Sample Paper 13

Class X 2022-23

Science (086)

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

General Instructions:

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

SECTION - A **20 MARKS**

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

1. **The chambers are shown to have contracted using arrows in the figure.**

Identify the phase of circulation that is depicted in the following heart diagram.

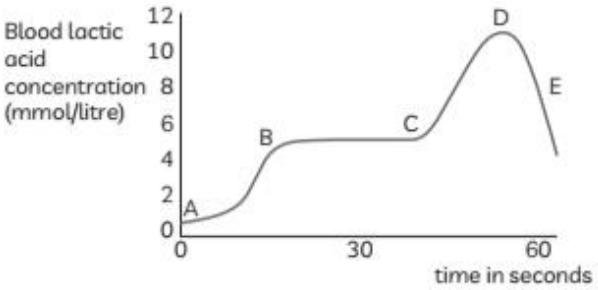
(a) Blood is pumped into several organs at once and transferred to the lungs for oxygenation.

(b) Various body organs receive blood from the lungs after it has been oxygenated.

(c) Blood flowed simultaneously to the left and right auricles.

(d) Blood is simultaneously pumped into the right and left ventricles. 1

2. **The lactic acid concentration in blood of a student during a sport's day race, with point D showing the peak is depicted in the graph.**



While competing in the race during sport's day, the student started producing lactic acid. Which of the subsequent processes best describes this incident?

(a) Breathing

(b) Aerobic respiration

(c) Anaerobic respiration

(d) Fermentation 1

3. **Take 4g of $Ba(OH)_2$, add 3g of NH_4Cl, and stir the mixture with a glass rod in a test tube. Now reach out and touch the test tube. When you touch the test tube, how do you feel?**

(a) The bottom of test tube is found to be cooler.

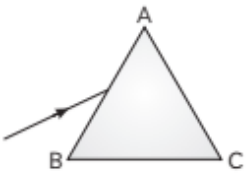
(b) The bottom of test tube is found to be hotter.

(c) The bottom of test tube is neither cool nor hot.

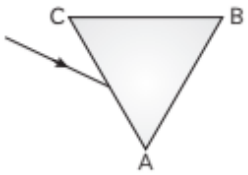
(d) The bottom of test tube is found to be cooler for some time and then it becomes extremely hot. 1

4. Prism ABC is positioned in various directions with BC serving as its base. As depicted in the figures provided below, a narrow beam of white light is incident on the prism. Which of the following situations, after dispersion, has the third colour from the top match the sky's colour?

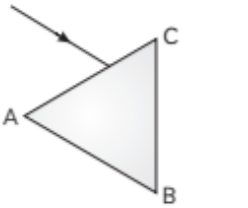
(a)



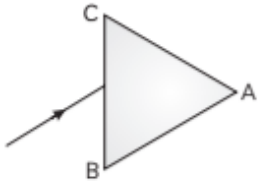
(b)



(c)

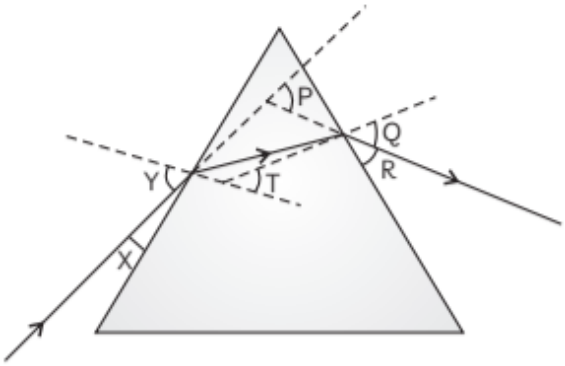


(d)



1

5. The path of a light beam passing through a glass prism is depicted in the diagram below:



In this diagram, the angles of incidence, emergence, and deviation are, respectively:

(a) X, Q and P (b) Y, Q and T

(c) X, R and T (d) Y, Q and P 1

6. A student compiled formulae and common names for various substances, but he neglected to record which formula corresponds to which compound. Some formulae were correct but some were incorrect as in the following table:

S. No.	Compound	Formula
(I)	Slaked lime	NaOH
(II)	Caustic soda	$Ca(OH)_2$
(III)	Lime	CaO
(IV)	Baking soda	$NaHCO_3$

Identify the option which shows incorrect matches:

(a) (I) and (II) (b) (I) and (III)

(c) (II) and (IV) (d) (III) and (IV) 1

7. Consider the following cross between peas plants showing self-pollination in F_1 generation:

Parents	RRyy	×	rrYY
	(Round, green seeded)		(Wrinkled, yellow seeded)
	↓		↓
Gametes	Ry		rY

The seeds produced in F_1 generation are:

(a) round and yellow

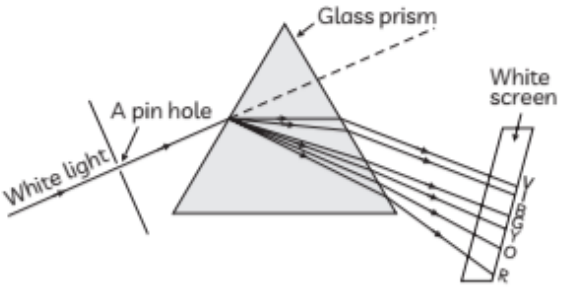
(b) round and green

(c) wrinkled and green

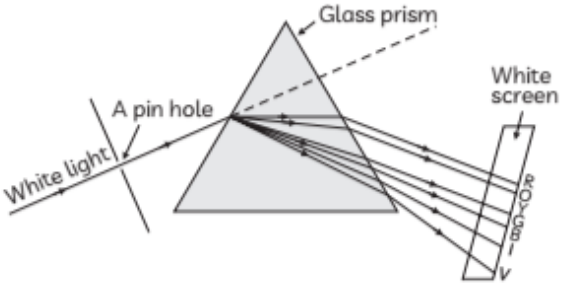
(d) wrinkled and yellow 1

8. Which of the following figure is correctly drawn?

(I)



(II)

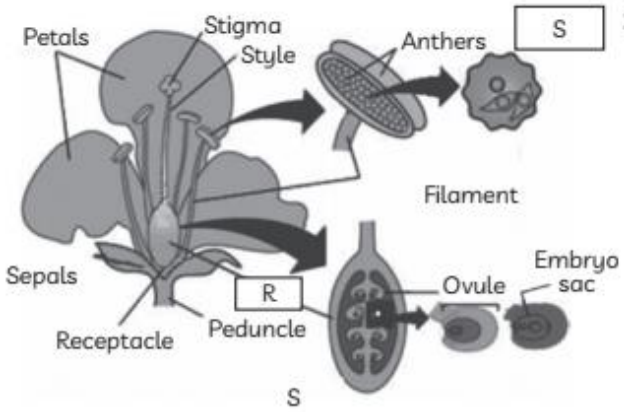


Select the correct option:

(a) (I) (b) (II)

(c) Both are correct (d) Both are incorrect 1

9. Identify the correct labelling for part labelled 'R' and 'S'



	R	S
(a)	Ovary	Pollen
(b)	Ovary	Female germ cell
(c)	Ovule	Male germ cell
(d)	Ovule	Pollen

1

10. Identify X and Y in the given reaction:

Glucose $\xrightarrow{\text{In cytoplasm}}$ Pyruvate + Energy

(6- carbon molecule) (3-carbon molecule)

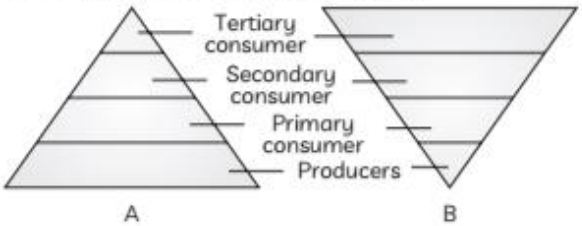
	X	Y
(a)	6	6
(b)	3	6
(c)	6	3
(d)	3	3

1

11. Refrigeration of food materials is done to prevent a phenomenon. Identify the change which can be observed during this phenomenon.

(a) Flavour changes
(b) Aroma changes
(c) Both (a) and (b)
(d) No change occurs 1

12. Take a look at the figures below.

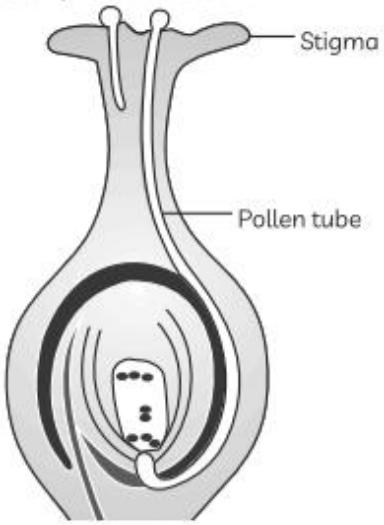


Which of the above figure is correct?

(a) Figure A (b) Figure B
(c) Figure A and B (d) Both are incorrect

1

13. Examine the illustration of the pollen-pistil interaction provided below:



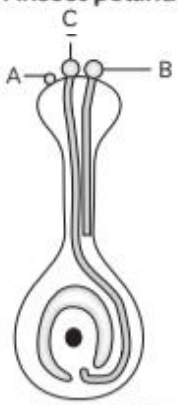
The name and number of the structure produced by Part 'Q':

(a) Male gamete, two
(b) Female gamete, one
(c) Male gamete, one
(d) Female gamete, two 1

14. Calcium reacts with water and begin to float. Identify the balanced chemical equation of the reaction.

(a) $Ca + H_2O \longrightarrow Ca(OH)_2 + H_2$
(b) $Ca + 2H_2O \longrightarrow Ca(OH)_2 + H_2$
(c) $2Ca + 2H_2O \longrightarrow 2Ca(OH)_2 + 2H_2$
(d) $2Ca + H_2O \longrightarrow 2Ca(OH)_2 + H_2$ 1

15. The most likely cause of pollen grain 'A''s failure to germinate in the given diagram of the carpel of an insect pollinated flower is:



(a) Pollen grains 'B' and 'C' were carried to the flower by insects, whereas pollen grain 'A' was carried to the flower by the wind.
(b) A flower of an incompatible species produced pollen grain 'A'.
(c) Pollen grain 'A' lacks protrusions necessary for proper adhesion to the stigma surface.
(d) Because pollen grains 'B' and 'C' arrived at the stigma first, their germination prevented pollen grain A from germinating. 1

16. Two elements $^{23}_{11}P$ and $^{19}_{9}Q$ are given. Which of them is a non-metal?

(a) P (b) Q

(c) Both P and Q (d) Both are metals 1

Q. no 17 to 20 are Assertion - Reasoning based questions.

These consist of two statements – Assertion (A) and Reason (R). Answer these questions selecting the appropriate option given below:

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

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

(c) A is true but R is false

(d) A is false but R is true

17. Assertion (A): C_nH_{2n+2} corresponds to general formula of alkanes.

Reason (R): Alkenes are unsaturated but this series is saturated series. 1

18. Assertion (A): Tigers have a shorter small intestine whereas deers hows a longer small intestine.

Reason (R): The length of the small intestine depends on the type of food the animals eat. 1

19. Assertion (A): Electrons move when current flows in the same direction to that of the current flow.

Reason (R): When electrons collide while travelling, heat is produced. 1

20. Assertion (A): Pollen Grain begins to shrink and develop in to a pollen tube.

Reason (R): Pollen tube reaches the ovule through the micropyle. 1

SECTION - B

12 MARKS

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

21. In a specific area, what kind of magnetic field lines are found. Create a diagram to symbolise. 2

22. Aluminum, magnesium, and sodium oxides cannot be converted to their corresponding metals by carbon. Why? In the reactivity series, where are these metals located? How do these metals get their ores into metals? 2

23. A student held a mirror in his hand and pointed the mirror's reflective surface towards the sun. Then, holding a piece of paper close to the mirror, he directed the reflected light there.

Will this activity enable him to calculate the mirror's approximate focal length? Give an explanation and a ray diagram to support your response in this situation.

OR

To illustrate refraction through a rectangular glass slab, create a ray diagram. How are incident and emergent rays related? 2

24. (A) When a mature *Spirogyra* filament reaches a significant length, what happens?

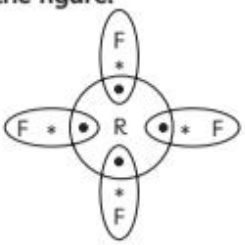
(B) What are the names of the organisms that have both sex organs in the same individual? Name one such organism as an example.

OR

(A) Give an explanation of why a more complex organism cannot produce new life through the process of regeneration.

(B) What distinguishes a unisexual flower from a bisexual flower? 2

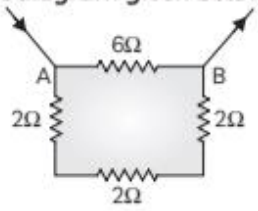
25. The electron arrangement in a compound made up of element "R" and fluorine is depicted in the figure.



(A) Write chemical formula of this compound.

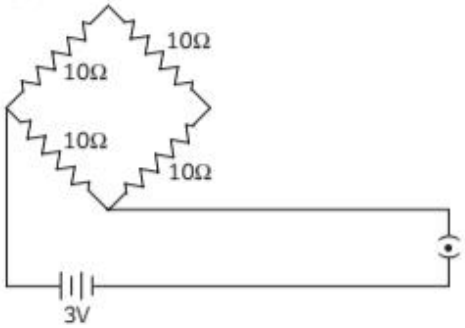
(B) Is this an ionic or covalent compound? Give reason. 2

26. Find the resistance between points A and B in the circuit diagram given below:



OR

Find the current drawn from the battery by the network of four resistors shown in the figure.



2

SECTION - C

21 MARKS

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

27. Without muscle cells, how do plant cells demonstrate movement? Name the movement that plant cells exhibit under these circumstances as well. 3

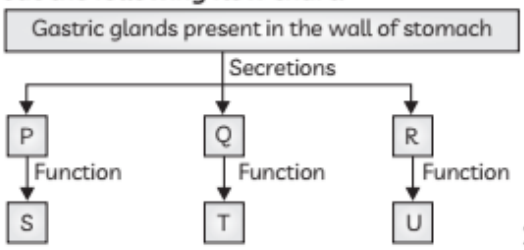
28. Explain the following:

(A) NaCl does not conduct electricity when it is solid, but it does so when it is molten or in an aqueous solution. Explain.

(B) When dipped in HNO_3, reactivity of aluminium decreases.

(C) In nature, metals like Na, Ca, and Mg are never found in their free state. 3

29. According to the instructions, help Riya to fill out the following flow chart.



3

30. Define spectrum. Why do various coloured rays diverge in different ways when they pass through a glass prism?

OR

(A) Create a diagram to demonstrate how a myopic eye forms an image of a distant object. How can such an eye defect be remedied?

(B) It is suggested that one wears glasses with convex lenses. What kind of vision impairment does he have? 3

31. Sunita wrote the chemical formula for an organic acid, 'X,' as $C_2H_4O_2$. It is a liquid that frequently freezes during the winter in cold countries. When she warmed it with ethanol while adding a few drops of concentrated sulphuric acid results in the formation of the sweet-smelling compound 'Y'.

(A) Identify 'X' and 'Y'. Draw their structure.

(B) Create a chemical equation to describe the reaction.

OR

(A) Why the methane-chlorine reaction is deemed a substitution reaction when sunlight is present?

(B) Give reason for the following observations:

(i) The use of synthetic detergents contaminates the water.

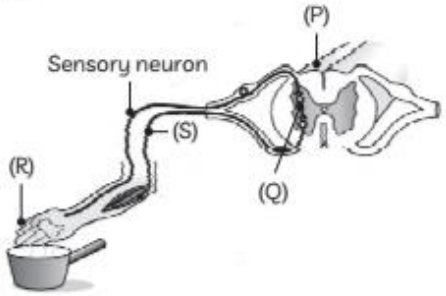
(ii) When the heated vessels turn black from the flame, the air holes of a gas burner must be adjusted. 3

32. Illustrate four possible circuit connections for four resistors with *r* ohm each. When is the combination's equivalent resistance:

(A) maximum

(B) minimum 3

33. Identify part P, Q, R and S in the figure given below:



What name is given to the series of events depicted in the figure? Explain. 3

SECTION - D

15 MARKS

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

34. (A) A species variations do not all have the same chances of surviving. Why?

(B) Breeding pea plants with violet flowers and pea plants with white flowers was done as a Mendelian experiment. What will happen to the F_1 progeny?

(C) When a tall pea plant crosses with a short pea plant, why are the offspring always tall? Also show its cross. 5

35. Draw lines encircling a magnet (as shown in the figure) in the magnetic field.

Indicate one point where the uniform and non-uniform magnetic fields differ.

(B) The uniform magnetic field is perpendicular to a current-carrying conductor. What happens to the conductor's displacement:

(i) if the current becomes stronger

(ii) a weak horseshoe magnet is used in its place ?

(C) Think about a wire loop that is lying in a circle on the table. Allow the current to move clockwise around the loop. To

determine the magnetic field's direction both inside and outside the loop, use the right-hand rule.

OR

(A) How often do electrical short circuits happen?

(B) Why are live and neutral pins thinner and shorter than earth pins?

(C) In the east-west direction, a straight conductor carrying current is positioned. What will be the direction of the force this conductor feels from the magnetic field of the earth? What effects will this force have when:

(i) changing the flow of the current's direction

(ii) increasing the current's strength? 5

36. Rakesh performed an experiment to produce HCl gas.

(A) Make a labelled diagram to demonstrate how hydrogen chloride gas is made in a laboratory.

(B) Use dry and then wet litmus paper to test the gas that has evolved. Which of the two scenarios results in a colour change on the litmus paper?

(C) Explain why dry HCl gas or HCl solution exhibits an acidic character.

OR

(A) What happens to the egg shells when nitric acid is added? Write the chemical equation involved.

(B) In two different beakers, a student made solutions of (i) an acid and (ii) a base. She neglected to label the solutions, and the lab was lacking in litmus paper. How will she tell one solution from the other when they are both colourless? 5

SECTION - E

12 MARKS

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

37. *To survive, yeast requires three things: food, warmth, and moisture. In the presence of warmth and moisture, yeast ferments the sugar and starch in its food to produce carbon dioxide and ethanol. The bread rises due to carbon dioxide. In this recipe, the ingredients that dry yeast loves the most—flour, milk, sugar, and melted butter—are actively mixed together. The process of kneading is crucial to making bread. It helps the dough develop gluten, which is essential for the elastic texture of bread. But this dish is unique. Because of how much the proteins are broken down, even small actions can produce gluten.* 4

(A) Energy is released as heat during the baking of bread. Exothermic reactions are what are known as such reactions. What happens in an exothermic reaction?

(B) 'Exothermic reactions occur much faster than endothermic ones.' Justify the statement.

OR

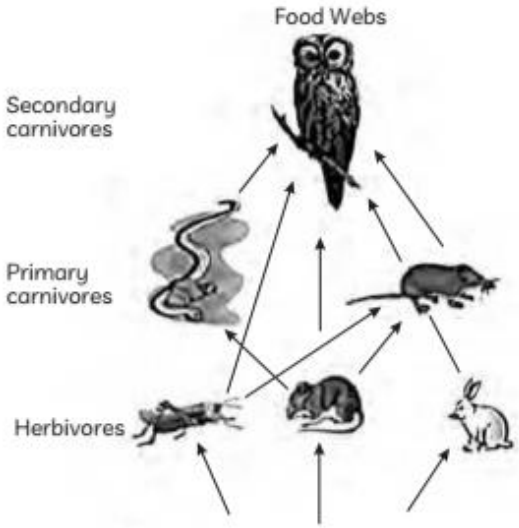
(B) Which of the following reactions is exothermic?

(I) $CaO_{(s)} + H_2O_{(l)} \rightarrow Ca(OH)_{2(aq)} + Heat$

(II) $2AgCl_{(s)} \xrightarrow{\Delta} 2Ag_{(s)} + Cl_{2(g)}$

(III) $2Pb(NO_3)_{2(s)} \rightarrow 2PbO_{(s)} + 4NO_{(g)} + O_{2(g)}$

38. *For the majority of species to survive, food chains are crucial. In some cases, the extinction of a species can happen when just one component of the food chain is eliminated.*



(A) What limits the number of trophic levels in a food chain?

(B) If Ravi is consuming curd and yogurt for lunch, which trophic level in a food chain he should be considered as occupying?

(C) The decomposers are not included in the food chain. What is the reason for the same ?

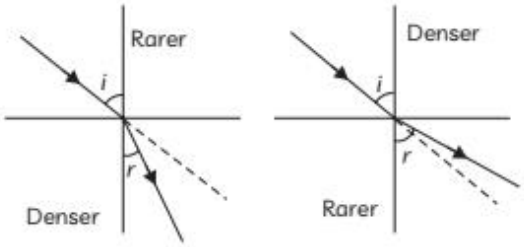
If 10,000 J solar energy falls on green plants in a terrestrial ecosystem, what percentage of solar energy will be converted into food energy?

OR

(C) Matter and energy are two fundamental inputs of an ecosystem. How is the

movement of energy and matter ? Give reason.

39. *The path of light is altered when it moves from one transparent medium to another. This phenomenon is known as light refraction. The optical density of the medium that the light passes through determines how the light will bend.*



From medium to medium, light travels at varying speeds. A medium with a higher speed of light is optically rarer, whereas a medium with a lower speed of light is optically denser. When light travels from one medium to another, its frequency does not alter; instead, its speed and wavelength do. It came to the conclusion that the primary cause of refraction is a change in light speed. 4

(A) How do light rays bend in one of the following ways when they pass through glass from air ?

(B) What happens to the frequency of light when light travels from one medium to another ?

(C) At what angle the ray of light hits the boundary of medium B so that no bending as light occurs?

OR

(C) What is the effect on speed when light travels through glass and into water? How do the bottom of a pool filled with water appears due to light refraction ?

SOLUTION

SAMPLE PAPER - 4

SECTION - A

1. *(a) Blood is pumped into several organs at once and transferred to the lungs for oxygenation.*

Explanation: In the figure, ventricular systole is visible. Blood is simultaneously pumped into numerous organs and transported to the lungs to be oxygenated through ventricular contraction.

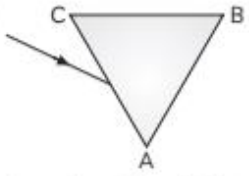
2. *(c) Anaerobic respiration*

Explanation: Our muscle cells' ability to break down pyruvate occasionally shifts to another pathway when there is insufficient oxygen present. Here, the pyruvate is changed into the three-carbon molecule lactic acid. Cramps are brought on by the accumulation of lactic acid in our muscles during intense exercise. When we perform challenging tasks, such as long distance running or intense exercise, this anaerobic respiration frequently occurs in our muscle cells.

3. *(a) The bottom of test tube is found to be cooler*

Explanation: The bottom of the test tube is found to be cooler when barium hydroxide is added to ammonium chloride because this reaction is endothermic.

4. *(b)*



Explanation: The third colour from the top in the prism, when it is positioned with angle A upward, is yellow. However, the third colour from the top that we were given is blue (colour of the sky). As a result, base BC must be on top, meaning the prism must be turned upside down.

5. *(d) Y, Q and P*

Explanation: Incident angle or angle Y in this case, is the angle formed by the incident ray with the normal to the first face of the prism. Emergent angle or angle Q in this case, is the angle that the emergent ray makes with the normal to the surface when it exits the prism following refraction. Angle of deviation, or angle P in this case, is the angle formed by the incident and emergent rays.

6. *(a) (I) and (II)*

Explanation: The correct formula of the compounds are:

Slaked lime- $Ca(OH)_2$

Caustic soda-NaOH

Baking soda- $NaHCO_3$

Lime-CaO.

7. *(a) round and yellow*

Explanation: Round and Yellow seeds (RrYy) are produced in F1 offspring as a result of the cross between round green seeded pea plants (RRyy) and wrinkled yellow seeded pea plants (rrYY).

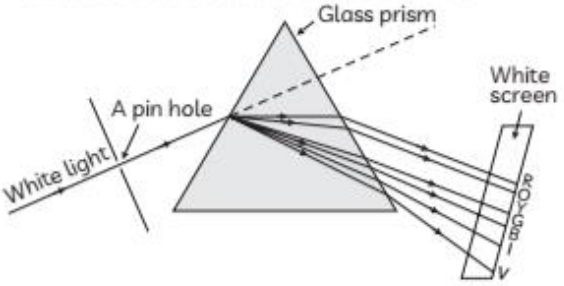
Parents	RRyy	×	rrYY
	(Round, green seeded)		(Wrinkled, yellow seeded)
	↓		↓
Gametes	Ry	×	rY
F_1	Rr Yy		
	(Round, yellow seeded)		

Related Theory

This demonstrates that round seeds and yellow cotyledons are dominant traits over wrinkled and green, respectively.

8. *(b) (II)*

Explanation: The correct figure showing the different colours on the white screen is:



9. *(b) R : Ovary; S : Female germ cell*

Explanation: The part labelled as 'R' and 'S' is ovary and female germ cell respectively. Once the pollen begins to grow, it travels through the cells of the style to the ovary, where it fertilises the female gamete.

10. *(c) X: 6; Y: 3*

Explanation: X = 6, Y = 3. Glucose is a 6-carbon molecule and pyruvate is a 3-carbon molecule.

11. *(c) Both (a) and (b)*

Explanation: Refrigeration of food materials is done to prevent rancidity. Rancidity is a process that causes food materials that contain fats and oils to alter their flavour and odour. Air, fats and oils interact to produce rancidity, which alters the flavour and aroma of food.

12. *(a) Figure A*

Explanation: The greatest number of people exist at the producer level in an ecosystem. Each level after that sees a decrease in this number. As a result, it has a pyramidal shape with a wider base and a tapered peak. 10% of the food is typically converted into body mass and made available to the following tier of consumers.

13. *(a) Male gamete, two*

Explanation: Part labelled as 'Q' is pollen grain. Two male gametes are produced from each pollen grain.

14. *(b)* $Ca + 2H_2O \rightarrow Ca(OH)_2 + H_2$

Explanation: Cold water and calcium react to produce calcium hydroxide and hydrogen gas. The balanced chemical equation of the reaction is:

$$Ca_{(s)} + 2H_2O_{(l)} \xrightarrow[\text{temperature}]{\text{Room}} Ca(OH)_{2(aq)} + H_{2(g)}$$

15. *(b) A flower of an incompatible species produced pollen grain 'A'.*

Explanation: Only when the pollen grain and stigma are compatible, that is, belong to the same or close relatives of species, can pollen grains begin to develop. A compatible species must have produced pollen grains 'B' and 'C'. Pollen tubes are created when only compatible pollen grains germinate.

16. *(b) Q*

Explanation: Based on the atomic number, the electronic configurations of the elements P and Q are:

	K	L	M
$^{23}_{11}P$ (Z = 11):	2	8	1
$^{19}_{9}Q$ (Z = 9):	2	7	

Non-metals usually have 5 to 7 electrons in their outermost shell. Therefore, element $_9{}^{19}Q$ is a non-metal.

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

Explanation: C_nH_{2n+2} corresponds to general formula of alkanes. Since, alkenes are unsaturated so this series is saturated series. A series of compounds with the same functional group is called a homologous series. Both their physical and chemical characteristics are similar. The general formula for compounds in the same homologous series is the same.

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

Explanation: Tigers have a shorter small intestine as meat is easier to digest.

Dears hane a longer small intestine to allow cellulose from the plants to be digested. We know that deers are herbivorous whereas tigers are carnivorous animals.

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

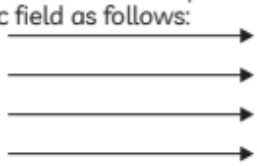
Explanation: Electrons move when current flows in the opposite direction to that of the current flow. When electrons collide while travelling, heat is produced. The resistance of each determines how much heat is produced. In the case of a series connection, the current had the same magnitude entering and leaving the resistors.

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

Explanation: The pollen grain begins to swell and develop into a pollen tube. The pollen tube develops into the style before passing through the micropyle to reach the ovule.The two male gametes that were locked inside the embryo sac are released when the pollen tube reaches it. The male gamete then fuses with the female game embryo sac.

SECTION - B

21. The parallel, equally spaced, lines of equal length are used to represent the uniform magnetic field as follows:

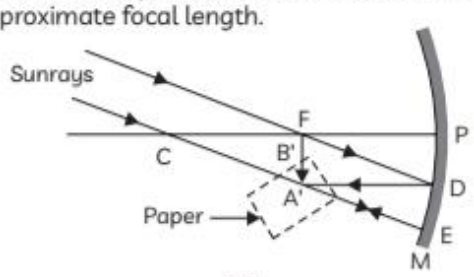


22. As these elements are positioned above carbon in the reactivity series, sodium, magnesium, and aluminium are all considered to be more reactive than carbon.

As a result of its lower natural reactivity, carbon cannot reduce the oxides of sodium, magnesium, and aluminium.

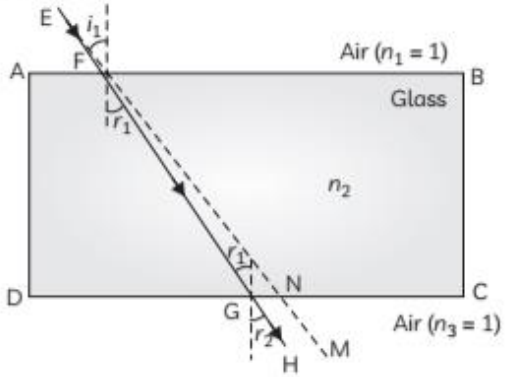
The electrolytic reduction (Electrolysis) method is used to remove highly reactive metals from their ores, including sodium, magnesium, and aluminium.

23. By measuring the distance between the paper and the mirror, the student can determine the approximate focal length.



OR

The adjacent figure displays a ray diagram illustrating refraction through a rectangular glass slab.



According to figure, parallel sunrays are focused on the paper at point A' in the mirror's focal plane so that PB' = *f*.

24. (A) *Spirogyra's* mature, elongated filament breaks into smaller pieces or fragments. The fragments develop into fully developed filaments.

(B) Hermaphrodites or bisexuals, such as Mustard and *Hydra*.

OR

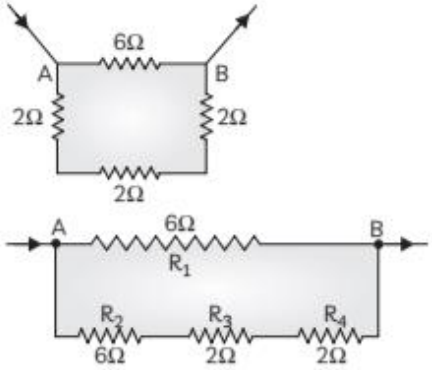
(A) Complex organisms like humans, birds, lizards, and others do not experience it. Regeneration in this case is restricted to minor part repair or regeneration. It's because complex animals have highly differentiated tissues and organs.

(B) A bisexual flower has both types of reproductive organs, whereas a unisexual flower only has one type, either stamens (the staminate or male flower) or pistils (the pistillate or female flower).

25. (A) RF_4

(B) It is a covalent compound. The molecule RF_4 is formed when an atom 'R' shares four pairs of electrons with four fluorine atoms, as depicted in the figure. Covalent compounds have the property of sharing electrons.

26.



R_2, R_3, R_4 are in series and have resultant resistance R'

R_1 = 6Ω;

R' is in parallel combination with R_1.

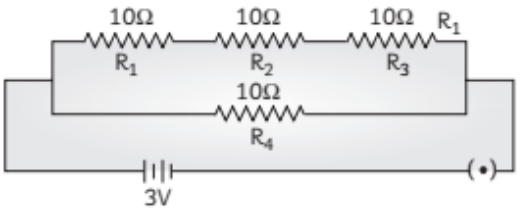
∴ Resultant resistance of the circuit (R)

$$\Rightarrow \quad \frac{1}{R}=\frac{1}{R_1}+\frac{1}{R_1}$$

$$\Rightarrow \quad \frac{1}{6}+\frac{1}{6}=\frac{2}{6}=\frac{1}{3}$$

∴ Resistance R = 3Ω.

OR



Resultant resistance of R_1, R_2 and R_3: R' = R_1 + R_2 + R_3 = 10 + 10 + 10 = 30Ω.

Resultant resistance of the circuit R :

$$\frac{1}{R}=\frac{1}{R'}+\frac{1}{R_4}$$

$$=\frac{1}{30}+\frac{1}{10}$$

$$=\frac{1+3}{30}=\frac{4}{30}$$

$$R=\frac{30}{4}=\frac{15}{2}=7.5\Omega$$

V = 3 volts

V = IR

I = ?

$$\Rightarrow \quad I=\frac{V}{R}=\frac{3}{7.5}=\frac{60}{75}$$

= 0.4 A

SECTION - C

27. Plants move either statically or tidally in the absence of muscle cells. Changes in the water content of a plant's cells allow for nastic movement. The nastic movement is carried out by the petiole of the leaves.

The action of various hormones in the plants causes the tropic movement.

(i) The hormone auxin causes phototropism.

(ii) The abscisic acid hormone causes leaves to wilt.

(iii) By using cytokinin, the fruits and seeds grow.

The movement that plant cells exhibit under these circumstances is termed as nastic movement.

28. (A) An ionic compound with sodium and chloride ions in its structure is sodium chloride. Ionic compounds do not conduct electricity when they are solid, but they do so when they are dissolved in water or molten. So, sodium chloride exhibits this property.

(B) Nitric acid is used to coat aluminium, causing aluminium oxide to form on the metal. Nitric acid is a potent oxidising agent, which causes this to occur. Aluminum's further reaction is stopped by the layer of aluminium oxide. The result is a decrease in aluminum's reactivity.

(C) Metals like sodium, calcium, and magnesium are extremely reactive and never occur in nature in their free state because they react with oxygen even at room temperature.

29. P – Hydrochloric acid (HCl)

Q – Protein digesting enzyme pepsin

R – Mucus

S – HCl makes medium acidic for the activation of an enzyme pepsin.

T – Pepsin acts in acidic medium which breaks down proteins into peptones.

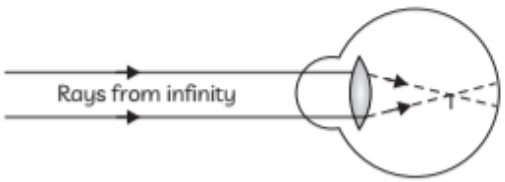
U – Mucus protects the inner lining of stomach from corroding action of HCl.

30. Spectrum: A band of seven colours is created on a white screen when a beam of white light passes through a prism. This is referred to as the white light spectrum.

When white light passes through a glass prism, different components of it are refracted or bent at different angles, which causes the white light to disperse. The seven-colored band, or spectrum, is created when white light is made up of seven colours and falls on a prism. Each colour is refracted or deviated by a different angle as a result.

OR

(A)



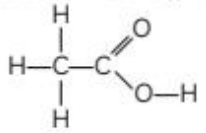
Eye suffering from myopia

By using a concave lens with the right focal length, myopia can be treated.

(B) Hypermetropia.

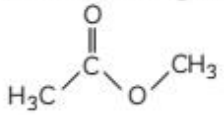
31. (A) The organic acid, X, which often freezes in the winters in cold countries, is ethanoic acid.

The structural formula is given below:



When ethanoic acid is warmed with methanol in the presence of a few drops of concentrated sulphuric acid, the compound 'Y' with sweet fragrance is formed. This compound is called methyl ethanoate,

The structural formula is given below:



(B) The chemical equation of the reaction is given below:

$$CH_3COOH + C_2H_5OH \xrightarrow{\text{conc } H_2SO_4} CH_3COOC_2H_5 + H_2O$$

OR

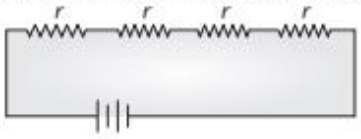
(A) Chloromethane and hydrogen chloride are form when methane and chlorine react in the presence of sunlight. Here, a chlorine atom replaces one of the hydrogen atoms in methane. Thus it is a substitution reaction.

(B) (i) In general, synthetic detergents are not biodegradable, meaning that bacteria cannot break them down. Consequently, the use of synthetic detergents pollutes lakes and rivers.

(ii) Gas burner air holes need to be adjusted because blackening of the vessel indicates that the gas stove's air holes are becoming blocked, which prevents the fuel from burning completely due to lack of oxygen.

32. Four possible circuit connections for four resistors with r ohm each are as following:

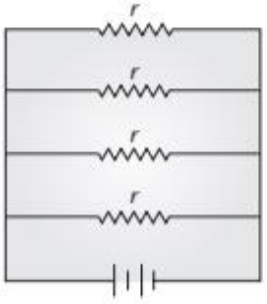
(i)



Resultant resistance, $R = r + r + r + r$;

$$R = 4r$$

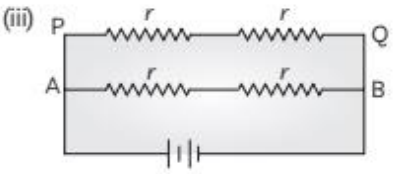
(ii)



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

$$R = \frac{r}{4}$$

(iii)



Resistance (AB) = $R_1 = r + r = 2r$

Resistance (PQ) = $R_2 = r + r = 2r$

Resultant, R = ?

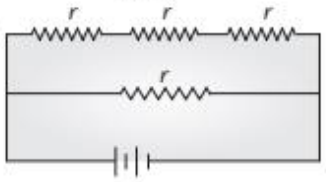
$$\frac{1}{R} = \frac{1}{R_1} + \frac{1}{R_2}$$

$$= \frac{1}{2r} + \frac{1}{2r} = \frac{1+1}{2r}$$

$$= \frac{2}{2r} = \frac{1}{r}$$

$$R = r$$

(iv)



$R_1 = r + r + r = 3r$

Resultant, R = ?

$$\frac{1}{R} = \frac{1}{R_1} + \frac{1}{r}$$

$$= \frac{1}{3r} + \frac{1}{r}$$

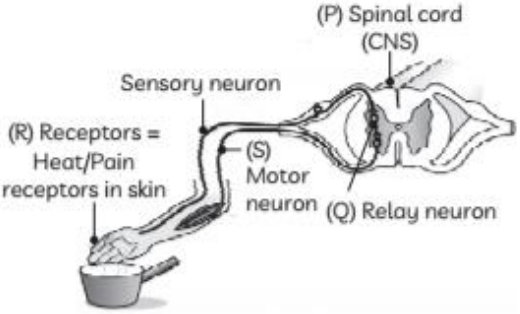
$$= \frac{1+3}{3r} = \frac{4}{3r}$$

$$R = \frac{3r}{4}$$

(A) Maximum resistance = Case (i) where all the resistors are combined in series.

(B) Minimum resistance = Case (ii) where all the resistors are combined in parallel combination.

33.



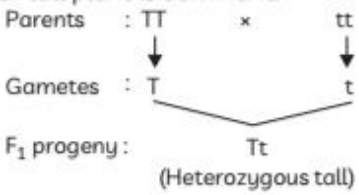
The name given to the series of events depicted in the figure is reflex action. The reflex arc is the path taken by the nerve impulses involved in a reflex action. A stimulus is first detected by skin-based receptors, which then send an impulse carrying the stimulus to the spinal cord. The motor neurons receive the impulse from the spinal cord after it has processed the stimulus. The effectors, or muscles, are stimulated by the motor neurons to react to the stimulus.

SECTION - D

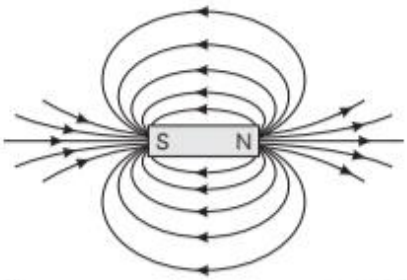
34. (A) The chances of each variation surviving in their natural environment are not equal. Different people would benefit in different ways depending on the types of variations. The organisms that are best suited to their surroundings will endure.

(B) According to the Mendelian experiment, violet colour (VV) is dominant and white colour (WW) is recessive trait. Consequently, the F_1 progeny's flower will be violet in colour (Vw).

(C) Only tall plants are produced in the F_1 progeny when a tall plant (TT) crosses with a short pea plant (tt). This is due to the fact that only one of two contrasting traits is present in the first generation's offspring. Accordingly, the trait that manifests in the F_1 generation is dominant, whereas the trait that does not manifest is recessive. All of the plants are tall because the character TT for tall plant is dominant.



35. (A)



The term "uniform magnetic field" refers to an area or space with a consistent magnetic field throughout. Non-uniform magnetic field is the term used to describe the magnetic field that is different in strength and direction at every location in space.

(B) When the current is increased, the displacement of the conductor (i) will rise, and (ii) will fall when a weak horse shoe magnet is used.

(C) According to the right-hand rule, we discover that the magnetic field lines are pointed inward and perpendicular to the plane of the paper inside the loop. Magnetic field lines that are directed away from the loop are coming from the paper's plane.

OR

(A) Live wire and neutral wire may come into direct contact if either the insulation of the wires used in an electric circuit is damaged or if there is a problem with the appliances. As a result, the circuit experiences short circuiting and an abrupt rise in current.

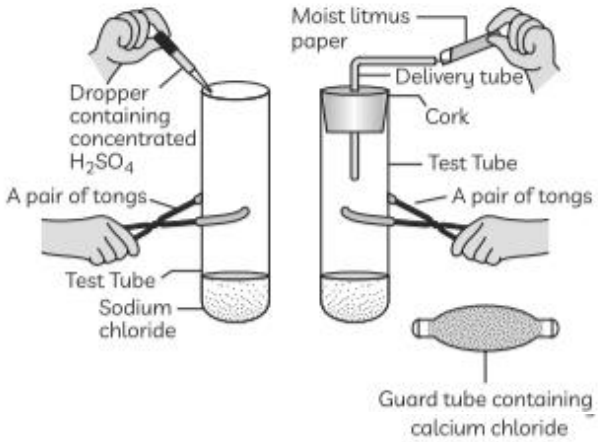
(B) Earth pin is thicker to prevent insertion into the live or neutral sockets. It is lengthened so that it can make contact with the earth terminal before the live and neutral pins do. This guarantees the user's security.

(C) The earth's magnetic field is oriented from 0-north to U-south. Suppose the current is going east to west. Force is therefore directed vertically upward.

(i) The direction of will be reversed—vertically downwards—by changing the direction of the current.

(ii) The force's strength is doubled.

36. (A) (i)



Preparation of hydrogen chloride gas

(B) Blue litmus paper that is "dry" stays the same colour, but blue litmus paper that is "moist" turns red when it comes in contact with the test tube mouth.

This demonstrates that HCl gas behaves acidically in the presence of water but not in the absence of water.

(C) Hydrochloric acid solution, or $HCl_{(aq)}$, is created when HCl gas dissolves in water. This solution then produces $H^+_{(aq)}$ or $H_3O_{+(aq)}$ ions.

$$HCl + H_2O \rightarrow H_3O^+ + Cl^-$$

The H^+ or H_3O^+ present causes it to behave acidically.

OR

(A) Calcium carbonate is present in egg shells. Nitric acid and calcium carbonate react to produce calcium nitrate and carbon dioxide gas.

$$CaCO_{3(s)} + HNO_{3(aq)} \rightarrow CaNO_{3(aq)} + CO_{2(g)} + H_2O_{(l)}$$

(B) To determine which beaker contain acid and which contains base, we can use phenolphthalein. In basic solutions, phenolphthalein turns pink instead of colourless.

In addition, we can use other organic indicators like turmeric or China rose.

An organic indicator is turmeric. It is coloured yellow. While turmeric paper does not change colour when exposed to acid, it does turn red when submerged in a basic solution.

Another natural indicator is the China rose. With acid, China rose solution produces a dark pink (magenta) colour, and with base, a green colour.

SECTION - E

37. (A) Exothermic refers to chemical reactions that release energy. When bonds are formed in the products of exothermic reactions, more energy is released than is required to break the bonds between the reactants. The temperature of the reaction mixture rises as a result of exothermic reactions.

(B) Exothermic reactions are regarded as being more rapid than endothermic ones. This is primarily due to the instantaneous or spontaneous nature of the reactions in the exothermic process. In this case, no energy input is necessary to get past any significant energy obstacles. Contrarily, in the case of endothermic reactions, we need some kind of energy (typically heat) to get past an energy barrier even before the process itself begins. Exothermic reactions therefore happen much more quickly than endothermic ones.

OR

(B) Reaction (I) and (III) are exothermic. Reaction (I): Heat is produced as a result of the reaction, as evidenced by the heat symbol (Δ) at the side of the products. As a result, the reaction is exothermic because heat is being released.

Reaction (III): Three products are formed during the decomposition of $2Pb(NO_3)_2$. Decomposition reactions always occur by gaining energy. Thus it is exothermic reaction.

Caution

Students should note that decomposition reactions almost always move forward by gaining energy. This is due to the fact that bond breaking requires some energy. Therefore, any illustration of a decomposition reaction also constitutes an exothermic reaction.

38. (A) Decrease in energy at higher trophic level limits the number of trophic levels in a food chain.

Related Theory

As per the 10% law of energy transfer, only 10% of energy assimilated by an organism of a particular trophic is transferred to the next trophic level. Therefore, energy keeps on decreasing from primary to secondary level.

(B) Ravi is a primary consumers and primary consumer occupy. the second trophic level.

(C) Decomposers are not included in the food chain because they do not directly interact with any organisms.

Green plants in a terestical ecosystem convert 1% of the total solar energy falling on it into food = 1% of 10,000 = 100 J.

OR

(C) Movement of energy is unidirectional and of matter is repeatedly circulating. The flow of energy in the ecosystem is unidirectional because the energy lost as heat from the living orgasim of food chain cannot be used by plants in photosynthesis.

39. (A) A light ray bends toward the normal as it passes through glass from air.

(B) When light travels from one medium to another, its frequency remains constant.

(C) When light is incident normally or perpendicularly on a boundary between two media, it does not bend because the angle of incidence and the angle of refraction are both zero.

OR

(C) Because water is an optically rarer medium than glass, light travels faster when it passes through water.

Refraction causes a pool's bottom to appear shallower than it actually is.