Periodic Table

1 What gas is produced when group 1 metals react with water?

A: Hydrogen gas

Periodic Table

2 When group 1 metals react with water, an alkaline solution is produced. What ion causes the solution to be alkaline?

A: hydroxide ion OH^-

Periodic Table

3 How is the reaction between potassium and water different from sodium and water?

A: The reaction with potassium is faster, produces more fizzing, the potassium moves more; the potassium melts and a purple flame is produced.

Periodic Table

4 Why were many scientists critical about Newland's octaves?

A: There was no clear division between metals and non-metals, there were no gaps left, he put two elements in one box, and elements in the same group had dissimilar properties.

Periodic Table

5 Give two ways in which Mendeleev's periodic table was better than Newland's.

A: It left gaps for undiscovered elements, elements were arranged by mass order and by properties, divided metals and non-metals.

Periodic Table

6 The modern periodic table is an arrangement of the elements in terms of their atomic structures. Explain how.

A: Rows show number of shells, group number is the number of electrons in the outer shell, arranged by atomic number which is the proton number.

Periodic Table

7 Give 3 differences between Newlands' and today's periodic table.

A: Hydrogen is in the same group as the halogens, there are only 7 groups, halogens are in group 1, metals and non- metals not separated, elements are arranged in mass order not atomic number order.

Periodic Table

8 What order is used in the modern periodic table?

A: Atomic number.

Periodic Table

9 Argon has a higher atomic mass than potassium. Why is this not a problem?

A: Because by swapping their positions, they are arranged by atomic number and their electron structure matches the group number.

Periodic Table

10 Why was Mendeleev able to predict the existence of undiscovered elements?

A: Because he had arranged the elements based on their mass and properties.

Periodic Table

11 If you could react Francium with water, how would the reaction compare to Sodium and water? Why?

A: More violent with Francium because the outer electron is further from the nucleus and more shielded from the nuclear attraction so lost more easily.

Periodic Table

12 What is the balanced equation for group 1 metals reacting with water?

A: $2Me + 2H_2O \rightarrow 2MeOH + H_2$.

Periodic Table

13 Why should potassium be placed before argon in the periodic table?

A: Because potassium has a lower mass number than argon. The order is swapped to match the group number to the outer electron configuration and match the chemical properties within the groups.

Periodic Table

14 Why did scientists think Mendeleev's table was incorrect?

A: Because group 4 contained metals and non-metals.

Periodic Table

15 In 1890s the noble gases were discovered. Why did they easily fit into Mendeleev's periodic table?

A: Because they could be added to the end.

Periodic Table

16 Give one piece of evidence that supports the law of octaves.

A: Li/Na/K all are in the same group and have similar chemical properties (same for F/Cl/Br).

Periodic Table

17 Why do elements in the same group have similar chemical properties?

A: Because they have the same number of electrons on the outer shell.

Periodic Table

18 What happens when sodium reacts with water?

A: Floats on the surface of water, moves across surface, melts into a ball and disappears, bubbles of gas produced, alkaline solution left behind (NaOH) might produce a yellow flame .

Periodic Table

19 Which group and period does 2,8,5 belong to?

A: Period 3 and Group 5.

Periodic Table

20 What are the names of groups 1, 7 and 0?

A: Alkali metals, halogens, noble gases.

Periodic Table

21 Which group is missing from Mendeleev's table?

A: The noble gases.

Periodic Table

22 State the physical properties of Group 1 metals.

A: very low density, very soft, silvery shiny surface when first cut, dull outer layer.

Periodic Table

23 State the physical properties of the transition metals.

A: harder and denser than Group 1 or 2 metals, good conductors of heat and electricity, hard, high melting points (apart from mercury).

Periodic Table

24 State the chemical properties of the transition metals.

A: form coloured compounds, good catalysts, less reactive than metals in Group 1.

Periodic Table

25 State the physical properties of the group 7 elements.

A: Fluorine yellow gas, chlorine green gas, bromine orange-brown liquid, iodine purple-grey solid; low melting and boiling points), poor electrical and thermal conductors.

Periodic Table

26 What do you see when chlorine is added to a bromide solution?

A: Colour change from colourless to orange/yellow/red/brown/red-brown.

Periodic Table

27 Why is bromine less reactive than chlorine?

A: bromine is bigger and the outer shell is further from the nucleus. The outer shell is more shielded and there is less attraction to the positive nucleus. It is therefore more difficult for bromine to attract another electron onto the outer shell.

Periodic Table

28 Why do all group 7 elements react in a similar way with hydrogen?

A: They all have 7 electrons on the outer shell.

Periodic Table

29 Explain why group 0 elements are monatomic.

A: The outermost shell is full and there is no tendency to lose or gain electrons.

Periodic Table

30 Explain why chlorine can displace iodide from sea water.

A: chlorine atom is smaller in size and has fewer shells than an iodine atom. There is less shielding in chlorine and it is easier for chlorine to attract another electron to the outer shell.

Periodic Table

31 If aluminium ions react with chlorine, what is the formula of the product aluminium chloride?

A: Al is in Group 3 and forms a 3+ ion. Chlorine is in Group 7 and forms a 1- ion. The formula will then be $AlCl_3$.

Periodic Table

32 What is the electron structure of chloride Cl^-?

A:
2,8,8.

Periodic Table

33 What are the similarities and differences in electron structure going from Na to Ar?

A: Same number of shells. Outer shell gains one extra electron from one element to the next.

Periodic Table

34 What are the differences and similarities in electron structures going from F to At?

A: Same number of outer shell electrons. Each element gains one extra shell (8 electrons) going from one element to the next.

Periodic Table

35 Why could Hydrogen be placed in group 1 or 7?

A: It can lose one electron and form a 1+ ion like the alkali metals and it can gain one electron to gain a full outer shell and form a 1- ion like the halogens.

Periodic Table

36 Why are group 1 metals stored in oil?

A: Because they would react with the oxygen in the air or with water.

Periodic Table

37 Why is group 1 called the Alkali metals?

A: When added to water they react to form an alkaline solution.

Periodic Table

38 Why are group 0 elements unreactive?

A: They have a full outer shell.

Hard Water

39 How is water made safe to drink?

A: Water is filtered to remove solids; flocculation to remove metal ions; add chlorine to kill bacteria.

Hard Water

40 What is hard water?

A: Water that contains Ca^{2+} and/or Mg^{2+} ions.

Hard Water

41 What is the effect of temporary hard water on a kettle?

A: Scale forms when the water is boiled. The scale builds up around the heating element and it takes longer to heat up the water as the efficiency of the heating element is reduced.

Hard Water

42 What is the difference between temporary and permanent hardness?

A: Temporary hard water contains HCO_3^- ions which form $CaCO_3$ when water is boiled. Permanently hard water contains SO_4^{2-} ions which do not precipitate out when water is boiled.

Hard Water

43 How do you remove permanent hardness?

A: Distil the water. Add washing soda (Na_2CO_3) to the water or pass the water through an ion exchange column.

Hard Water

44 What are the advantages of hard water?

A: Tastes better, strengthens bones and teeth, prevents heart diseases.

Hard Water

45 Why is lime scale a problem for heating elements?

A: Wastes energy; takes longer to heat up the water; reduces the efficiency as a result of lime scale coating the heating element.

Hard Water

46 How does washing soda soften permanently hard water?

A: carbonate ions react with calcium /magnesium ions, forming a precipitate of calcium carbonate / magnesium carbonate
therefore the water is softened because this removes the calcium / magnesium ions.

Hard Water

47 How does a water filter soften permanently hard water?

A: Sodium or hydrogen ions in the resin displace the magnesium or calcium ions in the water.

Hard Water

48 How to you show in an experiment that water has been softened?

A: Add soap to original sample and shake to form scum. Keep adding soap and shake until a permanent lather forms. Repeat with boiled sample and compare the amount of soap needed to form a stable lather.

Hard Water

49 How do you show in an experiment that water is hard?

A: Add soap solution and shake. If scum forms the sample is hard.

Hard Water

50 How does water become hard?

A: When streams and rivers flow over rocks that contain calcium and/or magnesium compounds these compounds become dissolved in the water so that the water contains calcium and/or magnesium ions.

Hard Water

51 What is the difference between scale and scum?

A: Scale is formed when heat decomposes dissolved calcium and/or magnesium compounds. Scale is calcium or magnesium carbonate. Scum is formed when hard water reacts with soap to form calcium or magnesium stearate.

Water Treatment

52 Give a reason for and against adding chlorine to drinking water.

A: Kills harmful bacteria so prevents diseases. Chlorine can react with substances in water and form toxic compounds. It also does not taste nice

Water Treatment

53 What is the purpose of silver and carbon in a water filter?

A: Carbon absorbs chlorine and improves the taste. Silver prevents the growth of bacteria.

Water Treatment

54 Give a reason for and against adding fluoride to drinking water.

A: Fluoride reduces tooth decay and prevents heart diseases. It can lead to Fluorosis (white steaks on teeth), weakening of bones and potentially bone cancer.

Energetics

55 How do you know if a reaction is endothermic or exothermic?

A: The temperature rises in an exothermic reaction, but drops in an endothermic reaction. More energy is released in bond making than is needed to break the bonds in an exothermic reaction. The energy of the products is below the energy of the reactants in an exothermic reaction.

Energetics

56 Is bond breaking exo-or endothermic?

A: endothermic. Bond making is exothermic.

Energetics

57 How do you calculate the total energy change from bond energy data?

A: Calculate the total amount of energy needed to break the bonds in the reactants and take away the total amount of energy released when the bonds in the products are made.

Energetics

58 Define activation energy.

A: Minimum amount of energy needed to start the reaction. (The energy needed to break the bonds in the reactants).

Energetics

59 How does a catalyst increase the rate of reaction?

A: If offers an alternative reaction pathway with a lower activation energy.

Energetics

60 Why does energy need to be supplied at the start of an exothermic reaction but the reaction continues by itself afterwards?

A: Existing bonds must be broken first, which is why energy must be supplied. Much more energy is released when new bonds form and this energy is used to continue breaking the reactants' bonds.

Energetics

61 How do you prevent energy loss in a colorimetry experiment?

A: Use a lid and/or draught excluders.

Energetics

62 How do you measure the energy released when a fuel is burned?

A: Weigh a spirit burner which contains the fuel. Fill a can with 100ml of water and find the temperature. Light the fuel and raise the temperature of the water by 20°C. Reweigh the fuel. Calculate the energy released using $E = mc\Delta T$ where m is the mass of water heated Work out the moles of fuel burned and divide E by the moles.

Energetics

63 A reaction happens rapidly without the help of a catalyst. What does this suggest about the activation energy?

A: The activation energy is small.

Energetics

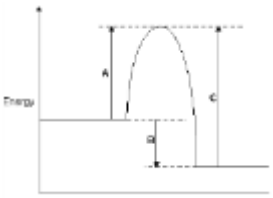
64 Why is hydrogen a good fuel for planes and rockets?

A: It has a low density, is easy to light, releases plenty of energy and does not produce harmful pollution gases.

Energetics

65 Sketch a fully labelled energy profile for an exothermic reaction.

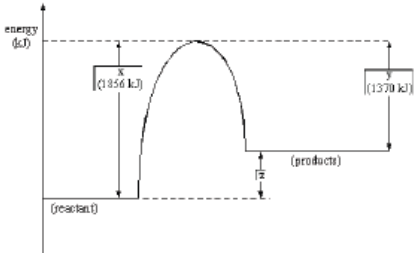
A: A = Ea (bonds broken); C = bonds made, B = overall energy change



Energetics

66 Sketch a fully labelled energy profile for an endothermic reaction.

A: x = Ea(bonds broken), y = energy released when bonds are made; z = overall energy change



Energetics

67 How does a hydrogen fuel cell work?

A: Hydrogen molecules lose their electrons and form hydrogen ions at the anode. The electrons travel to the cathode where oxygen molecules take them on and form hydroxide ions. The hydroxide ions move through the electrolyte to the anode where they react with the hydrogen ions to make water. Energy is released.

Analysis

68 What colour do calcium ions give in a flame test?

A: brick red

Analysis

69 What colour do lithium ions give in a flame test?

A: crimson

Analysis

70 What colour do sodium ions give in a flame test?

A: yellow

Analysis

71 What colour do potassium ions give in a flame test?

A: lilac

Analysis

72 What colour do barium and copper ions give in a flame test?

A: green

Analysis

73 If a substance contains both sodium and potassium ions, why is it difficult to identify both in a flame test?

A: Because the colours mix and the yellow is stronger than the lilac.

Analysis

74 How do you test for chloride, bromide and iodide ions?

A: Add nitric acid to remove any carbonate present. Add silver nitrate solution to form a silver halide precipitate. Silver chloride is white, silver bromide cream and silver iodide pale yellow.

Analysis

75 How do you test for carbonate ions?

A: Add an acid. If the solution fizzes, carbon dioxide is produced because carbonate ions were present.

Analysis

76 How do you test for sulphate ions?

A: Add dilute hydrochloric acid to remove any carbonate ions. Add barium chloride to form a white precipitate of barium sulphate.

Analysis

77 How do you test for aluminium, iron(II), iron(III), copper, calcium and magnesium ions?

A: Add sodium hydroxide to form precipitates: white aluminium hydroxide, green iron(II) hydroxide, orange iron(III) hydroxide, pale blue copper(II) hydroxide, white magnesium hydroxide, white calcium hydroxide .

Analysis

78 How do you distinguish between aluminium, calcium and magnesium hydroxide?

A: Add excess sodium hydroxide. Aluminium hydroxide will dissolve. Do a flame test. Calcium hydroxide will give a red flame.

Analysis

79 What piece of apparatus is used to measure out volumes of solutions?

A: graduated pipette.

Analysis

80 How do you read the volume off a burette?

A: From the bottom of the meniscus at eye level.

Analysis

81 Name an indicator used in a titration.

A: Methyl orange or phenolphthalein.

Analysis

82 How do you calculate moles from volume and concentration data?

A: moles = concentration ($moldm^{-3}$) x volume (cm^3)/1000.

Analysis

83 How do you use titration results to find the concentration of an unknown solution?

A: Use the titration volume and the concentration of the known chemical to find the moles of the known chemical used. Use the mole ratio from the equation and the moles of the known chemical to find the moles of the unknown chemical that reacted. Multiply the moles reacted by 1000 and divide by the volume that was in the flask. This is now the concentration in $moldm^{-3}$.

Analysis

84 How do you convert $moldm^{-3}$ to gdm^{-3}?

A: multiply the $moldm^{-3}$ by the RFM.

Analysis

85 How do you carry out a titration?

A: Fill the burette with chemical A (known concentration). Use a pipette and place 25ml of chemical B (unknown concentration) into a conical flask. Add 3-5 drops of indicator and place a white tile underneath the flask. Add chemical A 1ml at a time to chemical B and swirl. Stop adding when the indicator changes colour. This is the end point. Repeat the experiment but add chemical A drop wise near the end point. Repeat the experiment until you have 2 concordant results.

Equilibria

86 Where do the raw materials in the Haber Process come from?

A: Nitrogen form the air and hydrogen from natural gas.

Equilibria

87 Ammonium salts used as fertilisers are soluble in water. Why is this a useful property?

A: So that the fertilisers can be absorbed through the roots. So that the farmer can evenly spray the fertiliser on the field.

Equilibria

88 What acid is used to make ammonium sulphate from ammonia?

A: Sulphuric acid

Equilibria

89 What happens to any unreacted hydrogen and nitrogen in the Haber process?

A: It is recycled and passed back into the reaction chamber.

Equilibria

90 How can fertilisers get into peoples' bodies even if they do not consume plants that were fertilised?

A: Fertilisers can get washed into rivers and streams and get into drinking water. Humans might consume animals that were contaminated with fertilisers.

Equilibria

91 Describe the conditions used in the Haber process that increase the rate of reaction.

A: High pressure, high temperature and an iron catalyst.

Equilibria

92 Describe the conditions used in the Haber process which increase the yield of ammonia.

A: High pressure, ammonia is liquefied and removed at the end of the process; unreacted hydrogen and nitrogen are recycled.

Equilibria

93 What are the conditions used in the Haber process?

A: Iron catalyst, 200atm pressure, 450°C.

Equilibria

94 Why does increasing the pressure increase the rate of reaction in the Haber process?

A: Higher collision frequency so more chance of a successful collision.

Equilibria

95 What are the ideal conditions in the Haber process? Why?

A: Low temperature to shift the equilibrium to the right as the forward reaction is exothermic. High pressure to shift the equilibrium to the right as there are fewer moles of gas on the right hand side.

Equilibria

96 Why is a low temperature not used in the Haber process?

A: Because the rate of reaction would be too slow.

Equilibria

97 Why is a high pressure not used in the Haber process?

A: The walls of the pipes would have to be very thick and this is too expensive to build. A lot of energy is needed to create high pressure and this is expensive.

Equilibria

98 Describe and explain the effect of increasing the temperature in the reaction between nitrogen and hydrogen in the Haber

A: Rate increases but yield decreases. The forward reaction is exothermic so the equilibrium would shift to the left and more hydrogen and nitrogen would be produced.

Equilibria

99 How does a reaction reach equilibrium?

A: Equilibrium is reached in a closed system when the rate of the forward reaction is equal to the rate of the backward reaction.

Equilibria

100 Why are 450°C and 200atm the optimum conditions in the Haber process?

A: At a lower temperature the reaction would be too slow so 450°C is a compromise between rate and yield. 200atm gives a reasonable yield at an acceptable cost.

Equilibria

101 What do plants use the nitrogen in fertilisers for?

A: To build proteins or amino acids.

Organic Chemistry

102 What is the general formula for all alcohols?

A: $C_nH_{2n+1}OH$

Organic Chemistry

103 What is the formula of the functional group for alcohols?

A: OH

Organic Chemistry

104 What are alcohols used for?

A: alcoholic beverages, solvents, perfumes

Organic Chemistry

105 What is produced when alcohols are combusted?

A: Carbon dioxide and water.

Organic Chemistry

106 What are alcohols oxidised to?

A: Carboxylic acids

Organic Chemistry

107 What is formed when carboxylic acids are added to water?

A: A weakly acidic solution

Organic Chemistry

108 What is the formula of the functional group for carboxylic acids?

A: -COOH

Organic Chemistry

109 What is the formula of the functional group for esters?

A: -COOC-

Organic Chemistry

110 What is a homologous series?

A: A group of compounds with the same functional group where one member differs from the next by a CH_2 group.

Organic Chemistry

111 What are the properties of esters?

A: Smell fruity, are volatile, are good solvents.

Organic Chemistry

112 What are esters used for?

A: Perfumes, flavourings in food and drinks.

Organic Chemistry

113 What is ethanoic acid used for?

A: To make esters, to make vinegar.

Organic Chemistry

114 Which alcohol is used to make propyl ethanoate?

A : Propanol

Organic Chemistry

115 What acid is used to make the ester ethyl butanoate?

A: Butanoic acid

Organic Chemistry

116 Which oxidising agent is used to oxidise alcohols?

A: Potassium dichromate(VI)

Organic Chemistry

117 What is the catalyst used in the reaction between alcohols and carboxylic acids?

A: Concentrated sulphuric acid.

Organic Chemistry

118 What is the pH when ethanol is added to water?

A: Neutral; pH 7

Organic Chemistry

119 How do you test for carboxylic acids?

A: Add sodium carbonate. Carbon dioxide is produced (fizzing) as well as water and sodium carboxylate

Organic Chemistry

120 Why are carboxylic acids weak acids?

A: Because they only partially dissociate when added to water.

Organic Chemistry

121 What are the health problems caused by alcohol?

A: high blood pressure, heart disease, memory loss, liver damage.

Organic Chemistry

122 Why are alcoholic drinks taxed?

A: To pay for health problems caused by drinking, days lost at work and policing antisocial behaviour.

Organic Chemistry

123 How do you turn esters into biofuels?

A: Plant oils are esters and they are reacted with methanol or ethanol to make biodiesel.