CBSE
Class X Science
Sample Paper – 2 (Reference Solutions)
2024-25

SECTION - A

1. Correct option-c: X- Ammonium hydroxide and Y – Tartaric acid
Window cleaner consists of ammonium hydroxide while grapes consist of tartaric acid.

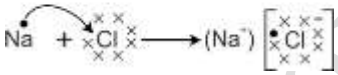
2. Correct option-d: (i) and (iv),
Aluminium has good thermal conductivity and high melting point.

3. Correct option-a: Baking powder solution
The effect of an acid can be nullified by the application of a base.
Bee sting venom contains formic acid which is one of the major factors for the painful burning sensation. Hence, the acidic effect can be neutralised by applying baking powder.

4. Correct option- a: Na and Cl

$Na \rightarrow Na^+ + e^-$
2,8,2 2,8
(Sodium cation)

$Cl + e^- \rightarrow Cl^-$
2,8,7 2,8,8
(Chloride anion)



Sodium gives away one valence electron to chlorine to form ionic bond.

5. Correct option-c: Rancidity
Rancidity of food: Oils and fats react with oxygen and get oxidised or turn rancid. This process is called rancidity.

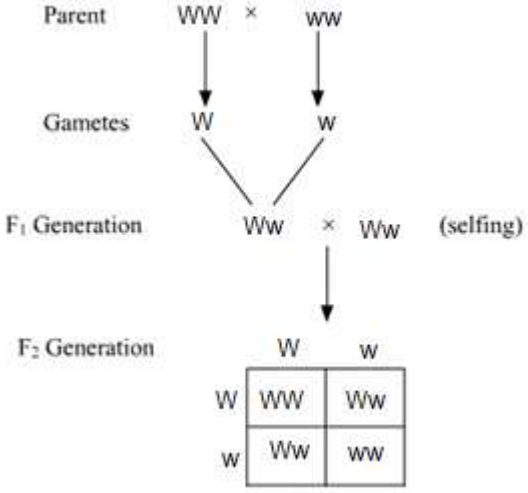
6. Correct option-d: Antacid
Indigestion causes acidity and to neutralize this acid, antacid is taken as it is basic in nature.

7. Correct option-b: Aldehyde
The functional group –CHO is present in aldehyde.

8. Correct option – d: Only I, II and III
Cerebrum is involved in the process of sensory information or decision making. Skeletal muscle is involved in the physical movement of the body. Cerebellum maintains body balance. Coordinated functions of these organs helped Shilpa to cross the road safely.

9. Correct option – c: Turgid state; helps in increasing the size of the stoma, i.e., opening the stomata.
Due to absorption of water, the guard cells become turgid, thus increasing the size of the stoma, and resulting in opening of the stomata.

10. Correct option – c : 1:2



The ratio of the genotype WW and Ww in the F_2 progeny is 1 (WW):2 (Ww).

11. Correct option – a : 1 only
1 – Sepals, 2 – Petals, 3 – Anther, 4 - Ovule
Sepals are the outermost, green, leaf-like protective structures in a flower. They protect the essential parts of the flower during the bud stage and help in the manufacture of food.

12. Correct option – b: A – ii, B – iii, C – i, D – iv
Ingestion – Food vacuole is formed with the help of pseudopodia.
Digestion – Food is engulfed within the food vacuole.
Absorption – Food diffuses into the cytoplasm.
Excretion – Undigested food is excreted out through the pseudopodia.

13. Correct option - d) 7.3 A
By using Ohm's law,
V = IR
I = V/R
Thus, I = 220/30 =7.3 A

14. Correct option - d) four times

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

$$P = \frac{(2V)^2}{R} = 4\left(\frac{V^2}{R}\right)$$

15. Correct option – d) T_4

At each trophic level of the food chain, majority of the energy available is utilised for respiration and other life processes while only 10% of the available energy is passed on to the next trophic level. Since only 10% of the available energy can be passed on to the next trophic level, higher trophic levels have substantially lesser energy and the number of trophic levels in a food chain is limited. Lower the trophic level, higher will be the amount of available energy. Hence, maximum amount of energy is expected in trophic level T_1 while T_4 will have minimum energy.

16. Correct option – d) They are made of non-biodegradable materials.

Disposable plastic plates are non-biodegradable and hence, cannot be degraded by micro-organisms. They continue to persist in the environment and pollute it.

17. A is true but R is false.

When an acid reacts with a base, then salt and water are formed. So, the assertion is true. When hydrochloric acid reacts with sodium hydroxide solution, then a neutralisation reaction takes place to form sodium chloride and water.

$NaOH(aq) + HCl(aq) \rightarrow NaCl(aq) + H_2O(l)$

Such a reaction is termed as neutralisation reaction. So, the reason is false.

18. Both A and R are true, and R is the correct explanation of A.

During sexual reproduction the genetic material of two individuals is combined to produce genetically diverse offspring that differ from their parents. The genetic diversity of sexually produced offspring is thought to give species a better chance of surviving in an unpredictable or changing environment. So, both assertion and reason are true, and the reason correctly explains the given assertion.

19. A is false but R is true.

The second trophic level of a food chain is occupied by herbivores that feed on plants or producers present at the first trophic level. So, the assertion is false. Carnivores feed on herbivores. Here, herbivores are primary consumers and carnivores are secondary consumers. So, the reason is true.

20. A is true but R is false.

Iris controls the size of the pupil.

SECTION - B

21. The syrupy liquid in the tube was concentrated sulphuric acid. Since sulphuric acid has great affinity for water, the energy released was in the form of heat. Hence, the tube cracked, and the vapours of the escaping acid produced blisters on the skin.

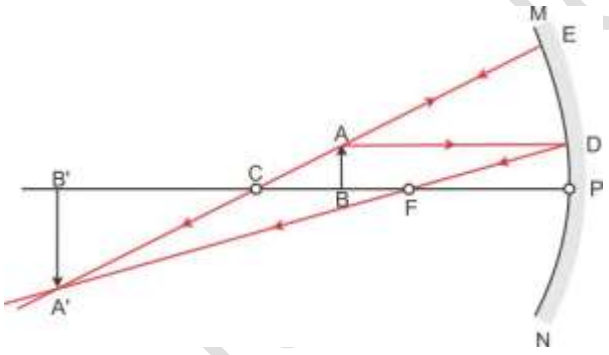
22. During fertilisation, a sperm comes in contact with the zona pellucida layer of the ovum and induces changes in the membrane that blocks the entry of additional sperms. Hence, although 300 million sperms are released during a single ejaculation from the penis into the vagina, only one of these sperms fertilizes the egg in the fallopian tube.

23. Aquatic organisms obtain oxygen dissolved in water. As compared to air, the availability of oxygen in water is low. Hence, aquatic organisms breathe faster as compared to terrestrial organisms to inhale the oxygen dissolved in water. That is why, the rate of breathing in aquatic organisms is much faster than in terrestrial organisms.

OR

Separation of oxygenated and deoxygenated blood allows a highly efficient supply of oxygen to the body. This is especially important in birds and mammals which have high energy needs and constantly use energy to maintain their body.

24.



Now for the given case as we can see, when an object is placed between centre of curvature and focus the image formed will be beyond the centre of curvature and its nature will be enlarged, real and inverted.

25.

i) Total resistance in arm CE

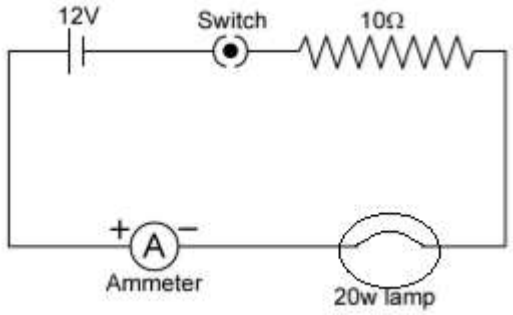
$R_s = 6 + 6 = 12\ \Omega$

ii) Current in arm AB

$$I = \frac{5\ V}{17\ \Omega} = 0.29\ A$$

OR

Circuit diagram:



26. DDT is a non-biodegradable chemical which not only accumulates at each trophic level of a food chain but also undergoes biomagnification with a rise in the trophic level. In a food chain comprising of grass, sheep, and man, the DDT concentration is maximum in man than in grass and sheep because man occupies the highest trophic level in the given food chain. Grass is at the producer level; sheep is at the primary consumer level and man is at the secondary consumer level.

SECTION - C

27.

(a) The cake didn't rise because baking soda ($NaHCO_3$) was used instead of baking powder. Baking soda alone cannot create carbon dioxide, which makes the cake rise and become soft and fluffy.

(b) If baking soda is used instead of baking powder to make cakes, the sodium carbonate formed will make the cake taste bitter.

(c) Tartaric acid, an edible oil, must be added to the baking soda. The acid reacts with baking soda and releases carbon dioxide, which helps the cake rise. It also neutralises the basic effect of baking soda, which helps eliminate the bitter taste.

28.

(a) The chemical reaction between citric acid and purple coloured potassium permanganate solution is characterised by a change in colour from purple to colourless.

(b) The chemical reaction between sulphur dioxide and acidified potassium dichromate solution is characterised by a change in colour from orange to green.

(c) The chemical reaction between iron and blue coloured copper sulphate is characterised by a change in colour from blue to light green.

OR

(c) When chlorine is passed over dry slaked lime at room temperature, the main reaction product is $CaOCl_2$ (bleaching powder).

$Ca(OH)_2 + Cl_2 \rightarrow CaOCl_2 + H_2O$

(a) When dilute hydrochloric acid reacts with sodium hydrogen carbonate, carbon dioxide gas is liberated.

$NaHCO_3 + HCl(dil) \rightarrow NaCl + CO_2 + H_2O$

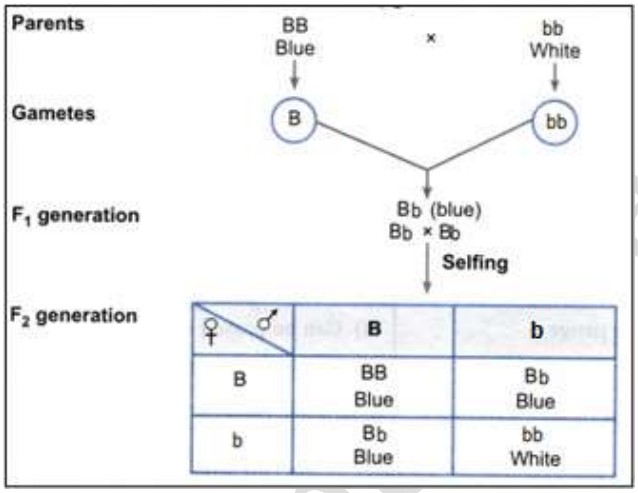
(b) Sodium hydrogen carbonate on heating decomposes into sodium carbonate, water, and carbon dioxide. This is a type of thermal decomposition reaction.

$2NaHCO_3 \xrightarrow{\Delta} Na_2CO_3 + H_2O + CO_2 \uparrow$

29.

(a) Adrenaline
(b) Insulin
(c) Growth hormone

30. 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.



(a) All the F_1 generation plants would be blue (Bb).
(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.

31.

(a) When we enter a dark room from bright sunlight, we are unable to see at first. This is because the size of the pupil is small. When we enter the dark room, the pupil expands and more light enters the eye enabling us to see.
(b) The iris controls the size of the pupil. So, when our eye encounters bright light, the iris contracts the pupil and protects the retina from damage.
(c) A person is wearing spectacles of power +1.5 D. So, the lens has a positive focal length which indicates that he is wearing a convex lens. Hence, he is suffering from hypermetropia or long-sightedness. For a person wearing spectacles of power –1.5 D, the lens has a negative focal length which indicates that he is wearing a concave lens. Hence, he is suffering from myopia or short-sightedness.

32.

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

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

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

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

(b) Total current in the circuit is

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

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

$$\therefore I = 4.2 \text{ A}$$

(c) Total resistance in the circuit is

$$V = IR_{eq}$$

$$\therefore R_{eq} = \frac{V}{I} = \frac{12}{4.2}$$

$$\therefore R_{eq} = 2.85\ \Omega$$

33. Given:

Object distance, u = −20 cm

Image distance, v = −40 cm

Height of object (h_0) = 2 cm

According to the mirror formula,

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

$$\frac{1}{-40} + \frac{1}{-20} = \frac{1}{f}$$

$$\frac{1}{f} = \frac{-1-2}{40}$$

$$f = -\frac{40}{3} = -13.33 \text{ cm}$$

magnification, $m = -\frac{v}{u} = \frac{h_i}{h_0}$

$$m = -\frac{-40}{-20} = \frac{h_i}{2}$$

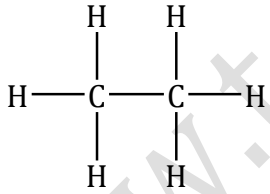
$$h_i = -4 \text{ cm}$$

SECTION - D

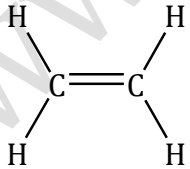
34. Distinguishing factors between alkanes, alkenes and alkynes are as follows:

Alkanes	Alkenes	Alkynes
Alkanes are hydrocarbons in which all the linkages between the carbon atoms are single covalent bonds.	Alkenes are unsaturated aliphatic hydrocarbons, which contain one double bond.	Alkynes are unsaturated aliphatic hydrocarbons, which contain one triple bond.
Alkanes are saturated hydrocarbons with the general formula $C_nH_{2n}+2$.	Alkenes are unsaturated hydrocarbons with the general formula C_nH_{2n}.	Alkynes are unsaturated hydrocarbons with the general formula C_nH_{2n-2}.
They are less reactive because of the non-availability of electrons in the single covalent bond.	Alkenes are more reactive than alkanes and alkynes because of the presence of a double bond.	Alkynes are more reactive than alkanes because of a triple bond.
They undergo substitution reactions.	They undergo addition reaction.	They undergo addition reaction.
Example: Ethane	Example: Ethene	Example: Ethyne

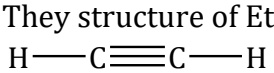
The structure of Ethane is:



The structure of Ethene is:



They structure of Ethyne is:



OR

An organic compound A (molecular formula $C_2H_4O_2$) reacts with Na metal to form a compound B and evolves a gas which burns with a pop sound.

A is ethanoic acid, CH_3COOH.
B is sodium ethanoate, CH_3COONa

$$2CH_3COOH + 2Na \longrightarrow 2CH_3COONa + H_2\uparrow$$
$$A(C_2H_4O_2) \qquad\qquad B$$

Compound A (ethanoic acid) on treatment with an alcohol C in the presence of a little concentrated sulphuric acid forms a sweet-smelling compound D (molecular formula $C_3H_6O_2$).

C is methanol, CH_3OH
D is methyl ethanoate, CH_3COOCH_3

$$CH_3COOH + CH_3OH \longrightarrow CH_3COOCH_3 + H_2O$$
$$A \qquad C \qquad D(C_3H_6O_2)$$

Compound D (methyl ethanoate) on treatment with NaOH solution gives back B (sodium ethanoate) and C (methanol).

$$CH_3COOCH_3 + NaOH \longrightarrow CH_3COONa + CH_3OH$$
$$D \qquad\qquad B \qquad C$$

35.

(a)

(i) (Part 2) <u>Seminiferous tubules:</u> Produce sperms by the process of spermatogenesis.
(Part 3) <u>Epididymis:</u> Stores sperms for some days during which they mature and become motile.

(ii) The production and survival of sperms require a temperature which is lower than the normal body temperature. So, the testes are located in the scrotal sac which is outside the abdomen to maintain a temperature 3°C below the normal body temperature.

(b) Before the rains, the tubers contained starch. When it rained, the plants started growing again producing new foliage. So, the plant converted the starch in the tuber to sugar, a water-soluble form, in order to be transported. This sugar made the tuber sweet.

OR

(a) A – Cyton
B – Dendrites
C - Axon

(b) Part B (dendrites) acquire information in the neuron.

(c) Information travels in a neuron from Part B (dendrites) to Part A (cyton) to Part C (axon).
(d) Information travels in a neuron in the form of electrical impulses.
(e) The impulse is converted into a chemical signal for onward transmission at the synapse.

36.

(a)

(i) Right-hand thumb rule: If one holds a wire carrying current in the right hand in such a way that the thumb indicates the direction of current, then the folded fingers indicate the direction of the magnetic field surrounding the wire.

(ii) Fleming's left-hand rule: If we stretch the first three fingers of the left hand mutually perpendicular to each other such that the forefinger points along the direction of the magnetic field and the middle finger points along the direction of the current, then the thumb indicates the direction of the force experienced by the conductor.

(iii) Fleming's right-hand rule: If the forefinger, middle finger, and thumb of the right hand are stretched at right angles to each other, with the forefinger in the direction of the field and the thumb in the direction of the motion of the wire, then the induced current in the wire is in the direction of the middle finger.

(b) The direction of AC changes after equal intervals of time. The direction of DC does not change. Advantage of AC over DC is that AC can be transmitted over long distances without much loss of energy.

OR

(a) Given that,
Potential difference, V = 220 V
Electric power, P = 800W
Time for which it is kept ON, t =60 × 60 × 10×7
Therefore,
Energy consumed by Air conditioner, E = P × t
E = 800 × 3600 × 70
E = 201,600,000 J or 201.6 MJ

(b) Given that,
New power rating, P' = 800/2 = 400 W
Time, t = 60 × 60 × 10 × 7
Now,
Energy consumed, E = P' × t = 400× 3600× 70
E = 100.8 × 106 -J = 100.8 MJ
Alternate method:
Since the power rating is halved, the new power rating can be determined by finding the ratio of initial and final energy consumption since the time period is constant.
i.e., P' = ½ × P

$$\frac{E'}{E}=\frac{P'\times t}{P\times t}$$

$$\therefore E'=201.6\times\frac{1}{2}=100.8\ MJ$$

(c) Difference in energy consumption, ΔE = E- E' = 100.8 MJ
Thus, Total unit of power consumed = 100.8/3.6 = 28 Units.
Net saving = 28 × 4 = 112 rupees

SECTION - E

37.

(a) Methods to cut off contact between metal and air:
(i) Galvanising: It is the process of giving a thin coating of zinc on iron or steel to protect them from corrosion. Example: shiny nails, pins, etc.
(ii) Electroplating: In this method, a metal is covered with another metal using electrolysis. Example: silver plated spoons, gold plated jewellery, etc.

(b) Iron reacts with moist air to acquire a coating of brown flaky substance called rust which is hydrated iron (III) oxide ($Fe_2O_3.xH_2O$).
Hence, corrosion of iron is termed as rusting process.
An alloy of iron is stainless steel composed of iron, nickel, chromium, and carbon.

OR

(c) When the surface of a metal is exposed to air, moisture or any other substance around it, the metal is said to corrode, and the phenomenon is known as corrosion.
(i) Silver corrodes to form Silver sulphide
(ii) Copper corrodes to form basic copper carbonate (mixture of copper carbonate and copper hydroxide).

38.

(a) Mendel studied two traits related to flower i.e., flower colour and flower position, two traits related to pod i.e, pod shape and pod colour and two traits related to seed i.e., seed shape and seed colour.

(b) There were 3 colour based contrasting traits studied by Mendel in pea plant namely flower colour, seed colour and pod colour.

(c)

	Flower colour	**Pod colour**	**Seed shape**
Dominant traits	Violet	Green	Round
Recessive traits	White	Yellow	Wrinkled

OR

The dominant and recessive traits are correctly placed with respect to seed colour (i), flower colour (ii) and pod shape (iii) only. With respect to flower position, the axial flowers are dominant over terminal flowers which are recessive.

39.

(a) Electrical appliances are connected in parallel combination at home.

(b) Frequency of AC supply in India is 50 Hz.

(c) Overloading is the condition in which too many appliances are connected in a single socket thus drawing an extremely high current.

OR

(c) The live wire is at a high potential, i.e., 220 V, while the neutral wire is at zero potential. Thus, the potential difference between the live wire and the neutral wire is $220 - 0 = 220$ V.