SCIENCE - Code No. 086

CBSE CLASS 10 SAMPLE PAPER 2

Prepared by Future Topper | Not an official CBSE publication

Time allowed: 3 Hours **Maximum Marks:** 80

General Instructions:

1. This question paper consists of 39 questions in 3 sections.

2. Section A is Biology, Section B is Chemistry, Section C is Physics.

3. All questions are compulsory. However, an internal choice is provided in some questions. Attempt only one option where a choice is given.

4. Marks are indicated against each question.

SECTION A - BIOLOGY (30 Marks)

1. Which sequence correctly represents the pathway of urine formation and removal in humans? *[1]*

A. Kidney → Urethra → Ureter → Urinary bladder

B. Kidney → Ureter → Urinary bladder → Urethra

C. Urinary bladder → Kidney → Ureter → Urethra

D. Kidney → Urinary bladder → Ureter → Urethra

2. Anaerobic respiration in yeast produces: *[1]*

A. Lactic acid and energy

B. Ethanol, carbon dioxide and energy

C. Carbon dioxide, water and energy

D. Oxygen and energy

3. Which part of the human brain is primarily responsible for maintaining posture and balance of the body? *[1]*

A. Cerebrum

B. Cerebellum

C. Medulla

D. Hypothalamus

4. Iodine deficiency in the diet primarily affects the functioning of which gland, leading to goitre? *[1]*

A. Pituitary

B. Thyroid

C. Adrenal

D. Pancreas

5. In guinea pigs, a cross between two black-furred parents produced some white-furred offspring. What does this suggest about the parents' genotypes? *[1]*

A. Both parents were homozygous dominant

B. Both parents were heterozygous carriers of the recessive white allele

C. One parent was homozygous recessive

D. Both parents were homozygous recessive

6. Which of the following statements about biodegradable and non-biodegradable substances are correct? (i) Biodegradable substances are broken down by microorganisms into simpler substances. (ii) Plastics are biodegradable. (iii) Non-biodegradable substances tend to accumulate in the environment. (iv) Fruit and vegetable peels are non-biodegradable waste. *[1]*

A. (i) and (iii)

B. (ii) and (iv)

C. (i), (ii) and (iii)

D. (ii), (iii) and (iv)

7. Excessive use of chemical fertilisers in agriculture can lead to which environmental problem? *[1]*

A. Reduction in soil fertility over time and water pollution due to runoff

B. Immediate and permanent improvement in soil quality

C. Complete elimination of the need for irrigation

D. Increase in biodiversity of the soil

The following two questions consist of an Assertion (A) and a Reason (R). Choose the correct option: (A) Both A and R are true, and R is the correct explanation of A. (B) Both A and R are true, but R is not the correct explanation of A. (C) A is true but R is false. (D) A is false but R is true.

8. Assertion (A): In humans, the sex of a child is determined by the chromosome contributed by the father, not the mother. Reason (R): All human eggs carry an X chromosome, while sperm can carry either an X or a Y chromosome. *[1]*

9. Assertion (A): Decomposers play a vital role in maintaining the balance of an ecosystem. Reason (R): Decomposers break down dead organic matter and release nutrients back into the soil for reuse by producers. *[1]*

10. Why is chemical coordination through hormones necessary in multicellular organisms, in addition to the nervous system? *[2]*

11. Attempt either option A or B. *[2]*

A.. Distinguish between voluntary, involuntary and reflex actions, giving one example of each.

OR

B.. Explain the role of stomata in the process of transpiration in plants.

12. A garden pond contains algae, tadpoles, small fish, water beetles, herons and decomposer bacteria. Construct one food chain with at least three trophic levels using organisms from this list. *[2]*

13. With the help of a labelled diagram, describe the structure of the human alveoli and explain how they are adapted for efficient exchange of gases. *[3]*

14. A cross was made between pea plants with round, green seeds (RRyy) and pea plants with wrinkled, yellow seeds (rrYY). *[3]*

(i). What will be the phenotype of the F1 generation?

(ii). When the F1 plants were self-pollinated, 320 F2 seeds were obtained. In what ratio would you expect the four possible phenotypes to appear among these seeds?

15. Simran drank a glass of milk and ate a slice of buttered bread for breakfast. Attempt either subpart A or B. *[4]*

A.. Which component of this meal is rich in fats? Describe briefly how fats are digested in the small intestine, mentioning the role of bile and any one enzyme.

OR

B.. (i) Which component of the meal is rich in carbohydrates? (ii) Name the enzyme in saliva that initiates its digestion, and state the product formed. (iii) Why does digestion of starch stop temporarily once food reaches the stomach?

16. Attempt either option A or B. *[5]*

A.. A farmer wants to produce a large number of banana plants genetically identical to a high-yielding parent plant within a short time. (i) Would you recommend growing bananas from seeds or through a vegetative method? Justify your choice. (ii) Explain why sexually produced offspring generally show more variation than asexually produced offspring. (iii) Why is variation considered important for the long-term survival of a species?

OR

B.. A researcher studied fruit formation in two groups of apple trees: Group X grown in an orchard with beehives nearby, Group Y grown in a greenhouse excluding all insects. (i) Which group would likely show a higher rate of fruit formation? Give a reason. (ii) State three changes that occur in a flower after successful fertilisation.

SECTION B - CHEMISTRY (25 Marks)

17. In the reaction $2Mg(s) + O2(g) \rightarrow 2MgO(s)$, which statement is correct? *[1]*

A. Magnesium is reduced and oxygen is oxidised.

B. Magnesium is oxidised and oxygen is reduced.

C. Neither magnesium nor oxygen changes oxidation state.

D. Both magnesium and oxygen are reduced.

18. Consider the following statements about oxides: (I) Aluminium oxide reacts with both HCl and NaOH. (II) Sodium oxide reacts only with HCl. (III) Carbon monoxide is a neutral oxide, unreactive with acids or bases. (IV) Zinc oxide reacts only with HCl. Which statements are correct? *[1]*

A. I and III

B. I and II

C. II and IV

D. III and IV

19. A copper strip is dipped into aqueous silver nitrate, and a silver strip into aqueous copper sulphate, in two separate test tubes. What would be observed? *[1]*

A. Copper displaces silver from silver nitrate; no reaction occurs in the other test tube.

B. Silver displaces copper from copper sulphate; no reaction occurs in the other test tube.

C. Both reactions occur, forming silver and copper metal respectively.

D. Neither reaction takes place.

20. Universal indicator is added to dilute nitric acid and separately to aqueous calcium hydroxide. What colours would approximately be observed? *[1]*

A. Red in acid, blue/violet in base

B. Blue in acid, red in base

C. Green in both

D. Colourless in both

21. Which of the following, when dissolved in equal volumes of water, would produce a solution with the highest pH? *[1]*

A. Hydrochloric acid

B. Acetic acid

C. Potassium hydroxide

D. Ammonium chloride

22. Dilute hydrochloric acid is added to solid sodium hydrogen carbonate. The gas evolved: *[1]*

A. Turns lime water milky and is carbon dioxide

B. Is hydrogen and is highly flammable

C. Is chlorine and has a pungent smell

D. Is oxygen and supports combustion

23. Aqueous solutions of silver nitrate and sodium chloride are mixed. The observation is: *[1]*

A. No visible reaction occurs

B. A white precipitate of silver chloride is formed

C. A yellow precipitate of sodium nitrate is formed

D. The solution turns green

The following question consists of an Assertion (A) and a Reason (R). Choose the correct option as described above.

24. Assertion (A): C2H4, C3H6 and C4H8 belong to the same homologous series. Reason (R): These are all examples of saturated hydrocarbons called alkanes. *[1]*

25. Two metal strips, one of copper and one of aluminium, are each coated with wax at one end with a pin stuck to the wax, and heated from the other end simultaneously. In which strip would the pin fall off first? Justify your answer using the concept of thermal conductivity. *[2]*

26. Attempt either option A or B. *[3]*

A.. An element 'Z' has a low melting point, is a poor conductor of electricity, and reacts with oxygen to form an acidic oxide. (i) Is 'Z' likely to be a metal or a non-metal? Give a reason. (ii) Write a general equation showing the reaction of a non-metal oxide with water.

OR

B.. Silver articles turn black after being exposed to air for a long time. (i) Name the compound responsible for this colour change and the gas in the air that causes it. (ii) Suggest one method to prevent or reduce this tarnishing. (iii) Why does gold not undergo a similar change when exposed to air?

27. During electrolysis of acidified water, Karan observed that the volume of gas collected at one electrode was double that collected at the other electrode in the same time. *[3]*

(i). At which electrode (anode or cathode) would you expect the larger volume of gas, and what is this gas?

(ii). Why is a small amount of acid or salt added to water before electrolysis?

(iii). Write the chemical formula of the gas collected at the electrode with the smaller volume.

28. Ayesha took 3 mL of dilute hydrochloric acid and added two drops of methyl orange, turning it red. She added dilute sodium hydroxide drop by drop until the colour changed to yellow, requiring 36 drops. She repeated with different volumes: Volume of HCl (mL): 3, 4, 5 → Drops of NaOH required: 36, 48, 60. *[4]*

A.. Identify the type of reaction occurring in this experiment.

B.. Based on the pattern, how many drops of NaOH would likely be required if Ayesha used 6 mL of the same HCl solution?

C.. Write the balanced chemical equation for the reaction between hydrochloric acid and sodium hydroxide.

29. Attempt either option A or B. *[5]*

A.. A hydrocarbon CxHy undergoes complete combustion as shown: $2C_xH_y + 6O_2 \rightarrow 4CO_2 + 4H_2O$. (a) Determine the values of x and y. (b) Give the IUPAC name of the hydrocarbon and state whether saturated or unsaturated. (c) Write its structural formula. (d) This hydrocarbon can undergo an addition reaction with hydrogen in the presence of a nickel catalyst. Write the equation for this reaction. (e) Name the process by which this hydrocarbon can be converted to ethanol.

OR

B.. Two elements P (atomic number 12) and Q (atomic number 9) combine to form a compound. (a) What type of bond will form between P and Q? (b) Write the chemical formula of the compound. (c) State whether the compound will conduct electricity in molten state, with reason. (d) Will the compound have a high or low melting point? Give a reason. (e) If element Q combines with hydrogen instead, what type of bond will form, and will the resulting compound's aqueous solution be acidic, basic or neutral?

SECTION C - PHYSICS (25 Marks)

30. Which of the following statements about image formation by a convex lens is correct? *[1]*

A. A convex lens always forms a virtual image regardless of object position.

B. A convex lens can form either a real or virtual image depending on the position of the object relative to the focus.

C. A convex lens always forms a diminished image.

D. A convex lens cannot form a magnified image.

31. Which of the following correctly explains why the sun appears reddish at sunrise and sunset? *[1]*

A. Blue light is scattered away more, leaving mostly red and orange light to reach our eyes when sunlight travels through a thicker layer of atmosphere.

B. Red light is scattered more than blue light at all times.

C. The sun emits only red light during sunrise and sunset.

D. The atmosphere absorbs all colours except red during these times.

The following question consists of an Assertion (A) and a Reason (R). Choose the correct option as described earlier.

32. Assertion (A): An object placed at the centre of curvature of a concave mirror forms a real, inverted image of the same size as the object. Reason (R): For an object placed at the centre of curvature of a concave mirror, the image also forms at the centre of curvature. *[1]*

33. A concave lens forms a virtual, diminished image of an object, one-third the size of the object, at a distance of 12 cm from the lens. *[2]*

(i). What is the image distance from the lens (with appropriate sign)?

(ii). Using the magnification relation, calculate the object distance from the lens.

34. Attempt either option A or B. *[2]*

A.. Three resistors of 4Ω, 6Ω and 10Ω are connected in series to a 40 V battery. Calculate (i) the total resistance and (ii) the current in the circuit.

OR

B.. Two resistors of 6Ω each are connected in parallel, and this combination is connected in series with a 2Ω resistor across a 10 V battery. Calculate the current through the 2Ω resistor.

35. A person can clearly see distant objects but cannot see objects placed closer than 100 cm from the eye without discomfort. *[3]*

(i). Identify the defect of vision.

(ii). What type of corrective lens is required?

(iii). Mention one possible cause of this defect.

36. A wire has a length of 5 m, a cross-sectional area of 0.5 mm^2, and a resistance of 25 Ω. *[3]*

(i). Calculate the resistivity of the material of the wire.

(ii). If a second wire of the same material has double the length and double the cross-sectional area, what will be its resistance?

37. State two properties of magnetic field lines produced by a current-carrying straight conductor. Explain, with reason, how the pattern of these field lines would change if the current in the conductor is reversed. *[3]*

38. A slide projector uses a convex lens to project an enlarged image of a small slide onto a distant screen. The lens has a focal length of 8 cm. *[4]*

A.. What type of image (real/virtual) is formed on the screen in a slide projector?

B.. Should the slide be placed within the focal length or beyond the focal length of the lens for this to work? Explain briefly.

Attempt either subpart C or D.

C.. If the slide is placed 10 cm from the lens, calculate the position of the image formed using the lens formula.

OR

D.. A projector lens forms a real image at a distance of 72 cm from the lens when the slide is placed 9 cm from the lens. Calculate the focal length of the lens.

39. Attempt either option A or B. *[5]*

A.. In a circuit, two resistors of 30Ω and 60Ω are connected in parallel, and this combination is connected in series with a 4Ω resistor. This series combination is connected to a battery, and the power dissipated in the 4Ω resistor is found to be 16 W. Calculate: (i) the current flowing through the circuit (ii) the voltage across the parallel combination (iii) the total voltage of the battery.

OR

B.. Three heating elements, each rated 500 W, 100 V, and having equal constant resistance, are connected as follows: elements X and Y are connected in series, and this series combination is connected in parallel with element Z. The circuit is connected to a 100 V supply. (i) Calculate the resistance of one heating element. (ii) Calculate the current through element Z when the circuit is switched on. (iii) Calculate the total power consumed by the circuit.

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MARKING SCHEME - CBSE CLASS 10 SAMPLE PAPER 2

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General Instructions: The value points below are suggested guidelines only. Award marks for any scientifically correct alternative method or expression.

SECTION A - BIOLOGY (30 Marks)

1. B *[1]*

2. B *[1]*

3. B *[1]*

4. B *[1]*

5. B *[1]*

6. A *[1]*

7. A *[1]*

8. A (Both A and R are true, and R is the correct explanation of A) *[1]*

9. A (Both A and R are true, and R is the correct explanation of A) *[1]*

10. Hormonal (chemical) coordination is needed because some responses, such as growth, metabolism or long-term regulation of body functions, need to act over a longer duration and reach many cells throughout the body, which the fast but localised nervous system alone cannot achieve efficiently. *[2]*

11. A. Voluntary actions are consciously controlled (e.g. writing); involuntary actions occur without conscious control (e.g. heartbeat); reflex actions are rapid, automatic responses to a stimulus, bypassing conscious thought (e.g. withdrawing hand from a hot object). OR B. Stomata are tiny pores mostly on the leaf surface that open and close to regulate the loss of water vapour; when open, water evaporates from the mesophyll cells and diffuses out through the stomata, driving the process of transpiration. *[2]*

12. Sample food chain: Algae → Tadpoles → Small fish → Herons (any valid three-or-more level chain using the given organisms with correct trophic order is acceptable). *[2]*

13. Diagram should show alveoli as thin-walled, balloon-like sacs surrounded by a network of blood capillaries. Their large surface area, thin single-cell-thick walls, moist lining and rich blood supply allow efficient diffusion of oxygen into the blood and carbon dioxide out of the blood. *[3]*

14. (i) F1 phenotype: round, yellow seeds (RrYy, both dominant traits expressed). (ii) Expected ratio in F2: 9 round yellow : 3 round green : 3 wrinkled yellow : 1 wrinkled green. Out of 320 seeds: approximately 180 round yellow, 60 round green, 60 wrinkled yellow, 20 wrinkled green. *[3]*

15. A. Butter is rich in fat. In the small intestine, bile (from the liver) emulsifies fat into smaller globules, increasing surface area; the enzyme lipase then breaks down fats into fatty acids and glycerol. OR B. (i) Bread is rich in carbohydrates (starch). (ii) Salivary amylase breaks down starch into maltose (sugar). (iii) The stomach's acidic environment (hydrochloric acid) inactivates salivary amylase, temporarily halting starch digestion until it resumes in the small intestine. *[4]*

16. A. (i) A vegetative method (such as tissue culture or offsets) should be used, since it produces genetically identical banana plants quickly, unlike seeds which involve variation through sexual reproduction. (ii) Sexual reproduction combines genetic material from two parents, creating new combinations of traits (variation), while asexual/vegetative reproduction produces exact genetic copies. (iii) Variation is essential because it increases the chance that some individuals can survive and adapt if the environment changes, ensuring the species' long-term survival. OR B. (i) Group X (with beehives) would show a higher rate of fruit formation, since pollinators are necessary to transfer pollen and enable fertilisation, which Group Y lacks. (ii) After fertilisation, the ovary develops into a fruit, ovules develop into seeds, and petals typically wither and fall off. *[5]*

SECTION B - CHEMISTRY (25 Marks)

17. B *[1]*

18. A *[1]*

19. A *[1]*

20. A *[1]*

21. C *[1]*

22. A *[1]*

23. B *[1]*

24. C (A is true, since these are indeed the same homologous series of alkenes; R is false because they are unsaturated alkenes, not saturated alkanes) *[1]*

25. The pin would fall off first in the copper strip, since copper has higher thermal conductivity than aluminium, so heat travels faster along the copper strip and melts the wax at the far end sooner. *[2]*

26. A. (i) 'Z' is likely a non-metal, since it has a low melting point, is a poor conductor of electricity, and forms an acidic oxide (a characteristic property of non-metal oxides). (ii) Non-metal oxide + water → Acid (general equation). OR B. (i) This is called tarnishing; the compound formed is silver sulphide, caused by reaction with sulphur compounds present in air. (ii) Prevention: storing silver articles in air-tight containers or applying a protective coating. (iii) Gold is highly unreactive (very low in the reactivity series) and does not readily react with substances in air, unlike silver. *[3]*

27. (i) The gas at the electrode with the larger volume is hydrogen (H2), formed at the cathode. (ii) Pure water conducts electricity poorly due to very few free ions; adding acid/salt provides more ions to carry current. (iii) The gas at the electrode with the smaller volume is oxygen, formula O2. *[3]*

28. A. This is a neutralisation reaction. B. Based on the pattern (12 drops of NaOH per mL of HCl), 6 mL of HCl would require approximately 72 drops of NaOH. C. HCl + NaOH → NaCl + H2O (balanced neutralisation equation). *[4]*

29. A. (a) x=2, y=4 (the hydrocarbon is C2H4). (b) IUPAC name: ethene; it is an unsaturated hydrocarbon (alkene) since it contains a carbon-carbon double bond. (c) Structural formula: CH2=CH2. (d) CH2=CH2 + H2 (Ni catalyst) → CH3-CH3 (ethane). (e) Ethene is converted to ethanol through a hydration reaction, adding water in the presence of an acid catalyst. OR B. (a) P (magnesium, group 2) and Q (fluorine, group 17) form an ionic bond. (b) Chemical formula: MgF2. (c) MgF2 conducts electricity in molten state, since the ions become free to move and carry charge, unlike in the solid state where ions are fixed in a rigid lattice. (d) MgF2 has a high melting point due to strong electrostatic forces of attraction between oppositely charged ions in its lattice. (e) Fluorine (Q) with hydrogen forms HF, a covalent (polar covalent) bond; its aqueous solution is acidic. *[5]*

SECTION C - PHYSICS (25 Marks)

30. B *[1]*

31. A *[1]*

32. A (Both A and R are true, and R correctly explains A, since an object at the centre of curvature of a concave mirror forms a real, inverted image of the same size, also located at the centre of curvature) *[1]*

33. (i) Image distance v = -12 cm (virtual image, same side as object). (ii) Using m = v/u with m = 1/3: 1/3 = -12/u, so u = -36 cm; the object is placed 36 cm from the lens. *[2]*

34. A. (i) Total resistance = 4+6+10 = 20 Ω. (ii) Current = V/R = 40/20 = 2 A. OR B. Parallel combination of two 6Ω resistors = 3Ω; total resistance with series 2Ω resistor = 5Ω; current = 10/5 = 2 A. *[2]*

35. (i) Hypermetropia (long-sightedness/far-sightedness). (ii) A convex (converging) lens is used for correction. (iii) Possible cause: the eyeball is too short, or the eye lens has lost some of its converging power. *[3]*

36. (i) Resistivity $\rho = RA/L = (25 \times 0.5\times10^{-6})/5 = 2.5\times10^{-6}$ Ω·m. (ii) When both length and area are doubled, resistance stays the same as the original: 25 Ω (since R=ρL/A, doubling both L and A cancels out). *[3]*

37. Properties: (a) Field lines around a straight current-carrying conductor form concentric circles around the wire. (b) The direction of the field lines can be found using the right-hand thumb rule. If the current direction is reversed, the direction of the magnetic field lines (the sense of the concentric circles) also reverses, though their circular pattern and spacing remain the same. *[3]*

38. A. A real, inverted image forms on the screen in a slide projector. B. The slide should be placed just beyond the focal length of the lens so that a real, magnified, inverted image forms on the distant screen. C. Using 1/v = 1/f + 1/u with f=8, u=-10: 1/v = 1/8 - 1/10 = 1/40, so v = 40 cm (real image). OR D. Using 1/f = 1/v - 1/u with v=72, u=-9: 1/f = 1/72 + 1/9 = 1/72+8/72 = 9/72 = 1/8, so f = 8 cm. *[4]*

39. A. Parallel combination of 30Ω and 60Ω = 20Ω. Using $P=I^2R$ for the 4Ω resistor: $16=I^2\times4$, so I=2A. (i) Current = 2 A. (ii) Voltage across parallel combination = I × 20 = 40 V. (iii) Total battery voltage = 40 + (I×4) = 40+8 = 48 V. OR B. (i) Resistance of one element = $V^2/P = 100^2/500$ = 20 Ω. (ii) Current through Z (across 100V directly) = 100/20 = 5 A. (iii) Total power = power of Z (500 W at rated voltage) + power of X&Y in series ($V^2/R_{series} = 100^2/40$ = 250 W) = 750 W. *[5]*