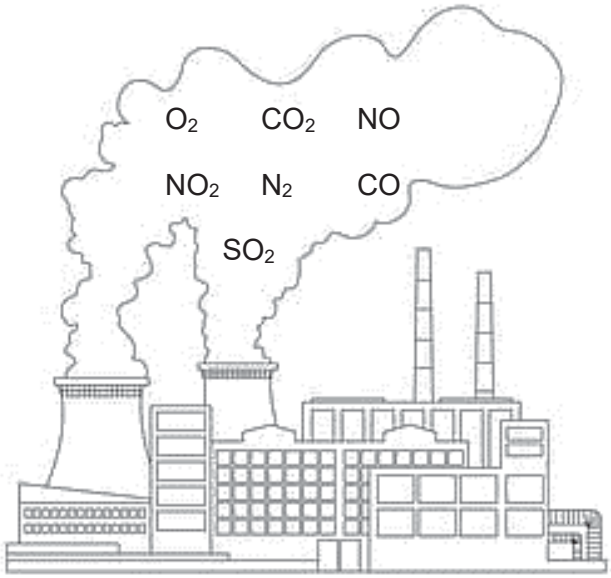
Section A

Answer **all** questions in the spaces provided.

A1 The diagram below shows the formulae of some gases found in polluted air.



Choose formulae from the diagram to answer the following questions **(a)** to **(d)**. Each may be use once, more than once or not at all.

(a) Give the formula of a gas that is produced by incomplete combustion of fuels. State the harmful health effect of this gas.

……...
……... [2]

(b) Give the formulae of two gases that are produced by reactions in catalytic converters.

…… and ……... [1]

(c) Give the formulae of two gases that are involved in both respiration and photosynthesis.

…… and ……... [1]

(d) Give the formulae of two gases that produce acid rain.

…… and ……... [1]

[Total: 5 marks]

A2 Sulfur and sulfur compounds are common in the environment.

(a) A sample of sulfur from a volcano contained two different types of sulfur isotopes: sulfur-32 and sulfur-34.

(i) Complete the table below to show the atomic structure of each isotope of sulfur.

Isotope	Number of		
	Proton	Neutron	Electron
Sulfur-32			
Sulfur-34			

[2]

(ii) The relative atomic mass of sulfur is 32.2. Explain why does the relative atomic mass of sulfur is not a whole number.

……...

……..…. [2]

(b) One of the gases produced during volcanic eruptions is hydrogen sulfide. H_2S. Hydrogen sulfide is a poisonous, colourless gas which smells of rotten eggs.

(i) Draw a dot-and-cross diagram to represent the bonding in a hydrogen sulfide molecule. Show outer electrons only.

[2]

(ii) Explain, in terms of bonding and structure, why hydrogen sulfide gas does not conduct electricity.

……

…….. [2]

[Total: 8 marks]

A3 The table below shows some salts and products that contain them.

Salt	product
Silver chloride	Photographic film
Potassium nitrate	fertiliser
Zinc sulfate	Health supplement

(a) **(i)** Which salt in the table can be made by **precipitation**?
Explain your reasoning.

Salt: ……

Reason: …… [2]

(**ii**) Which salt in the table can be made by **titration**? Suggest two reagents needed to make this salt.

Salt: ……

Reagent 1: …… Reagent 2: …… [2]

(b) Other substances are used to make a range of useful products.
Put a tick (√) in one box in each row to show a correct use of each substance.

Substance	**Use**			
	to make car battery	**to make road surface**	**to reduce acidity in soil**	**to fill filament bulb**
Calcium silicate				
Calcium hydroxide				
Argon				
Sulfuric acid				

[2]

[Total: 6 marks]

A4 In an oil refinery petroleum is separated into useful fractions by fractional distillation.

(a) What is the physical property that allows the various fractions in crude oil to be separated?

…….. [1]

(b) To meet the world's demand for petrol, heavier fraction such as diesel undergoes cracking to produce lighter fractions as shown in the equation below.

$C_{12}H_{26}$ → C_6H_{14} + C_2H_4 | product **P**

Give the chemical name and formula of the product **P**.

Chemical name: …….

Chemical formula: ……. [2]

[Total: 3 marks]

A5 The Thermit reaction is used to weld railway rails together.

In Thermit reaction, aluminium powder reacts with iron(III) oxide to make small amounts of molten iron which runs into the gaps between the rails. Solid aluminium oxide is made at the same time.

(a) Complete the equation for the reaction by filling in missing state symbols.

2 Al (……..) + Fe_2O_3 (……..) → 2Fe (……..) + Al_2O_3 (……..) [1]

(b) **(i)** The table shows some information about oxidation state changes during the reaction. Complete the table.

Element	Oxidation state at the start	Oxidation state at the end	Oxidised or reduced?
Oxygen	-2	-2	unchanged
Aluminium			
iron			

[2]

(ii) Hence, or otherwise, explain why Thermit reaction is a redox reaction.

…….

…… [1]

(c) Is Thermit reaction an endothermic or exothermic reaction? Explain your answer.

……

…… [2]

(d) Predict if the melting point of aluminium oxide is high or low. Explain your answer in terms of structure and bonding.

……

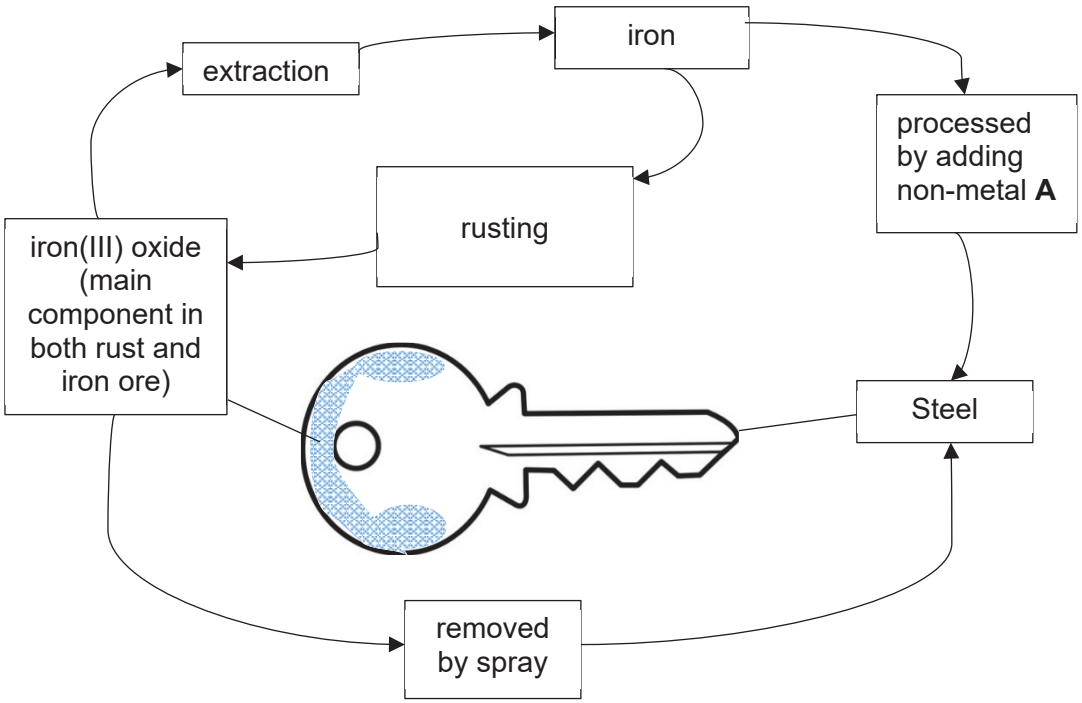
……

……

…… [2]

[Total: 8 marks]

A6 Common keys are made from steel. One problem with using steel is that the iron in steel will rust. The diagram shows the cycle of changes that happens when iron in a steel key rust and then extracted.



(a) **(i)** Identify non-metal **A**. …… [1]

(ii) Explain the importance of adding **A** to iron in making steel key.

……

……

…….. [2]

(b) A shop sells a spray-on rust treatment. The spray contains particles of zinc. Explain how zinc prevents rust from forming.

……...

……

……..… [2]

(c) Write a balanced chemical equation for the extraction of iron in the blast furnace.

……..…….... [1]

(d) Though the extraction of iron from blast furnace is a relatively cheap process, steels are still widely recycled.

Explain the importance of recycling of metals such as iron.

……...

……..… [1]

[Total: 7 marks]

A7 **(a)** Propane burns completely in oxygen to form carbon dioxide and water.

The equation for the reaction is

$$C_3H_8 + 5O_2 \rightarrow 3CO_2 + 4H_2O$$

(i) Calculate the number of moles in 44 g of propane.

[1]

(ii) Hence, calculate the volume of carbon dioxide that is produced from 44 g of propane at room temperature and pressure.

[2]

(b) **(i)** State why propene can be made into polymer but propane cannot.

……

…… [1]

(ii) Describe a test to distinguish between propene and propane.

……

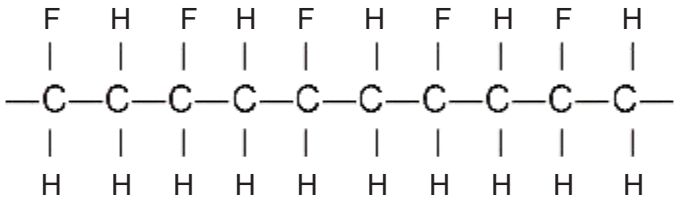
…… [2]

(iii) State one harmful effect of polymer to the environment.

…… ……

…… [1]

(c) The figure below shows the structure formula of part of an addition polymer.



Deduce and draw the structural formula of the **monomer** from which this polymer is made.

[1]