

Name: _____

School Year: _____

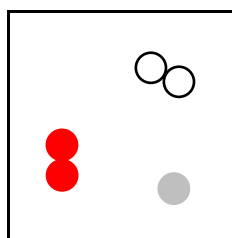
School: _____

*Answer all questions in the spaces provided.**You are provided with a Periodic table.**Write your answers clearly. Show all working.**The total marks allocated to the paper are 40 marks (Section A 10 marks, Section B 30 marks)**The time allocated to the paper is 30 minutes.*

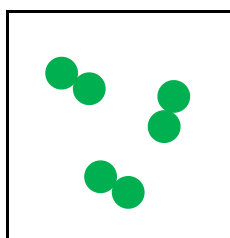
Scoring: Section A / 10 Section B / 30 Total / 40

SECTION A General chemistry knowledge

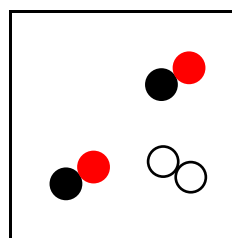
1.



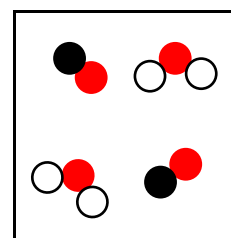
A



B



C



D

Choose the diagram (A-D) that best represents: [2]

a. a pure element _____ b. a mixture of compounds _____

2. Name the change of state that occurs when a solid changes to a gas without passing through the liquid state. [1]
_____3. Name the element that is the only metal that is a liquid at room temperature. [1]
_____4. Name the element which is the most reactive of the halogens. [1]

5. Name the separating technique needed to separate each of the following mixtures: [3]

a. Pure water from a solution of salty water _____

b. The dyes in a sample of ink _____

c. A mixture of liquids with similar boiling points _____

6. Complete the word equation: [1]
magnesium + oxygen → _____7. State the **two** products from the complete combustion of a hydrocarbon fuel. [1]

SECTION B Questions linked to this year's theme of Sustainable Chemistry

8. This question is about fertilisers.



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As the population of the world increases more food has to be produced on the finite amount of land available.

Plants need water, sunlight and certain chemical elements – nitrogen (N), phosphorus (P) and potassium (K) to grow. They obtain these elements from the soil and the air.

If the plants are harvested as food crops, these elements are lost from the soil.

Fertilisers replace these nutrients in the soil and help to improve crop yield.

- a. Fertilisers are made from ammonia.

A molecule of ammonia is shown in **Figure 1**.

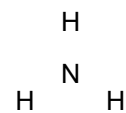


Figure 1

Name the **two** elements in a molecule of ammonia

[2]

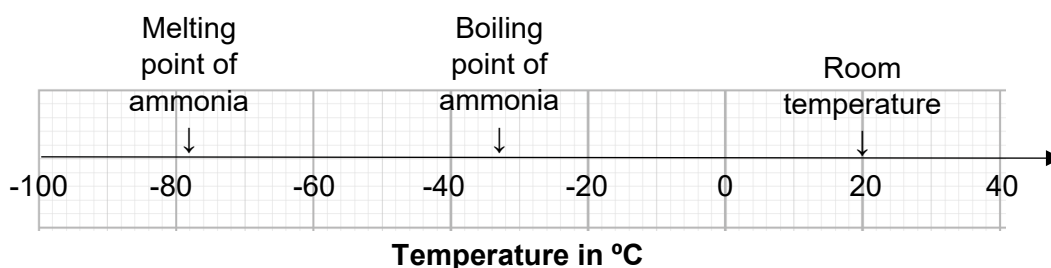


Figure 2

Figure 2 gives the melting point and boiling point of ammonia.

- b. Using the information in **Figure 2** circle the state of ammonia at room temperature. [1]

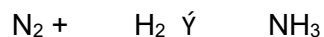
solid

liquid

gas

Ammonia, NH_3 is made by reacting nitrogen, N_2 with hydrogen, H_2 .

- c. i. Balance the symbol equation for the reaction shown below: [1]



- ii. What does the symbol \rightarrow tell you about this reaction? [1]
-

Figure 3 below shows how the percentage conversion to ammonia changes with temperature and pressure.

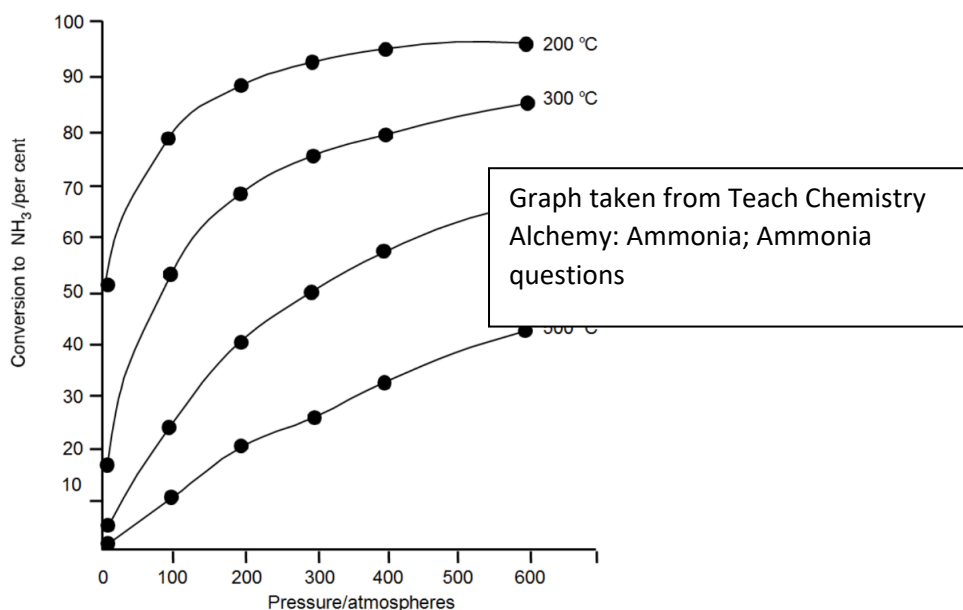


Figure 3

- d. Use **Figure 3** to identify the conditions that give the highest percentage conversion. [1]

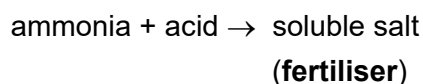
- High temperature and high pressure
- High temperature and low pressure
- Low temperature and high pressure
- Low temperature and low pressure

- e. An iron catalyst is also used in this reaction.

- i. Describe the role of a catalyst in a chemical reaction. [2]
-
-

- ii. Explain why finding a suitable catalyst is important for industrial processes. [1]
-

In order to be absorbed by the crop's roots, the ammonia must be converted into a soluble salt by reacting it with an acid. This is the fertiliser:



A company wishes to make a fertiliser containing the soluble salt, **ammonium nitrate**.

- f. i. Circle the name of the acid ammonia must be reacted with to make ammonium nitrate. [1]

hydrochloric acid

sulfuric acid

nitric acid

phosphoric acid

- ii. Identify the type of reaction used: [1]

thermal decomposition

neutralisation

displacement

Question 8 continues on the next page

Not all the ammonia produced globally is used to make fertilisers. **Table 1** shows the percentage amount of fertiliser used for different purposes.

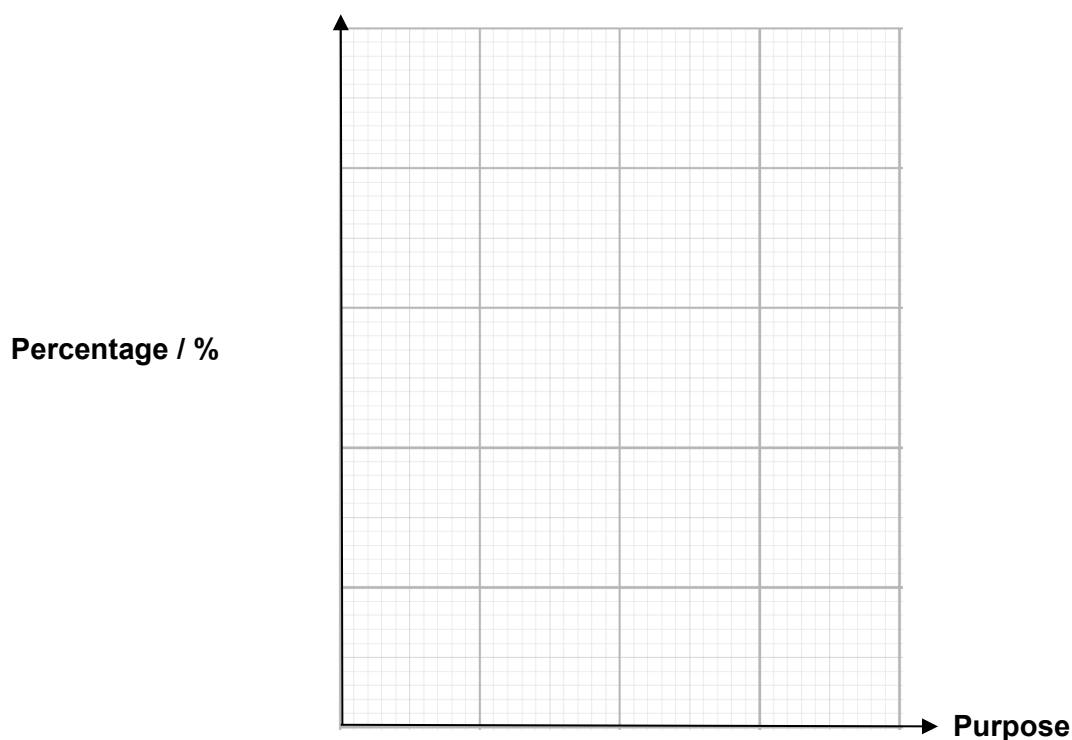
Purpose	Percentage
Making fertilisers	80%
Making other chemicals and wool pulp	8%
Making nylon	7%
Making nitric acid	5%

Data taken from
Teach Chemistry
Alchemy:
Ammonia;
Ammonia fact
file

Table 1 Percentage amount of ammonia used for different purposes

g. i. Represent this data as a **bar chart** on the axes below.

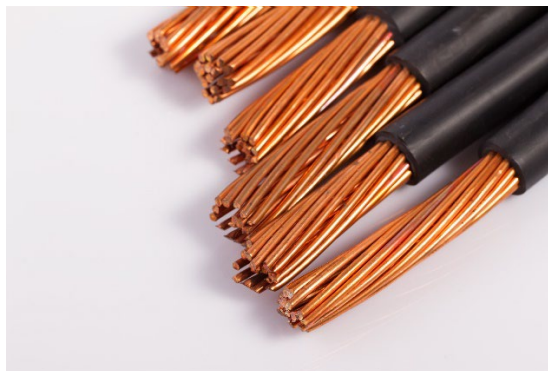
[3]



ii. If the annual global production of ammonia is 176 million tonnes per year, calculate the mass of ammonia **in kg** that is used to produce fertilisers each year. [2]

(1 tonne = 1000 kilograms)

9. This question is about the metal, copper.



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a. A major use of copper is for electrical wiring.

Identify the **two** properties of copper from the list below that make it useful for electrical wiring. [2]

Good electrical conductivity

Good thermal conductivity

Ductile

Lustrous

b. Copper exists as two isotopes, 63-copper ${}^{63}_{29}\text{Cu}$ and 65-copper ${}^{65}_{29}\text{Cu}$

State **in terms of subatomic particles** what makes these atoms isotopes of the element copper. [2]

Copper can be found in rocks underground in the mineral malachite.

Malachite contains copper carbonate, CuCO_3 which has a distinctive green colour.

c. Copper carbonate undergoes thermal decomposition to produce black copper oxide, CuO and carbon dioxide, CO_2 .

i. Write a balanced symbol equation for this reaction. [1]

ii. State if this reaction, an example of a thermal decomposition reaction, is endothermic or exothermic. [1]

endothermic

exothermic

A student investigated the thermal decomposition of a sample of copper carbonate.

Figure 4 shows the apparatus they used.

Table 2 shows their results.

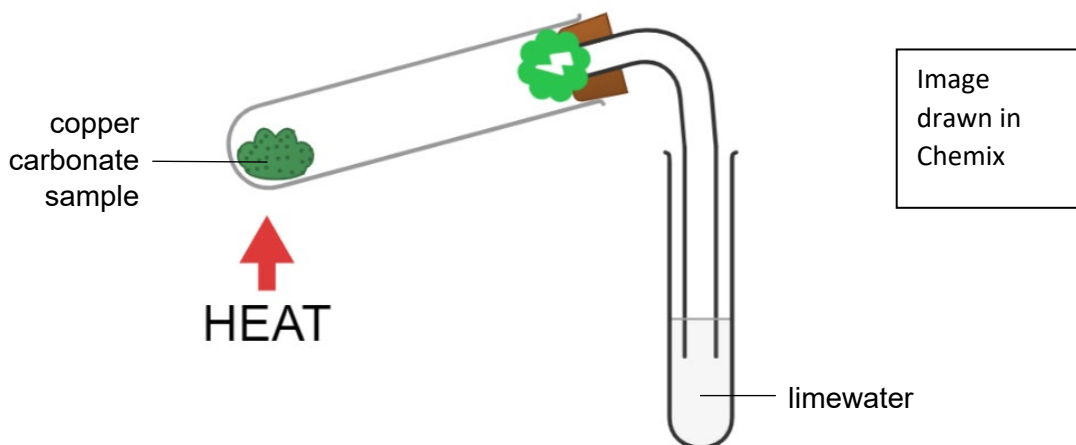


Figure 4

Mass of test tube and copper carbonate before heating in g	Mass of test tube and solids after 5 min of heating in g	Observations	
		Changes observed in the colour of the solid	Changes observed in the limewater
25.65	22.25	_____	_____
		_____	_____
		_____	_____

Table 2

- d. i. Explain the change in mass observed after heating the copper carbonate for 5 minutes. [2]

- ii. Complete **Table 2** by describing the changes that would be observed to both the solid and the limewater. [2]

In the early days of commercial mining, miners extracted malachite from the ground and used it as a source of pure copper.

potassium	K
sodium	Na
calcium	Ca
magnesium	Mg
aluminium	Al
<i>carbon (non metal)</i>	
zinc	Zn
iron	Fe
lead	Pb
<i>hydrogen (non-metal)</i>	
copper	Cu
silver	Ag
gold	Au
The reactivity series	

- e. Using **the reactivity series** explain why copper can be extracted from copper carbonate by heating with carbon. [2]

In order to continue to use copper as sustainably as possible it is important to continue to recycle as much as we can.

Currently 34% of the global annual amount of copper used is recycled.

- f. If in 2020, 8 495 580 tonnes of copper was recycled, calculate the annual global production of copper. [2]
