

Question bank

Chapter-1 Topic 1 Quantitative and qualitative analysis

- Q-1 **A is a solution of impure sulphuric acid containing 4.0 g in 250 cm³. B is a solution of pure sodium hydroxide containing 6.0 g per dm³. If 25.0 cm³ portions of solution B required an average of 15.5 cm³ for complete neutralisation, calculate the:**
- concentration of solution B in mol-dm⁻³
 - concentration of solution A in mol-dm⁻³
 - concentration of the pure acid in solution A in g-dm⁻³
 - percentage purity in solution A
- Q-2 **A solution of KMnO₄ of unknown concentration was titrated with an oxalic acid solution of concentration 0.025 mol-dm⁻³. When 25.0 cm³ of oxalic acid, acidified by 10 cm³ of a 2.0 mol-dm⁻³ solution of H₂SO₄, was titrated against KMnO₄, an average volume of 19.3 cm³ of KMnO₄ was required for complete oxidation. From the above data, calculate the concentration (in mol-dm⁻³) of KMnO₄.**
- Q-3 **The iron content in a 0.20 g sample of fencing wire was determined by dissolving the wire in dilute sulphuric acid and making up the resulting pale green solution of Fe²⁺ ions to 25 ml. The solution was titrated with 0.03 M potassium permanganate (KMnO₄) solution. A titre of 20.22 ml was obtained.**
- Write an overall equation for the titration reaction
 - Calculate the amount, in mol, of Fe²⁺ ions in the 25 ml volume of solution
 - Calculate the percentage, by mass, of iron in the wire
 - Why is no indicator needed for this titration?
 - Briefly describe two safety precautions for this titration
- Q-4 **Briefly describe how each of the following aqueous solutions could be identified in the laboratory:**
- ammonium trioxocarbonate (IV)
 - ammonium chloride

- Q-5 **You are given a food sample (wheat) to test for starch and proteins. Explain how you would go about testing your sample in a laboratory.**
- Q-6 **In the table below various tests for anions are described. Identify the anions.**
- a) Substance X + dil. HCl → rotten egg smell, turns lead(II) ethanoate paper silvery black
 - b) Substance Y + BaCl₂ → white precipitate, insoluble in dil. HNO₃
 - c) Substance Z + dil. HCl → turns limewater milky
- Q-7 **Match each term in Column B with the correct description in Column A.**
- a) Turns damp red litmus paper blue
 - b) Bleaches damp litmus paper
 - c) Gives white precipitate with limewater
 - d) 'Pops' with a lighted splint
 - e) Relights a glowing splint
- Q-8 **For each of the following test descriptions, identify the anion that is tested for:**
- a) Reacts with dilute HCl to produce CO₂ gas. When added to MgSO₄ solution, it produces a clear solution that turns white when heated.
 - b) Reacts with BaCl₂ to produce a white precipitate. When dilute HCl is added to the precipitate, it dissolves.
 - c) Add FeSO₄ solution and a little concentrated H₂SO₄. A brown ring forms between the two layers.
 - d) Reacts with AgNO₃ solution to produce a white precipitate. The precipitate dissolves when dilute NH₃ is added.
 - e) Reacts with BaCl₂ to produce a white precipitate. When dilute HCl is added to the precipitate, it does not dissolve.

Multiple Choice Questions

- Q-1 **A lighted wooden splint makes a popping sound in a test tube of gas. The gas is most likely to be:**
- (a) A) carbon dioxide
 - (b) B) chlorine
 - (c) C) hydrogen
 - (d) D) oxygen

- Q-2 **Which of the following tests show the presence of fats and oils in food?**
- (a) A) emulsion
 - (b) B) Benedict's
 - (c) C) biuret
 - (d) D) iodine
- Q-3 **To identify if starch is present in a food sample, you can use:**
- (a) A) Benedict's reagent
 - (b) B) iodine
 - (c) C) biuret solution
 - (d) D) alcohol
- Q-4 **Which one of the following is not an example of a reductant?**
- (a) A) hydrogen sulphide
 - (b) B) hydrogen peroxide
 - (c) C) chlorine
 - (d) D) potassium permanganate
- Q-5 **When NaOH is added to a solution of unknown ions, a green precipitate forms. The cations in the unknown solution are:**
- (a) A) Cu^{2+}
 - (b) B) Fe^{2+}
 - (c) C) Mg^{2+}
 - (d) D) Pb^{2+}

Chapter-2 Topic 2 Petroleum or crude oil

- Q-1 **You have analysed a hydrocarbon molecule, and have satisfied yourself that it is an alkane, and contains 8 carbon atoms. How many hydrogen atoms will it contain? Briefly explain your answer.**
- Q-2 **A catalyst is something that promotes a chemical reaction without being used up in the reaction. What general name is given to catalysts produced in, and used by, organisms? (Note: you have not been given the answer to this question in the Topic, but you should know the answer from your wider studies. Remember that you should never keep your learning or thinking in 'water-tight compartments'.)**

- Q-3 How many oil refineries does Nigeria have? Where are they?
- Q-4 What word is used to describe the underground 'chambers' in which deposits of crude oil exist?
- Q-5 What does the word 'petroleum' mean?
- Q-6 What does the acronym OPEC stand for?
- Q-7 How many carbon atoms does the alkane hexadecane contain?
- Q-8 Naphtha is a subgroup of the so-called 'light distillates' of crude oil. What are the upper and lower molecular masses of this subgroup of alkanes? (Take the atomic mass of carbon as 12 atomic mass units (amu), and of hydrogen as 1 amu.) Show your working briefly and clearly.
- Q-9 What is meant by saying that Nigeria produces 'sweet oil'?
- Q-10 Why is there no simple relationship between 'barrels', as a measure of volume, and mass, in the context of crude oil production?
- Q-11 What is the molecular formula of methane?
- Q-12 Methane is lighter than air. This is not surprising. Why should we not be surprised that methane is lighter than air?
- Q-13 Explain, very briefly, what is meant by 'knocking' in an engine.
- Q-14 What characteristic of a molecule, as a component of petrol, reduces the fuel's tendency to produce 'knocking'?
- Q-15 What is the most basic reason for cracking some of the products of crude oil?
- Q-16 What number does the prefix 'giga-' represent?
- Q-17 What is a 'methyl group'?
- Q-18 How do you spell the plural of 'gas'?

Chapter-3 Topic 3 Metals and their compounds

- Q-1 How did the earliest humans discover gold?
- Q-2 What is the difference between 'roasting' and 'smelting' in metallurgy?
- Q-3 What is the difference between 'smelting' and 'melting' in metallurgy?
- Q-4 If you were allowed only one word to describe the chemical process involved in metal purification, which do you think would be most appropriate to choose? Briefly justify your answer.
- Q-5 What does the word 'halite' refer to?
- Q-6 What was the earlier name for the metal tungsten?
- Q-7 What does the prefix 'pyro-' mean?
- Q-8 Which important metal is obtained from the ore malachite?
- Q-9 Name six alkali metals. Which one of these is 'odd' within the group? For what reason do you call it 'odd'?
- Q-10 What is the main danger associated with storage of pure sodium?
- Q-11 Name five compounds of sodium.
- Q-12 Name any three alkaline earth metals.
- Q-13 What name is given to the calcium-rich structures that hang down from the roofs of certain types of cave?
- Q-14 In terms of the arrangements of electrons within the atoms, what is the main distinguishing feature of the transition metals?

Chapter-4 Topic 4 Iron

- Q-1 What is the atomic number of iron?
- Q-2 In which part of the periodic table do we find iron?
- Q-3 Name the three main ores of iron.

- Q-4 **Briefly explain why limestone is added to a blast furnace for iron smelting.**
- Q-5 **What is the carbon content of pig iron?**
- Q-6 **Name the two most common forms in which iron (not steel) is used.**
- Q-7 **Briefly explain why boron is added to some steels in very low concentrations.**
- Q-8 **What is the main metal added to iron to produce stainless steel?**
- Q-9 **What is the main metal added to woodworkers' steel tools?**
- Q-10 **What may happen to concrete if the reinforcing steel starts to rust? Briefly explain your answer.**
- Q-11 **A certain type of arrangement in a blast furnace is known as a 'heat exchanger'. What is this arrangement? What advantage does it give to the furnace?**
- Q-12 **Briefly explain what is meant by a 'sacrificial anode'.**

Chapter-5 Topic 5 Ethical, legal and social issues

- Q-1 **Name four of the dangerous heavy metals.**
- Q-2 **What is the scientific name of the most radiation-resistant organism known?**
- Q-3 **What is the name of the Nigerian government agency that has the overall responsibility for maintenance of the environment?**
- Q-4 **What does 'BOD' stand for, in the context of water testing?**
- Q-5 **What is 'gas re-injection'?**
- Q-6 **Roughly what is the human population of Nigeria?**
- Q-7 **Roughly what is the annual, global increase in human numbers?**

- Q-8** Increasing the efficiency of energy use and pollution control is very important, but it does not provide a long-term solution to the environmental threat. Explain, in two to three sentences, why this is so.
- Q-9** Pollutants can be divided into two major categories. What are these categories? Briefly explain the two categories.
- Q-10** Using your own words and good English, explain what is meant by an 'algal bloom', and why an algal bloom is ecologically dangerous.

Chapter-6 Topic 6 Fats and oils

- Q-1** What is a better-known term for tri-acyl glycerols?
- Q-2** Why is a 'fatty acid' called 'fatty'?
- Q-3** What name is given to the chemical process involved in breaking lipid molecules into their component fatty acids and glycerol?
- Q-4** What name is given to the process of 'building' lipid molecules by joining together glycerol and fatty acid molecules?
- Q-5** What is the general formula for an alcohol?
- Q-6** What compound is used in our bodies to synthesise glycerol?
- Q-7** What is the main physical difference between a fat and an oil?
- Q-8** What does 'hydrolysis' mean?
- Q-9** Name two very simple tests for lipids.
- Q-10** Name two solvents in which lipids will dissolve.
- Q-11** What is the name of the fatty acid that has 20 carbon atoms, and four double bonds?

Chapter-7 Topic 7 Soap and detergents

- Q-1 What is the chemical name of 'lye'? Also give its chemical formula.
- Q-2 What is 'stoichiometry'?
- Q-3 What is a more technical name for a 'wetting agent'?
- Q-4 What does 'nonmiscible' mean?
- Q-5 Why does pure water tend to 'round up' into a spherical drop?
- Q-6 Why are soap molecules called 'amphiphilic', or 'amphipathic'?
- Q-7 In terms of chemical structure, what is the main thing that distinguishes a soap from a synthetic detergent?
- Q-8 In relation to detergents, what is the significance of the compound alkylbenzenesulphonate?
- Q-9 What is the main 'problem', or disadvantage, of soaps in comparison with the synthetic detergents?
- Q-10 How have modern synthetic detergents been made more environmentally safe than the earlier synthetic detergents?
- Q-11 Give a simple definition of a detergent.

Chapter-8 Topic 8 Giant molecules

- Q-1 What is a 'glycoprotein'?
- Q-2 What is the most common polymeric compound on the planet?
- Q-3 Why can cellulose not be digested by most animals?
- Q-4 What is the molecular formula of glucose?
- Q-5 What does 'oligo-' mean?
- Q-6 By what other name is glycogen known?
- Q-7 Which free groups in a sugar molecule give it reducing properties?

- Q-8 What is the essential reaction in Fehling's test for reducing sugars?**
- Q-9 What is the second most important use of starch (that is, after the food industry)?**
- Q-10 What is the starting material for manufacturing vitamin C?**
- Q-11 What is the chemical name of vitamin C?**
- Q-12 Of which two monosaccharides is sucrose made?**
- Q-13 What names are given to the two types of molecule that make up haemoglobin?**
- Q-14 What is the main protein of corn (mealies)?**
- Q-15 Why is an amino acid called an amino acid?**
- Q-16 What is the name of the simplest amino acid?**
- Q-17 Draw the structural formula of the amino acid in question 16, above.**
- Q-18 Roughly, how many amino acids occur naturally?**
- Q-19 What name is given to the process by which runny, transparent egg 'white' changes to an opaque solid when cooked?**
- Q-20 What, specifically, does the biuret reaction test for? (Don't just say 'protein.')**
- Q-21 What is the most common arrangement of the chain of amino acids in a protein?**