1 The following table gives information about six substances.

substance	melting point / °C	boiling point / °C	electrical conductivity as a solid	electrical conductivity as a liquid
A	839	1	good	good
B	–18		poor	poor
C	776	1	poor	good
D	–11		poor	poor
E	1607		poor	poor
F	–5	1	poor	good

(a) Which substance could be a metal?

.....

[1]

(b) State **all** the substances that are liquid at room temperature?

.....

[1]

(c) Which substance could have a macromolecular structure similar to that of silicon(IV) oxide?

.....

[1]

(d) Which substance could be propane?

.....

[1]

(e) Which substance could be sodium chloride?

.....

[1]

[Total: 5]

(a) Potassium iodide is an ionic compound.

(i) Describe what happens, in terms of electron loss and gain, when a potassium atom reacts with an iodine atom.

.....

.....

.....

..... [2]

(ii) Describe the structure of solid potassium iodide. You may draw a diagram.

.....

.....

..... [2]

(iii) Explain why potassium iodide has a high melting point.

.....

.....

..... [2]

(b) Potassium iodide and lead nitrate are both soluble. Lead iodide is insoluble.

(i) Describe how a pure dry sample of lead iodide could be made from solid potassium iodide and solid lead nitrate.

.....

.....

.....

.....

.....

..... [4]

(ii) Write an ionic equation for the formation of lead iodide, PbI_2, when potassium iodide and lead nitrate react with each other.
State symbols are **not** required.

..... [2]

(c) When chlorine gas is bubbled through an aqueous solution of potassium iodide, a redox reaction takes place.

$$2I^- + Cl_2 \rightarrow I_2 + 2Cl^-$$

(i) State the colour change expected in this reaction.

start colour .....

end colour .....
[2]

(ii) Identify the reducing agent in this reaction. Explain your answer.

.....

.....

..... [2]

[Total: 16]

3 Carbon dioxide and silicon(IV) oxide are oxides of Group IV elements.

(a) Complete the following table.

	carbon dioxide	silicon(IV) oxide
formula		SiO_2
melting point / °C	–56	1610
physical state at 25 °C	gas	
conduction of electricity	non-conductor	
structure		macromolecular

[4]

(b) (i) Name the type of bonds that exist between the atoms in silicon(IV) oxide.

..... [1]

(ii) Explain why silicon(IV) oxide has a very high melting point.

.....

..... [1]

(iii) Explain, in terms of attractive forces between particles, why carbon dioxide has a very low melting point.

.....

..... [1]

(iv) Explain, in terms of particles, why carbon dioxide is a non-conductor of electricity.

.....

..... [1]

(c) Suggest a chemical equation for the reaction between sodium hydroxide solution and carbon dioxide.

..... [2]

(d) (i) Name the type of chemical reaction in which carbon dioxide is produced from fossil fuels.

..... [1]

(ii) Name the chemical process in which green plants convert carbon dioxide into carbohydrates.

..... [1]

(iii) Name the chemical process in which living things produce carbon dioxide.

..... [1]

[Total: 13]

4 Iron pyrite, FeS_2, is known as Fool's Gold because it is a shiny yellow solid which is similar in appearance to gold. Iron pyrite is an ionic compound. Gold is a metallic element.

(a) Iron pyrite, FeS_2, contains positive and negative ions. The positive ion is Fe^{2+}.

Deduce the formula of the negative ion.

..... [1]

(b) A student is provided with a sample of iron pyrite and a sample of gold.

Suggest how the student could distinguish between the two substances.

.....

..... [2]

(c) Sulfur dioxide is produced on a large scale by heating iron pyrite strongly in air. The iron pyrite reacts with oxygen in the air producing iron(III) oxide, Fe_2O_3, and sulfur dioxide.

(i) Construct a chemical equation for the reaction between iron pyrite and oxygen.

..... [2]

(ii) Give **one** use of sulfur dioxide.

..... [1]

[Total: 6]

5 Carbon and silicon are elements in Group IV. They both form oxides of the type XO_2.

(a) Silicon(IV) oxide, SiO_2, has a macromolecular structure.

(i) Describe the structure of silicon(IV) oxide.

.....

.....

.....

.....

..... [3]

(ii) State **three** properties which silicon(IV) oxide and diamond have in common.

.....

.....

..... [3]

(iii) How could you show that silicon(IV) oxide is acidic and not basic or amphoteric?

.....

.....

..... [2]

(b) Explain why the physical properties of carbon dioxide are different from those of diamond and silicon(IV) oxide.

.....

..... [1]

[Total: 9]

6 Use your copy of the Periodic Table to help you answer some of these questions.

(a) Predict the formulae of the following compounds.

(i) nitrogen fluoride .....

(ii) phosphorus sulfide .....

[2]

(b) Deduce the formulae of the following ions.

(i) selenide .....

(ii) gallium .....

[2]

(c) Use the following ions to determine the formulae of the compounds.

ions OH^- Cr^{3+} Ba^{2+} SO_4^{2-}

compounds

(i) chromium(III) sulfate .....

(ii) barium hydroxide .....

[2]

[Total: 6]

7 Lithium bromide is an ionic compound. It can be electrolysed when it is molten or in aqueous solution. It cannot be electrolysed as a solid.

(a) Solid lithium bromide is a poor conductor of electricity. The ions cannot move to the electrodes, they are held in an ionic lattice by strong forces.

(i) Describe the motion of the ions in the solid state.

……. [1]

(ii) Define the term *ionic bonding*.

.....

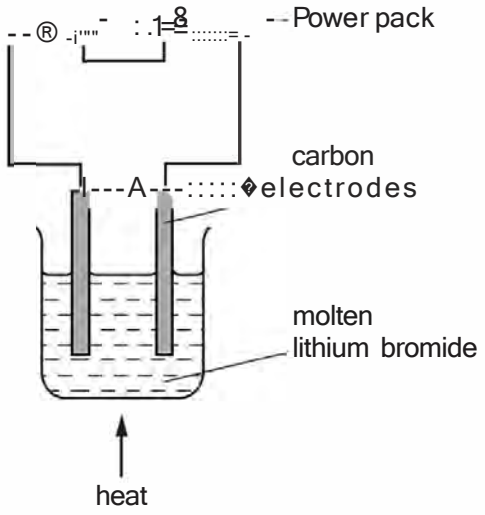
..... [2]

(iii) What is meant by the term *ionic lattice?*

.....

..... [2]

(b) The diagram shows the electrolysis of molten lithium bromide.



(i) Mark on the diagram the direction of the electron flow. [1]

(ii) Write an ionic equation for the reaction at the negative electrode (cathode).

……. [1]

(iii) Write an ionic equation for the reaction at the positive electrode (anode).

..... [2]

(iv) Which ion is oxidised? Explain your answer.

.....

..... [2]

(c) When aqueous lithium bromide is electrolysed, a colourless gas is formed at the negative electrode and the solution becomes alkaline.

Explain these observations and include an equation in your explanation.

.....

.....

.....

.... (3)

[Total: 14)