accumulated over a long period of time lead to the origin of a new species.

OR

(a) 1 → Style; 2 → Pollen tube; 3 → Polar nuclei; 4 → Embryo sac; 5 → Antipodal cells; 6 → Micropyle

(b) After fertilisation:

- The ovary enlarges to form the fruit and the ovarian wall forms the fruit wall.
- The ovule becomes the seed.

(c) Synergids help in nourishing the egg cell, guiding the pollen tube towards the egg, proper functioning of the pollen tube and releasing of sperm nuclei.

(d) Pollen grain is transferred to the stigma during pollination. Germination of pollen grain takes place only if it falls on the stigma. After germination, the

pollen tube grows through the stigma and reaches the ovary for the fertilisation of the egg cell.

28.

$$\underset{C}{2CH_3COOH} + 2Na \longrightarrow \underset{R}{2CH_3COONa} + H_2$$

$$\underset{A}{CH_3COOH} + \underset{}{CH_3OH} \xrightarrow{conc.H_2SO_4} \underset{S}{CH_3COOCH_3}$$

$$CH_3COOH + NaOH \longrightarrow \underset{R}{CH_3COONa} + H_2O$$

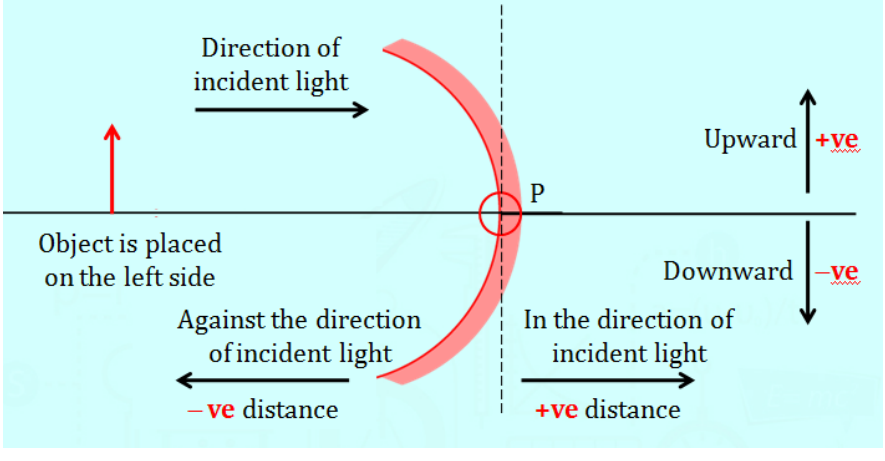
$$\underset{S}{CH_3COOCH_3} \xrightarrow{NaOH} \underset{R}{CH_3COONa} + \underset{A}{CH_3OH}$$

29.

(a) When you sleep with your mouth open, less air passes through the nasal passages. This is especially true when the nasal passages are plugged because you have a cold. As a consequence, air is not humidified and warmed. The dry air in turn dries the throat and the trachea, thereby irritating them.

(b) When a person breathes rapidly and deeply for several seconds, the carbon dioxide levels in the blood decrease and the blood pH increases. Carbon dioxide is an important regulator of respiratory movements. A decrease in blood CO_2 and an increase in blood pH result in a reduced stimulus to the respiratory centre. As a result, the respiratory movements stop until the blood CO_2 level builds up again in the body fluid. This normally requires a short time.

30.



New Cartesian sign conventions for spherical mirrors:

(a) All the distances are measured from the pole (P) of the mirror as origin.

(b) Distances measured in the direction of the incident light are taken as positive measurements.

(c) Distances measured in the direction opposite to the direction of incident light are taken as negative measurements.

(d) Distances measured upward and perpendicular to the principal axis are taken as positive.

(e) Distances measured downward and perpendicular to the principal axis are taken as negative.

OR

(a) Argon or neon gas is filled in electric bulbs.

These gases are used because they are inactive or inert. This prolongs the life of the filament.

(b)

The property of a conductor because of which it opposes the flow of current through it is called resistance. The resistance of a conductor depends on

(i) Length of the conductor: The resistance of a conductor is directly proportional to the length of the conductor.

(ii) Area of cross-section: The resistance of a conductor is inversely proportional to its area of cross-section.

(iii) Nature of the material of the conductor.

(iv) Temperature of the conductor: Resistance of all pure metals increases with temperature and *vice versa*.

The SI unit of resistance is ohm (Ω).

(c) Ohm's law: At a constant temperature, the current flowing through a conductor is directly proportional to the potential difference across its ends.