YOUNGEST PAPER

Name: ..... **School Year:** .....

School: .....

Answer all questions in the spaces provided.

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

NOTE In general don't penalise spelling errors unless specifically indicated.

1. Complete the following word equations; (4 marks)

a. zinc + hydrochloric acid → zinc chloride (1 mark) + hydrogen (1 mark)

b. sodium carbonate + sulfuric acid → sodium sulfate (1 mark) + carbon dioxide + water (1 mark for both)

2. Name the following compounds

a. $PbCO_3$ lead carbonate ..... (1 mark)

b. $(NH_4)_3PO_4$ ammonium phosphate NOT ammonia phosphate ..... (1 mark)

3. Name the acid found in lemons that is responsible for making them sour. (1 mark)

citric acid .....

4. Circle all of the following gases that are less dense than air.

½ mark for each correct answer; ½ mark deducted for each incorrect answer down to zero.

carbon dioxide (helium) (hydrogen) oxygen (1 mark)

5. Identify the **least** reactive metal from the metals below; (1 mark)

aluminium calcium (copper) iron zinc

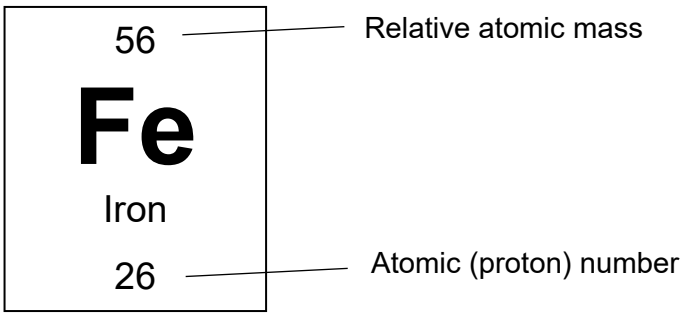
6. Balance the equation for the complete combustion of the fuel ethane. (1 mark)

C_2H_6 + 3 ½ O_2 → 2 CO_2 + 3 H_2O (allow multiples)

Total: 10 marks

SECTION B Questions linked to this year's theme of Materials

7. This question is about the metal iron.



(a) State the number of protons, neutrons and electrons in an atom of iron.

Protons 26 ..... (1 mark)

Neutrons 30 ..... (1 mark)

Electrons 26 ..... (1 mark) (3 marks)

Iron is obtained from the rock haematite. Haematite contains iron(III) oxide. Iron(III) oxide has the chemical formula;

Fe_2O_3

(b) State the **total number of atoms** in iron(III) oxide.

5.....(1 mark)

Iron is extracted from haematite by heating with carbon.

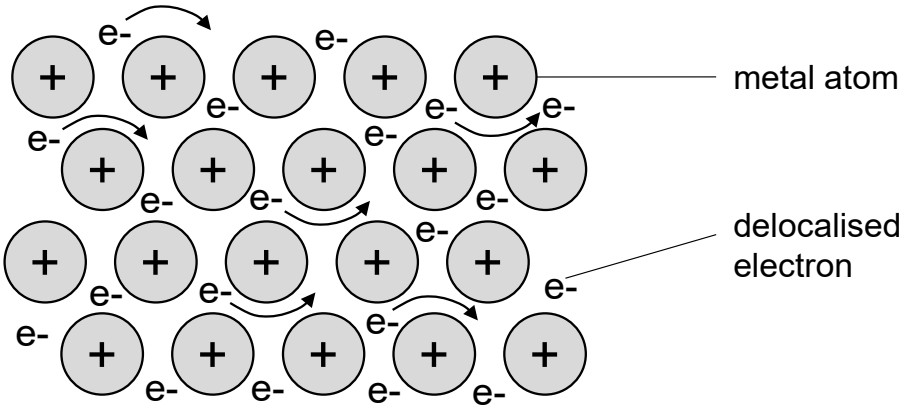
(c) Complete the symbol equation for the reaction given below.

- identify the gas produced in this reaction (1 mark for CO_2 or CO)
- balance the equation (1 mark for balancing – allow multiples) (2 marks)

..... Fe_2O_3 + ...1½ C → .....2 Fe + ...1½ CO_2 .....

Alternative ..... Fe_2O_3 + ...3 C → .....2 Fe + ...3 CO .....

The diagram below shows the bonding in a metal.



(d) State one property of a metal.

Use an understanding of the bonding in the metal to explain why the metal has this property.

Property (1 mark)	High melting point	Conduct electricity	Malleable
Explanation (1 mark)	Strong metallic bonds / strong attraction between positive metal centre and negative electrons	Delocalised electrons are free to move to carry the charge	Layers of atoms can slide over each other

(2 marks)

An **alloy** is a mixture of two or more metals or a metal and another element.

Pure iron is soft and easily shaped. However its properties can be changed by creating alloys in which the iron is mixed with other elements. These alloys are called steels.

The table below gives information about some different steels.

Type of steel	**Mass of each element in 200 g of the alloy**	**Relative cost**	**Properties**
Low carbon steel	199.5 g iron 0.5 g carbon	low	Easily shaped
High carbon steel	195 g iron 5 g carbon	medium	Hard
Stainless steel	140 g iron 40 g chromium 20 g nickel	high	Resistant to corrosion

(e) i. Which type of steel would you choose to make a hammer? Explain your choice.

Choice of steel High carbon steel (1 mark).....

Explanation Hard and not too expensive (½ mark for each point).....

.....

.....(2 marks)

ii. Calculate the percentage by mass of **carbon** in low carbon steel.

$\frac{0.5\text{ g}}{0.5\text{ g} + 199.5\text{ g}} \times 100$ (1 mark) .....

.....

= 0.25% (award 2 marks if correct answer with no working) .....(2 marks)

iii. A student wishes to investigate the density of the stainless steel used to make a knife.

The density of a substance is a measure of its mass per unit volume.

Briefly describe an experiment the student could carry out to determine the density of the steel used to make the knife. (4 marks)

Measure the mass / weight of the knife (1 mark).....

Measure the volume of the knife (1 mark) .....

Brief description of how they would measure the volume (probably displacement of water) (1 mark) .....

Description of how calculate density (= mass / volume) (1 mark).....

.....

.....

.....

.....

.....

(f) When exposed to water and oxygen in the air iron rusts.

The correct chemical name for rust is **hydrated iron(III) oxide**.

i. Write a word equation for the rusting process. (1 mark)

iron + oxygen + water → hydrated iron(III) oxide .....

.....

ii. A student investigates how the mass of an iron nail changes with rusting.

She places an iron nail in a beaker and records the mass of the nail and beaker.

She exposes the nail to air and water for a month.

She then reweighs the nail and beaker.

Predict how the total mass of the iron nail and beaker will change after one month.

Explain your prediction. (2 marks)

Mass will increase (1 mark).....

Because the iron has gained the mass of the oxygen / water atoms (1 mark).....

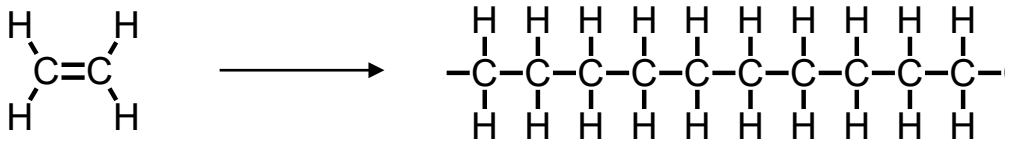
Prediction must be correct to gain explanation marks.....

.....

8. This question is about polymers.

Polymers are very large molecules formed by joining together lots of small molecules.

One common polymer is polyethene. This is formed by joining together lots of ethene molecules. The diagram below shows the process.



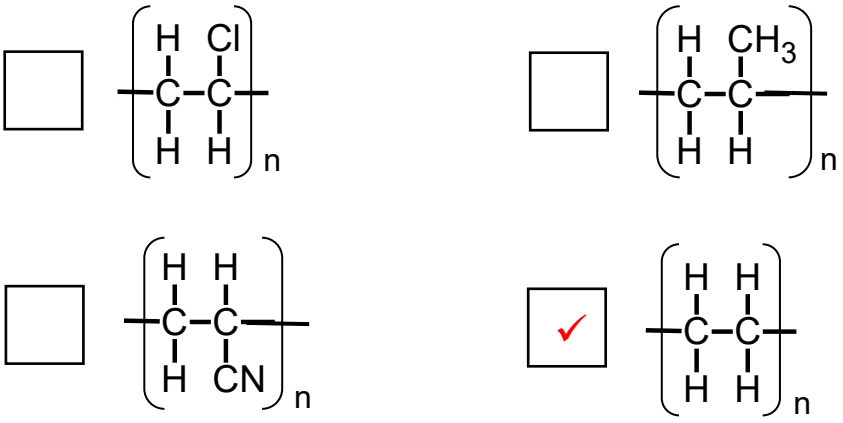
ethene polyethene

(a) Use the diagram to state the chemical formula for a molecule of **ethene**. (1 mark)

C_2H_4 .....

Instead of drawing out the whole polymer, you can draw a small part of it, called the **repeating unit**. The polymer is made up of this unit repeated over and over again.

(b) Which diagram correctly shows the repeating unit of polyethene? (1 mark)



(c) Single use plastic bags are commonly made out of polyethene.

The data below shows the number **in billions** of single use carrier bags used between 2010 and 2013 in Scotland, England, Wales and Northern Ireland.

	2010	**2011**	**2012**	**2013**
Scotland	0.75	0.75	0.76	0.80
England	6.29	6.76	7.06	7.40
Wales	0.35	0.27	0.06	0.07
Northern Ireland	0.17	0.19	0.19	0.06

Data taken from http://www.wrap.org.uk/2015_carrier_bag_figures accessed February 2018

Use the data to help you answer the following questions.

i. Wales introduced a 5 p charge for single use plastic bag use in 2011.
What evidence from the data supports this? (1 mark)

Dramatic drop in number of plastic bags used in Wales between 2012/2011.....

or Plastic bag usage in Wales in 2012 is significantly lower than in 2011.....

Mark quite tightly here ensuring that wording of explanation is clear i.e. plastic bag usage is lower is insufficient......

ii. Which other country does the data suggest introduced a similar charge within the time frame shown? (1 mark)

Northern Ireland (big drop in usage between 2012 and 2013).....

Many people now use a Bag for Life as an alternative to single use plastic bags. These are stronger and are made for repeated use.

iii. If to make a Bag for Life uses 20 g of polyethene and to make a single use plastic bag uses 8.6 g of polyethene, what is the minimal number of times a Bag for Life must be reused in order to reduce the overall amount of polyethene used. (2 marks)

20 g / 8.6 g = 2.3 (1 mark).....

Minimal number of times it must be reused is 3 (1 mark).....

(Correct answer with no working = 2 marks)

9. This question is about testing different materials.

A group of students wish to investigate which is the best material for a kitchen roll. To be effective the kitchen roll must be good at absorbing water.

The students test four different materials **A**, **B**, **C** and **D**.

They recorded the mass of the material dry.

They placed a square of each material in the bottom of a beaker and added 5 cm^3 of water to each beaker.

The students poured off any excess water and reweighed the material.

Their results are shown in the table below.

	Material A	**Material B**	**Material C**	**Material D**
Mass of material dry in g	2.45	2.78	2.15	2.37
Mass of material saturated with water in g	4.03	4.31	3.72	3.75

(a) State one thing that the students must keep the same in order to make sure this is a fair test. (1 mark)

The size of the square of material / the amount of material used .....

.....

(b) Name the **dependent** variable in the investigation. (1 mark)

The mass of water absorbed .....

.....

(c) State which material is the best for use as a kitchen roll.

Explain your answer by referring to the students' results. (3 marks)

Material A mass absorbed 1.58 g .....

Material B mass absorbed 1.53 g .....

Material C mass absorbed 1.57 g .....

Material D mass absorbed 1.38 g .....

Answer

Material A (1 mark)

Because it absorbed the greatest mass of water (1 mark)

Evidence of calculations or mass absorbed of 1.58 g stated (1 mark)

Correct material must be identified for allocation of subsequent marks.