Check your understanding

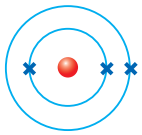
Chemistry 1

Atoms

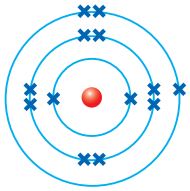
1 Because the number of electrons is equal to the number of protons. (*1 mark*)

2 **a)** 73 electrons; 73 protons; 108 neutrons (*1 mark each*)

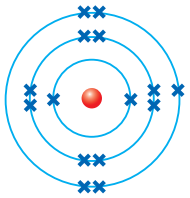
3 **a)** lithium



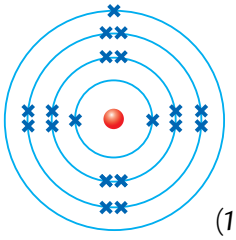
b) aluminium



c) phosphorus



d) potassium



(*1 mark each*)

4 Be (2,2), O (2,6), Mg (2,8,2), Ar (2,8,8) (*1 mark each*)

5 **a)** 1
b) 3
c) 2
d) 6
e) 7 (*1 mark each*)

The periodic table and chemical reactions

6 Electrons (*1 mark*)

7 **a)** potassium + water → potassium hydroxide + hydrogen (*1 mark*)
b) $2K(s) + 2H_2O(l) \rightarrow 2KOH(aq) + H_2(g)$ (*2 marks*)

8 **a)** lithium + oxygen → lithium oxide (*1 mark*)
b) $4Li + O_2 \rightarrow 2Li_2O$ (*2 marks*)

9 **a)** $CH_4 + 2O_2 \rightarrow CO_2 + 2H_2O$ (*2 marks*)
b) $2Na + 2H_2O \rightarrow H_2 + 2NaOH$ (*2 marks*)
c) $H_2SO_4 + 2NaOH \rightarrow Na_2SO_4 + 2H_2O$ (*2 marks*)

10 32 g (*1 mark*)

Calcium carbonate

11 **a)** zinc carbonate → zinc oxide + carbon dioxide (*2 marks*)
b) $ZnCO_3 \rightarrow ZnO + CO_2$ (*1 mark*)

12 **a)** water + calcium oxide → calcium hydroxide (*2 marks*)
b) $H_2O + CaO \rightarrow Ca(OH)_2$ (*2 marks*)

13 **a)** magnesium carbonate + hydrochloric acid → magnesium chloride + carbon dioxide + water (*2 marks*)
b) $MgCO_3 + 2HCl \rightarrow MgCl_2 + CO_2 + H_2O$ (*2 marks*)

14 Advantages — any two from: good appearance, cheap, strong, any positive effects of quarrying (e.g. local employment). (*2 marks*)
Disadvantages — any two of the negative effects of quarrying. (*2 marks*)

Extracting metals

15 The least reactive metals, such as gold, platinum and silver. (*1 mark*)

16 Reduction (*1 mark*)

17 Titanium is too reactive. (*1 mark*)

18 There are many stages in the extraction process and large amounts of energy are needed. (*2 marks*)

19 Extraction uses limited resources, is expensive in terms of energy and has damaging effects on the environment — therefore recycle. (*3 marks*)

Alloys and properties and uses of metals

20 Impurities (*1 mark*) make it brittle (*1 mark*).

21 This can be answered in the form of a table: Benefits/Drawbacks; Low-carbon steel/ Stainless steel.
- Low-carbon steel is easily shaped but will not resist corrosion. (*2 marks*)
- Stainless steel will resist corrosion but is not easily shaped. (*2 marks*)

22 The alloy is harder. (*1 mark*)

23 It is lightweight/low density (*1 mark*); it resists corrosion (*1 mark*).

Crude oil and hydrocarbons

24 The gases (e.g. oxygen and nitrogen) are not chemically combined together. (*1 mark*)

25 Numbers of carbon atoms in them (and therefore similar boiling points). (*2 marks*)

26 C_2H_5OH contains oxygen in addition to hydrogen and carbon; $C_{10}H_{22}$ is made up of hydrogen and carbon atoms **only**. (*2 marks*)

27 Boiling point (*1 mark*) increases with molecule size (*1 mark*); viscosity (*1 mark*) increases with molecule size (*1 mark*).

Hydrocarbon fuels

28 **a)** butane + oxygen → carbon dioxide + water (*2 marks*)
b) $C_4H_{10} + 6½O_2 \rightarrow 4CO_2 + 5H_2O$ (or doubled amounts — *2 marks*)

29 Carbon dioxide (*1 mark*) increases temperature (global warming) (*1 mark*) but soot (*1 mark*) decreases temperature (global dimming) (*1 mark*).

30 Carbon dioxide, water (vapour), carbon monoxide, soot (carbon), unburnt hydrocarbons (*5 marks*)

31 Reducing sulfur in petrol; removing sulfur from gases at a power station (flue-gas desulfurisation). (*2 marks*)

32 Advantages — renewable (do not use up non-renewable fuels); clean (no pollutants when burnt). (*2 marks*)
Disadvantages — takes a lot of land to grow; less energy output. (*2 marks*)

Obtaining useful substances from crude oil

33 A catalyst is a substance that speeds up a reaction, but is not used up in the reaction. (*2 marks*)

34 Thermal decomposition (*1 mark*)

35 Margarine will react with bromine water to change it from orange to colourless. (*2 marks*)

36 As on page 19. (*2 marks*)

Polymers: production and uses

37 Poly(propene) (*1 mark*)

38 **a)** alkenes, **b)** monomers, **c)** long, **d)** ethene (*1 mark* each)

39 A straightened suture will tighten up as it is warmed by body heat. (*2 marks*)

40 Benefit — the baby's skin stays dry. (*1 mark*)
Drawback — the nappy is not easily recycled/it will go to landfill. (*1 mark*)

Polymers: disposal

41 Social — happier community (because environment is cleaner). (*1 mark*)
Economic — creates employment. (*1 mark*)
Environmental — one of: conserves raw materials, produces less pollution, reduces use of landfill sites for disposal. (*1 mark*)

42 Any six valid points, but must score *4 marks* (1 per box) first. (*6 marks*)

	Advantages	**Disadvantages**
Crude oil products as fuels	High energy output Easy to produce	Produce pollution Uses finite resource only once
Crude oil products as raw materials	Can make lots of use of the oil Many products Many uses	Reduces availability for fuel

Ethanol

43 Because ethanol has a lower (*1 mark*) boiling point (*1 mark*) than the rest of the mixture.

44 Fractional distillation (*1 mark*)

45 Distillation and cracking (*1 mark*)

46 To gain full marks there must be at least one advantage and one disadvantage for each type of fuel from the table on page 25. No marks for the final choice. (*4 marks*)

Vegetable oils and emulsions

47 Crops (such as sugar cane) (*1 mark*)

48 It produces the same amount of CO_2 when it burns as was absorbed by the plants from which it was made. (*2 marks*)

49 It stops the oil and water mixture separating out. (*1 mark*)

50
- An emulsifier molecule has a hydrophilic 'head' and a hydrophobic 'tail'. (*2 marks*)
- The head is attracted to water; the tail is attracted to oil. (*2 marks*)
- The emulsifier keeps the oil in tiny droplets. (*1 mark*)

Saturated and unsaturated oils

51 Contains carbon–carbon double bonds. (*1 mark*)

52 **a)** Warm it (in a water bath) (*1 mark*); add/shake/mix with bromine water. (*2 marks*).
b) Bromine water will change from orange to colourless. (*2 marks*)

53 Less risk of heart disease/stroke. (*2 marks*)

54 **a)** Hydrogenation (*1 mark*)
b) Hydrogen (*1 mark*)
c) In the presence of a nickel catalyst (*1 mark*) at 60°C (*1 mark*)

The Earth's crust

55 As on page 30. (*4 marks*)

56 A new scientific theory becomes accepted by other scientists as they check each other's ideas and evidence. (*1 mark* for checking, *1 mark* for 'each other's')

57 By the Earth cooling and shrinking. (*1 mark*)

58 (The deep rift valleys in) the middle of the ocean floors. (*1 mark*)

59 The crust and (upper part of the) mantle. (*1 mark*)

60 A few centimetres per year. (*1 mark*)

61 Heat (*1 mark*) from radioactive processes in the core (*1 mark*) causes convection currents (*1 mark*) in the mantle. (*1 mark*).

62 At the boundaries between tectonic plates (*1 mark*) as the result of sudden movement. (*1 mark*)

The Earth's atmosphere

63 Four-fifths (80%) nitrogen, one-fifth (20%) oxygen (*2 marks*)

64 Oxygen increased (*1 mark*) from nearly zero (*1 mark*); carbon dioxide decreased (*1 mark*) from very high level to almost zero. (*1 mark*).

65 32% (*1 mark*)

66 Mars and Venus (*2 marks*)

67 There is no evidence to support any one theory. (*1 mark*)

68 Global warming (*1 mark*)

69 It is inert and therefore does not react with the filament. (*2 marks*)

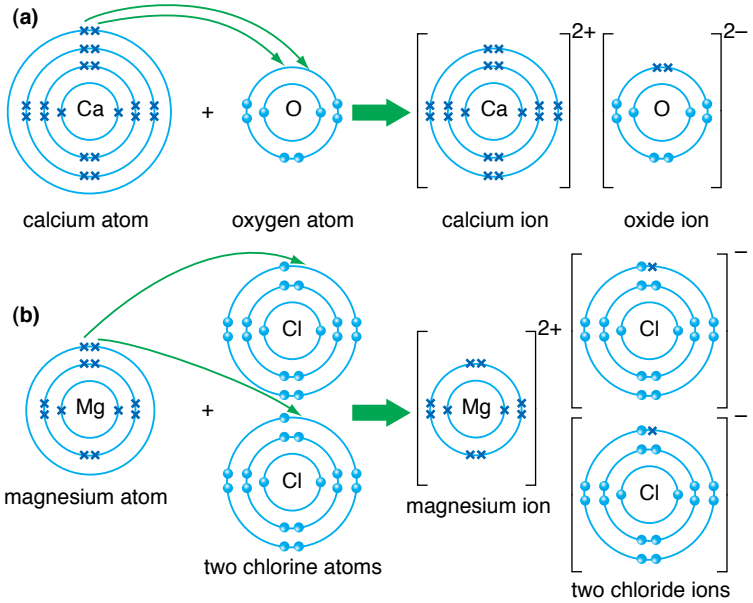
Check your understanding

Chemistry 2

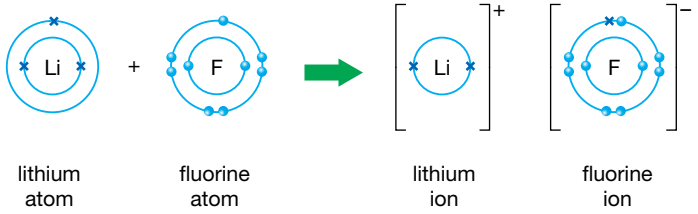
Structure and bonding (1)

1 **a)** Na_2O **b)** MgO **c)** $CaCl_2$ (*1 mark* each)

2 **a)** (*2 marks*)
b) (*2 marks*)

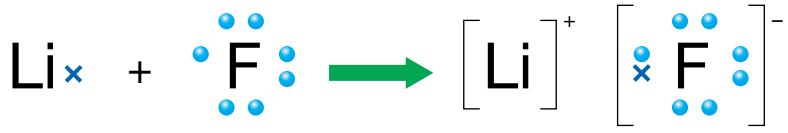


3 **a)** lithium + fluorine → lithium fluoride (*1 mark*)
b) $2Li + F_2 \rightarrow 2LiF$ (*1 mark* for symbols, *1 mark* for balancing)
c)



(*2 marks*)

d)

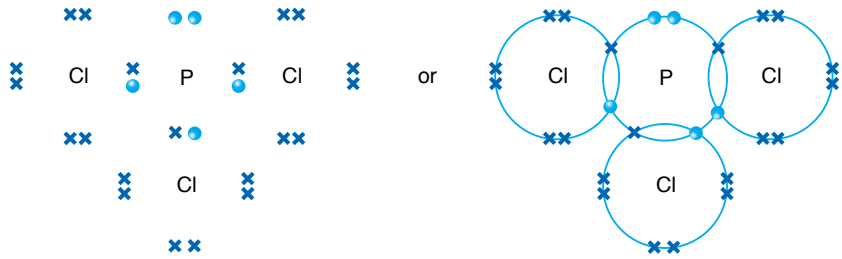


(*2 marks*)

Structure and bonding (2)

4 Any three of: hydrogen H_2, water H_2O, hydrogen chloride HCl, oxygen O_2, ammonia NH_3, methane CH_4, any halogen X_2 (e.g. chlorine Cl_2) (*1 mark* per name and per formula)

5 **a)**



b)

(*2 marks each*)

6 Giant structures of atoms arranged in a regular pattern. (*2 marks*)

7 Delocalised electrons (*1 mark*) between the ions hold them together by strong electrostatic attractions (*1 mark*).

Molecules and covalent structures

8 Low melting point solids (*1 mark*), low boiling point liquids/gases (*1 mark*)

9 When the water (H_2O) boils, weak intermolecular forces of attraction have been overcome (*1 mark*), water molecules escape the surface (*1 mark*), but do not break up (*1 mark*) because the covalent bonds (in the molecules) are not broken (*1 mark*).

10 Atoms (*1 mark*)

11 It is a slippery solid with a high melting point. (*2 marks*)

12 It is very hard (hardest known material). (*1 mark*)

13 Diamond is hard because each carbon atom binds with four others. (*1 mark*)
Graphite is slippery because the sheets of carbon atoms slip over one another. (*1 mark*)
Graphite has some freely moving electrons that conduct. (*1 mark*)

Ionic compounds, metals and polymers

14 An electrostatic force (*1 mark*) of attraction (*1 mark*) acting in all directions (omnidirectional) (*1 mark*) between oppositely charged ions (*1 mark*).

15 Large (*1 mark*) amounts of energy (*1 mark*) are required to break (*1 mark*) the many strong bonds (*1 mark*).

16 The ions are free to move (*1 mark*) and carry the current (*1 mark*).

17 Delocalised (*1 mark*) electrons are free to move (*1 mark*).

18 The layers of atoms are distorted (*1 mark*) therefore it is more difficult for them to slide (*1 mark*) over each other.

19 It can return to its original shape. (*1 mark*)

20 The conditions under which it is made. (*1 mark*)

21 It will not melt easily. (*1 mark*)

Nanoscience

22 1 to 100 nm (*1 mark*)

23 They have a very large surface-area-to-volume ratio. (*1 mark*)

24 **a)** Because aluminium has a low density (*1 mark*) and conducts electricity well (*1 mark*), but needs the strength of a steel core (*1 mark*).

b) Because even though silver conducts heat better (*1 mark*), it is too expensive (*1 mark*) and would weigh more (*1 mark*).

25 A is metallic (nickel); B is simple molecular (carbon dioxide); C is giant ionic (aluminium oxide); D is giant covalent (silicon dioxide). (*1 mark* each)

Atomic structure

26 Same proton number (*1 mark*), but different numbers of neutrons (*1 mark*).

27 210 – 84 (*1 mark*) = 126 (*1 mark*)

28 Relative atomic masses:

a) copper $\frac{69.0}{100} \times 63 + \frac{31.0}{100} \times 65$ (*1 mark*) = 63.6 (*1 mark*)

b) sulfur $\frac{95.00}{100} \times 32 + \frac{0.77}{100} \times 33 + \frac{4.23}{100} \times 34$ (*1 mark*) = 32.09 (*1 mark*)

29 **a)** NaOH = 40

b) $Cl_2 = (2 \times 35.5) = 71$

c) $H_2SO_4 = 98$

d) $Fe_2(SO_4)_3 = 400$ (*1 mark* each)

Analysing substances

30 Blue, red and green (*1 mark*)

31 It helps to identify the substance. (*1 mark*)

32 It identifies substances. (*1 mark*)

33 Butane, C_4H_{10} (*1 mark* each)

Quantitative chemistry

34 $Fe_2O_3 = (2 \times 56) + (3 \times 16) = 160$ (*1 mark* for 2×56, *1 mark* for answer)

% Fe in $Fe_2O_3 = \frac{(2 \times 56)}{160} \times 100\% = 70\%$ (*1 mark*)

35

What to do		
Element symbol	Cu	O
Step 1 Mass or percentage	6.4 (*1 mark*)	8 – 6.4 = 1.6
Step 2 Divide by relative mass	$\frac{6.4}{64}$ (*1 mark*) = 0.1	$\frac{1.6}{16}$ = 0.1
Step 3 Divide by smallest number	$\frac{0.1}{0.1}$	$\frac{0.1}{0.1}$
Step 4 Smallest whole ratio	1	1
And to finish off — write the formula: CuO (*1 mark*)		

36 $C_6H_{12}O_6 \rightarrow 2C_2H_5OH + 2CO_2$

$180\,g \rightarrow 2 \times 46\,g$ (*1 mark*)

$1\,g \rightarrow \frac{(2 \times 46\,g)}{180}$ (*1 mark*)

$100\,g \rightarrow \frac{(100 \times 2 \times 46\,g)}{180} = 51\,g$

51 g of ethanol (C_2H_5OH) will be produced by 100 g of sugar (*1 mark*)

37 Yield = $\frac{4.8}{6.0} \times 100\% = 80\%$ (*1 mark*)

38 It may be reversible (*1 mark*), some product may be lost (*1 mark*) or by-products may be formed (*1 mark*).

Rates of reaction

39 between 10 and 15 minutes (*1 mark*)

40 160 g (*1 mark*)

41 40 minutes (*1 mark*)

42 Reaction 3 (*1 mark*)

43 Reaction 3 (*1 mark*)

Energy transfer in chemical reactions

44 Energy is transferred to the surroundings. (*1 mark*)

45 Energy is absorbed from the surroundings. (*1 mark*)

46 Combustion, oxidation and neutralisation. (*1 mark* each)

47 The copper sulfate turns blue (*1 mark*), and the same amount of energy is given out as was absorbed during heating (*1 mark*).

Making salts

48 Dissolve the solid in hydrochloric acid until in excess (no more will dissolve); filter off excess solid; heat to crystallising point; set aside to cool and crystallise. (*4 marks*)

49 a) sodium hydroxide + hydrochloric acid → sodium chloride + water (*1 mark*)
b) copper oxide + nitric acid → copper nitrate + water (*2 marks*)
c) sodium hydroxide + sulfuric acid → sodium sulfate + water (*2 marks*)
d) lead nitrate + potassium chloride → lead chloride + potassium nitrate (*2 marks*)

50 a) By precipitating (*1 mark*) a compound formed from cadmium ions/cadmium hydroxide (*1 mark*).
b) $Cd^{2+}(aq) + Ca(OH)_2(aq) \rightarrow Cd(OH)_2(s) + Ca^{2+}(aq)$
(state symbols, *1 mark*; formulae correct, *1 mark* per side; balancing, *1 mark*)

Acids and bases

51 They contain hydrogen ions. (*1 mark*)

52 They produce hydroxide ions in aqueous solution. (*1 mark*)

53 7 (*1 mark*)

54 $H^+(aq) + OH^-(aq) \rightarrow H_2O(l)$ (*1 mark*)

55 a) Copper sulfate
b) Calcium chloride
c) Magnesium nitrate (*1 mark* each)

Electrolysis (1)

56 Conduction of electricity by ionic solutions. (*1 mark*)

57 Breaks down compounds into elements. (*1 mark*)

58 So the ions are free to move about (are mobile). (*1 mark*)

59

Compound	Cathode product	Anode product
Potassium hydroxide	Hydrogen	Oxygen
Calcium bromide	Hydrogen	Bromine
Copper chloride	Copper	Chlorine
Lead nitrate	Lead	Oxygen

(*1 mark* per product)

60 a) $Na^+(aq) + e^- \rightarrow Na(s)$ (*1 mark*)
b) $Pb^{2+}(aq) + 2e^- \rightarrow Pb(s)$ (*1 mark* for state symbols, *1 mark* for electron, *1 mark* for balancing after electron mark is awarded)
c) $2I^-(aq) \rightarrow I_2(s) + 2e^-$ (*1 mark* for state symbols, *1 mark* for balancing)
d) $2O^{2-}(l) \rightarrow O_2(g) + 4e^-$ (*1 mark* for state symbols, *1 mark* for balancing)
e) $4OH^-(aq) \rightarrow 2H_2O(l) + O_2(g) + 4e^-$ (*1 mark*, for state symbols, *1 mark* for electron, *2 marks* for balancing after electron mark is awarded)

Electrolysis (2)

61 It conserves raw material (silver) (*1 mark*); less energy is used in manufacture (*1 mark*); therefore less pollution (*1 mark*).

62 It lowers the melting point (*1 mark*) and this reduces the energy used in the process (*1 mark*).
(Note: a fact followed by a consequence/reason.)

63 It is more reactive than hydrogen. (*1 mark*)

Check your understanding

Chemistry 3

The early and modern periodic tables

1 He had to make too many adjustments for the elements to fit the octaves law. (*1 mark*)

2 By atomic weight. (*1 mark*)

3 It gives the number of electrons in the outer shell. (*1 mark*)

4 Newlands' table was a curiosity because there were too many problems with it (*1 mark*). Mendeleev's was useful for predicting properties (*1 mark*). The modern one shows the pattern of atomic structure (*1 mark*).

Trends within the periodic table (1)

5 **a)** potassium + chlorine → potassium chloride (*1 mark*)
b) $2K + Cl_2 \rightarrow 2KCl$ (*2 marks*)

6 rubidium (*1 mark*)

7 lithium (*1 mark*)

8 Transition elements are harder (*1 mark*), stronger (*1 mark*) and less reactive (*1 mark*) than alkali metals.

Trends within the periodic table (2)

9 **a)** copper + fluorine → copper fluoride (*1 mark*)
b) $Cu + F_2 \rightarrow CuF_2$ (*2 marks*)

10 I_2 (*1 mark*)

11 Br^- (*1 mark*)

12 **a)** fluorine + rubidium iodide → rubidium fluoride + iodine (*1 mark*)
b) $F_2(g) + 2RbI(aq) \rightarrow 2RbF(aq) + I_2(aq)$ (*2 marks*)

13 The caesium atom is bigger than the sodium atom, and therefore loses the outer electron more easily. (*2 marks*)

14 The iodine atom is bigger than the chlorine atom, and therefore gains the extra electron less easily. (*2 marks*)

Hard and soft water

15 It contains dissolved compounds, usually of calcium or magnesium. (*2 marks*)

16 By precipitation of insoluble metal salts. (*2 marks*)

17 Temporary (*1 mark*)

18 Hydrogencarbonate ions (HCO_3^-) decompose (*1 mark*) on heating to produce carbonate ions (CO_3^{2-}), which react with calcium and magnesium ions to form precipitates (*1 mark*).
$HCO_3^-(aq) \rightarrow H^+(aq) + CO_3^{2-}(aq)$ (*1 mark*)
then:
$CO_3^{2-}(aq) + Ca^{2+}(aq) \rightarrow CaCO_3(s)$ (*1 mark*)
The calcium ions are taken out of solution. (*1 mark*)

19

Advantages	Disadvantages
Good for bones and teeth	Difficult to lather
Reduces heart disease	Uses more soap
Less likely to dissolve lead pipes (in old houses)	Blocks water pipes
	Forms limescale in kettles
	Uses more energy
	Increases costs
	Reduces efficiency of heating systems
	Sodium-softened water cannot be drunk by babies

(*4 marks*: 2 from each column)

Purifying water

20 Industrial waste may have high levels of dissolved salts (*1 mark*) and water from sewers has too high a level of microbes (*1 mark*).

21 It makes teeth more resistant to acid attack (tooth decay). (*1 mark*)

22 They remove some dissolved substances (*1 mark*), chlorine (*1 mark*) and organic chemicals (*1 mark*), and soften the water (*1 mark*).

23 It uses a lot of energy in producing it. (*1 mark*)

Energy from reactions

24 0.15 kg × 4.2 kJ/kg/°C × 12°C = 7.56 kJ (*2 marks*)

25 energy released = 0.15 kg × 4.2 kJ/kg/° × 50°C = 31.5 kJ (*2 marks*)
energy per mole = (31.5 kJ/3.0 g) × 60 g/mol
= 630 kJ/mol (*4 marks*)

26

Breaking bonds			Making bonds		
Bonds	**Energy in kJ**		**Bonds**	**Energy in kJ**	
1 × C–C	1 × 348	+348	4 × C=O	4 × 743	–2972
5 × C–H	5 × 412	+2060	6 × O–H	6 × 463	–2778
1 × C–O	1 × 360	+360			
1 × O–H	1 × 463	+463			
3 × O=O	3 × 496	+1488			
	Total	**+4719**		**Total**	**–5750**
Overall energy change = 4719 – 5750 = –1031 kJ (exothermic)					

(*10 marks*)

27 They lower the activation energy. (*1 mark*)

Analysing substances (1)

28 In this order: do a flame test on each one (*1 mark*), calcium compound gives red flame (*1 mark*).
Dissolve the other two separately in water, add sodium hydroxide solution until in excess. (*1 mark*)
Both produce white precipitates, the aluminium hydroxide dissolves in excess sodium hydroxide. (*1 mark*)

29 A flame test (*1 mark*). The fertiliser gives a lilac flame (*1 mark*); the weedkiller gives a yellow flame (*1 mark*).

30 a) silver nitrate + potassium bromide → silver bromide + potassium nitrate (*1 mark*)
b) $AgNO_3(aq) + KBr(aq) \rightarrow AgBr(s) + KNO_3$ (*2 marks*)

Analysing substances (2)

31 The colour changes are not clear or sharp. (*2 marks*)

32 Volume (*1 mark*)

33 $HCl = 0.2\,mol/dm^3 \times 24.2\,cm^3/1000\,cm^3/dm^3 = 4.84 \times 10^{-3}\,mol$ (*1 mark*)
$Na_2CO_3 = HCl/2 = 2.42 \times 10^{-3}\,mol$ (*1 mark*)
concentration of $Na_2CO_3 = 2.42 \times 10^{-3}\,mol/25\,cm^3/1000\,cm^3/dm^3 = 0.0968\,mol/dm^3$ (*1 mark*)
$= 0.0968\,mol/dm^3 \times 106\,g/mol = 10.3\,g/dm^3$ (*1 mark*)

Making ammonia (1)

34 Iron catalyst (*1 mark*), temperature of 450°C (*1 mark*), pressure of 200 atmospheres (*1 mark*).

35 Cooled/condensed and removed as liquid. (*2 marks*)

36 They are put through the reactor again (recycled). (*1 mark*)

37 Only in a closed system (nothing can escape). (*1 mark*)

38 The yield of CaO and CO_2 increases/more of these is produced. (*1 mark*)

39 The yield of SO_3 increases/more SO_3 is produced. (*1 mark*)

Making ammonia (2)

40 They are a compromise between yield (*1 mark*) and rate (*1 mark*).

41 Production of less ammonia. (*1 mark*)

42 The reaction would be too slow. (*1 mark*)

43 Low temperature (*1 mark*), high pressure (*1 mark*), with a catalyst (*1 mark*).

Alcohols

44 Part of a molecule that takes part in most of its reactions. (*1 mark*)

45 The –OH group makes them reactive. (*1 mark*)

46 propanol + sodium → sodium propoxide + hydrogen (*2 marks*)

47 a) ethanol + oxygen → carbon dioxide + water (*1 mark*)
b) $C_2H_5OH(l) + 3O_2(g) \rightarrow 2CO_2(g) + 3H_2O(l)$ (*2 marks*)

48 Ethanol (C_2H_5OH) (*1 mark*)

49 Ethanoic acid (*1 mark*)

Carboxylic acids and esters

50 –COOH (*1 mark*)

51 –COOH ionises to produce H^+ ions. (*2 marks*)

52 methanoic acid + sodium carbonate → sodium methanoate + carbon dioxide + water (*2 marks*)

53 propanoic acid + methanol → methyl propanoate + water (*2 marks*)

54 They partially ionise (do not ionise completely), therefore the concentration of H^+ ions is low. (*2 marks*)

55 The pH of propanoic acid is higher (or the pH of nitric acid is lower). (*1 mark*)

56 Ethyl methanoate (*1 mark*)