Section A [45 marks]
Answer **all** the questions in the spaces provided.

1 Substances can be classified as elements, compounds or mixtures.
Complete Table 1.1 to describe the following substances.

Table 1.1

substance	classification (element, compound or mixture)	atoms found within the substance
hydrogen sulfide	compound	hydrogen, sulfur
brass		
limestone	compound	

[3]

[Total: 3]

2 Iron is the fourth most common element in the Earth's crust and it is also believed to form a large extent of the Earth's core.

(a) Pure iron can be prepared by the thermal decomposition of iron pentacarbonyl.
Fig. 2.1 shows the structure of iron pentacarbonyl.

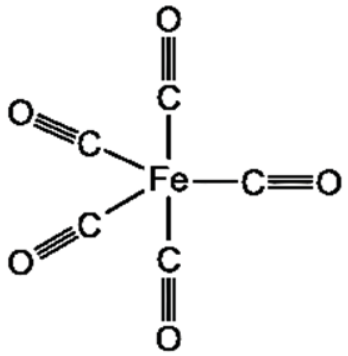

Fig. 2.1

Write the chemical formula for iron pentacarbonyl. ……. [1]

(b) **(i)** Iron metal oxidises partially to form iron(II) oxide.

Predict the electrical conductivity of this compound by including the condition under which conductivity is observed or not at all.

……..

…… [1]

2 **(b)** **(ii)** Complete Table 2.1 to show the number of electrons, neutrons and protons in iron(II) ion and oxide ion.

Table 2.1

	number of protons	number of neutrons	number of electrons
$^{56}_{26}Fe^{2+}$	26		
$^{16}_{8}O^{2-}$		8	

[2]

(c) **(i)** $^{54}_{26}Fe$ and $^{56}_{26}Fe$ are two common isotopes of iron.

Define *isotopes*.

……

…… [1]

(ii) These iron isotopes have different physical properties but exhibit same chemical properties.

Explain this observation.

……

…… [1]

[Total: 6]

3 When a colourless solution of copper(I) chloride is left in a beaker for a period of time, the following reaction takes place.

$$2CuCl(aq) \rightarrow CuCl_2(aq) + Cu(s)$$

(a) Calculate the oxidation state of copper in CuC*l* and $CuCl_2$.

oxidation state of copper in CuC*l* ……

oxidation state of copper in $CuCl_2$ …… [2]

(b) Explain, in terms of change in oxidation states, why CuC*l* is both oxidised and reduced in this reaction.

……

…… [2]

3 (c) Describe one observation in this reaction.

……..

……. [1]

[Total: 5]

4 (a) Name the pieces of apparatus most suitable to complete the following laboratory procedures:

(i) separate a precipitate from a solution,

……..[1]

(ii) measure exactly 25.30 cm^3 of solution into a conical flask,

……..[1]

(iii) measuring the mass gained in a reaction,

……..[1]

(iv) bubbling gas into a test-tube containing solution.

……..[1]

(b) Chromatography can be used to separate the coloured pigments extracted from lavender flowers. The apparatus used is shown Fig. 4.1.

After a few minutes, the solvent vapour fills the whole chromatography jar.

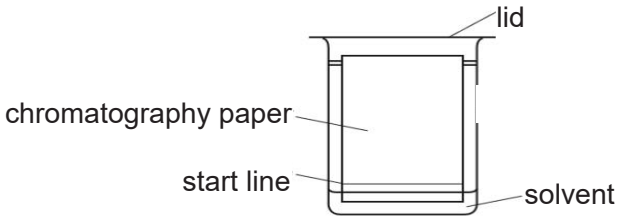

Fig. 4.1

Describe what happens to the movement and arrangement of the solvent particles as they become a vapour.

……..

……..

……..

……. [2]

[Total: 6]

5 A solution of nitric acid is prepared by diluting 0.15 mol to make 100 cm^3 of solution.

(a) Calculate the concentration of this solution in mol/dm^3 and g/dm^3.

concentration = …… mol/dm^3 [1]

concentration = …… g/dm^3 [1]

(b) The chemical equation for the reaction between nitric acid and potassium carbonate is as follows:

$$2HNO_3 + K_2CO_3 \rightarrow 2KNO_3 + CO_2 + H_2O$$

100 cm^3 of 0.5 mol/dm^3 nitric acid is added to an aqueous solution containing 0.02 mol of potassium carbonate.

(i) Calculate the number of moles of nitric acid.

number of moles = …… [1]

(ii) State the limiting reactant in this reaction.

……..……..…..[1]

(iii) Calculate the number of moles of potassium nitrate formed.

number of moles = …… [1]

[Total: 5]

6 Fig. 6.1 describes some of the properties and reactions of several substances.

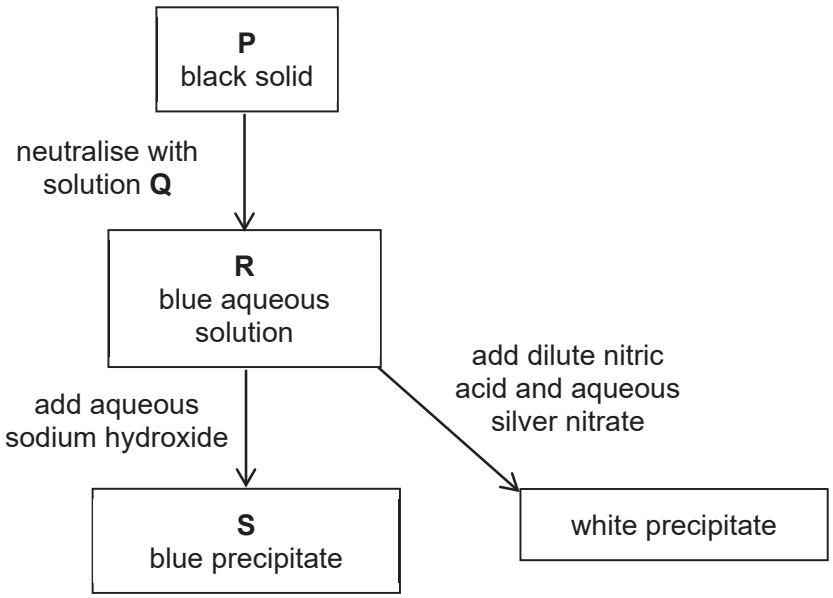

Fig. 6.1

(a) Identify **P**, **Q**, **R** and **S**.

P .....

Q .....

R .....

S ..... [4]

(b) Write the ionic equation for the reaction of **R** with aqueous silver nitrate.

..... [1]

[Total: 5]

7 **(a)** Lithium, sodium and potassium belong to Group I of the Periodic Table.
Table 7.1 shows the observations when these three metals react with water.

Table 7.1

Group I metal	observation
lithium	reacts quickly
sodium	reacts violently
potassium	reacts very violently

(i) Describe and explain the reactivity of Group I metals down the group.

……..

...……

...……

...……

……..……..……..[3]

(ii) Rubidium is located below potassium in Group I.

Predict what would happen when rubidium reacts with water.

...……

……..……..……..[1]

(iii) Name the gas evolved when Group I metals react with water.

……..……..……..[1]

(b) Group 0 elements are also known as noble gases.

(i) State one physical property of noble gases.

...……

……..……..……..[1]

(ii) Using your knowledge of electronic structures, explain why elements in Group 0 are unreactive.

...……

...……

……..……..……..[1]

[Total: 7]

8 The petrol burnt in car engines react with air to form a mixture of gases.
Table 8.1 shows the composition of the mixture of all the gases coming from car exhaust fumes.

Table 8.1

gas	% of gas in the exhaust fumes
carbon dioxide	15
carbon monoxide	3
hydrocarbons	2
hydrogen	1
oxides of nitrogen	1
oxygen	1
water vapour	18
gas **W**	59

(a) Identify gas **W**. ……. [1]

(b) The amount of carbon dioxide emitted by vehicles contributes to the increasing concentration of the gas in the atmosphere.

Explain why this is a global concern.

.....

.....

.....

.....[2]

(c) Explain why carbon monoxide is found in the exhaust gases.

.....

.....[1]

8 (d) Water is one of the major by-products in the combustion of petrol in vehicles.

Draw a 'dot and cross' diagram of water, showing only the arrangement of electrons on the valence shells.

[2]

(e) The combustion of petrol is exothermic.

(i) Define *exothermic*.

……..……..…….... [1]

(ii) Give another example of an exothermic reaction.

……..……..…….... [1]

[Total: 8]