Surname	Centre Number	Candidate Number
Other Names		0

GCSE

4493/01

S15-4493-01

CHEMISTRY

CHEMISTRY 3
FOUNDATION TIER

A.M. THURSDAY, 14 May 2015

1 hour

For Examiner's use only		
Question	**Maximum Mark**	**Mark Awarded**
1.	**5**	
2.	**6**	
3.	**7**	
4.	**12**	
5.	**6**	
6.	**10**	
7.	**8**	
8.	**6**	
Total	**60**	

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ADDITIONAL MATERIALS

In addition to this paper you will need a calculator and a ruler.

INSTRUCTIONS TO CANDIDATES

Use black ink or black ball-point pen.

Write your name, centre number and candidate number in the spaces at the top of this page.

Answer **all** questions.

Write your answers in the spaces provided in this booklet.

INFORMATION FOR CANDIDATES

The number of marks is given in brackets at the end of each question or part-question.

You are reminded of the necessity for good English and orderly presentation in your answers.

Assessment will take into account the quality of written communication (QWC) used in your answer to question **8**.

The Periodic Table is printed on the back cover of the examination paper and the formulae for some common ions on the inside of the back cover.

Examiner only

Answer **all** *questions.*

1. *(a)* The fire triangle is used in fighting fires. State what is meant by the term 'fire triangle' and how it is used to fight fires. [3]

.....

.....

.....

.....

(b) The pictures below show two methods of fighting fires. State how each method puts out the fire. [2]

Method 1

.....

.....

Method 2

.....

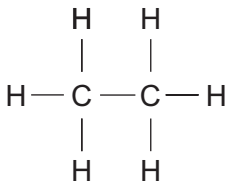
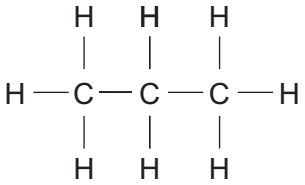
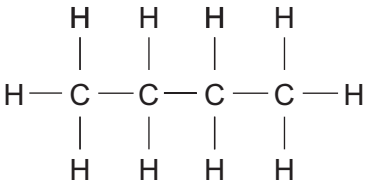
.....

5

Examiner only

2. *(a)* (i) The table below shows the names, molecular formulae and structural formulae of some alkanes.

Complete the table. [2]

Name	Molecular formula	Structural formula
methane	CH_4	
ethane	.....	
propane	C_3H_8	
butane	C_4H_{10}	

(ii) Octane contains 8 carbon atoms. Give the molecular formula for octane. [1]

.....

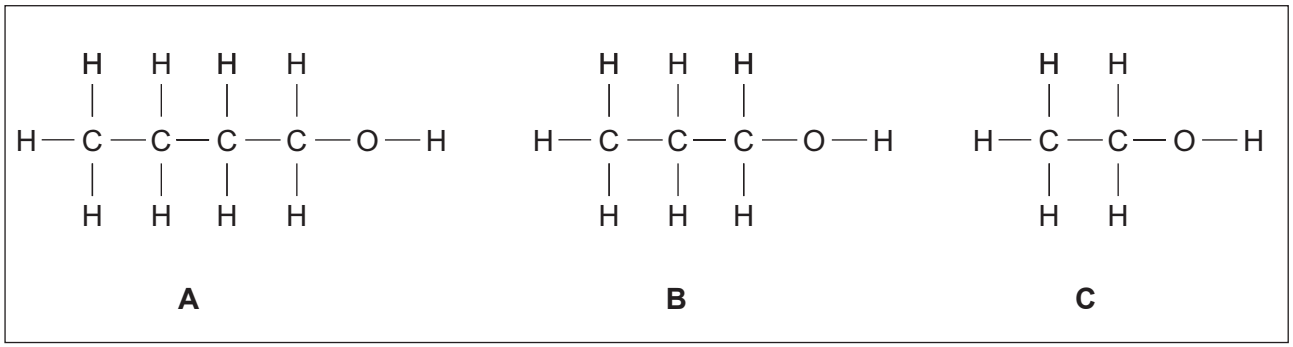
Examiner only

(b) (i) Compound **X** is made by a process called fermentation. The equation below shows the reaction that occurs.

$$\underset{\text{glucose}}{C_6H_{12}O_6} \xrightarrow{\text{yeast}} \underset{\text{compound } \mathbf{X}}{2C_2H_5OH} + 2CO_2$$

Give the name of compound **X**. ..... [1]

(ii) Choose from the box below the structural formula, **A**, **B** or **C**, of compound **X**. [1]



A **B** **C**

Letter .....

(iii) Give **one** everyday use of compound **X**. [1]

.....

6

Examiner only

3. Ammonia is manufactured from nitrogen and hydrogen using the Haber process.

(a) The equation below shows the formation of ammonia.

$$N_2(g) + 3H_2(g) \rightleftharpoons 2NH_3(g)$$

(i) State the numbers of nitrogen atoms and hydrogen atoms on the **left** hand side of the equation. Use these numbers to show that the equation is balanced. [2]

Number of nitrogen atoms ..... *Number of hydrogen atoms* .....

.....

(ii) Give the meaning of (g) in the equation. [1]

.....

(b) The box below shows some of the conditions and terms used when describing the Haber process.

ammonia	**hydrogen**	**450 °C**	**iron**	**cooling**
nitrogen	**reversible**	**200 atmospheres**		**recycling**

(i) Choose from the box

I. the process used to remove the product from the reaction mixture, [1]

.....

II. the method used to reduce the waste of reactants. [1]

.....

(ii) Choose from the box the catalyst used in the reaction. State the purpose of a catalyst. [2]

Catalyst .....

Purpose .....

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7

Turn over.

Examiner only

4. *(a)* The table below shows information about three substances. Complete the table. [3]

Common name	Chemical name	Chemical formula
.....	calcium carbonate	$CaCO_3$
quicklime	calcium oxide	.....
slaked lime	.....	$Ca(OH)_2$

(b) A group of pupils investigated the composition of egg shells. They suspected that egg shells contain calcium carbonate. They carried out the following tests.

(i) Flame test

Choose from the box below the colour you would expect to see if egg shells contain calcium ions. [1]

brick-red	**lilac**	**yellow**	**green**	**white**

Colour .....

(ii) Test for carbonate ions by adding dilute hydrochloric acid

Name the gas formed if egg shells contain carbonate ions. Describe the test you would carry out to identify this gas. Include the result for your test. [2]

Gas .....

Test and result .....

.....

(iii) The pupils were told that 2.0 g of egg shells contain 1.9 g of calcium carbonate. Calculate the percentage of calcium carbonate in these egg shells. [2]

Percentage = ... %

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(c) The box below shows some of the concerns a local conservation group have about the opening of a new limestone quarry in their area.

Concerns
Noise pollution from blasting
Unsightly quarry pits
Dust pollution from rock blasting
Noise and dust pollution from lorries
Habitat destruction

The quarry owner suggests that planting trees around the quarry will reduce the impact of noise pollution. Suggest **two** other things the quarry owner could do to reduce the impact of the quarry on the local environment. [2]

.....

.....

.....

(d) Suggest **two** advantages of limestone quarrying. [2]

Advantage 1 .....

Advantage 2 .....

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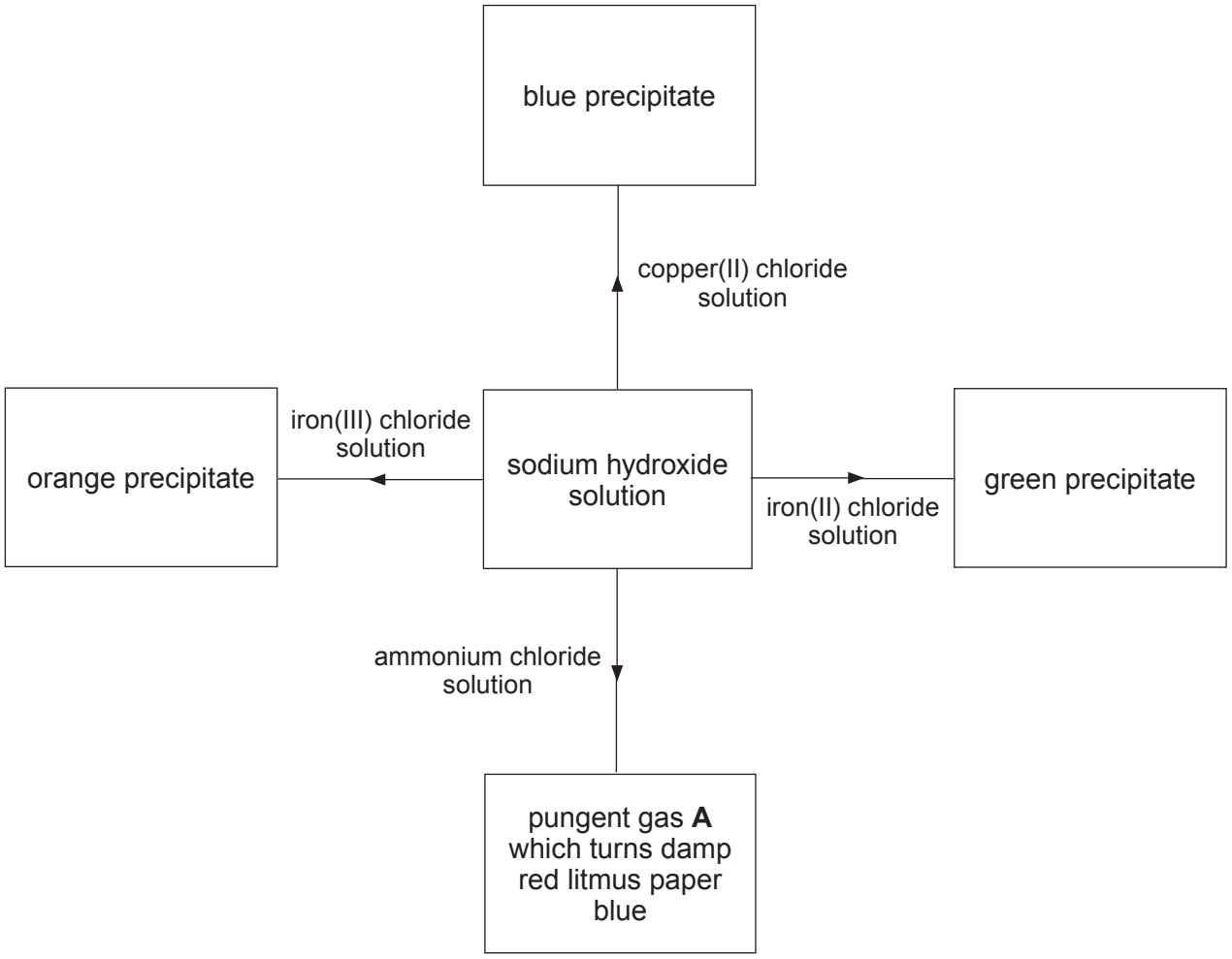
Turn over.

Examiner only

5. *(a)* A Year 11 pupil added sodium hydroxide to solutions of four compounds. The observations made by the pupil are shown below.



(i) Name pungent gas **A**. [1]

.....

(ii) Give the chemical name of the blue precipitate formed. [1]

.....

(iii) The green precipitate formed is iron(II) hydroxide. Give the chemical formula for this compound. [1]

.....

Examiner only

(b) The following table shows the colours of universal indicator at different pH values.

Colour	red	orange	yellow	green	blue	navy blue	purple
pH	0-2	3-4	5-6	7	8-9	10-12	13-14

(i) Universal indicator turns red in sulfuric acid and orange in ethanoic acid. State what these results tell you about the **relative** strength of these acids. [1]

.....

(ii) Both acids react with magnesium ribbon forming hydrogen gas.

I. State how the reactions would differ. [1]

.....

II. Give the test you would carry out to identify hydrogen. Include the result of your test. [1]

.....

.....

6

Turn over.

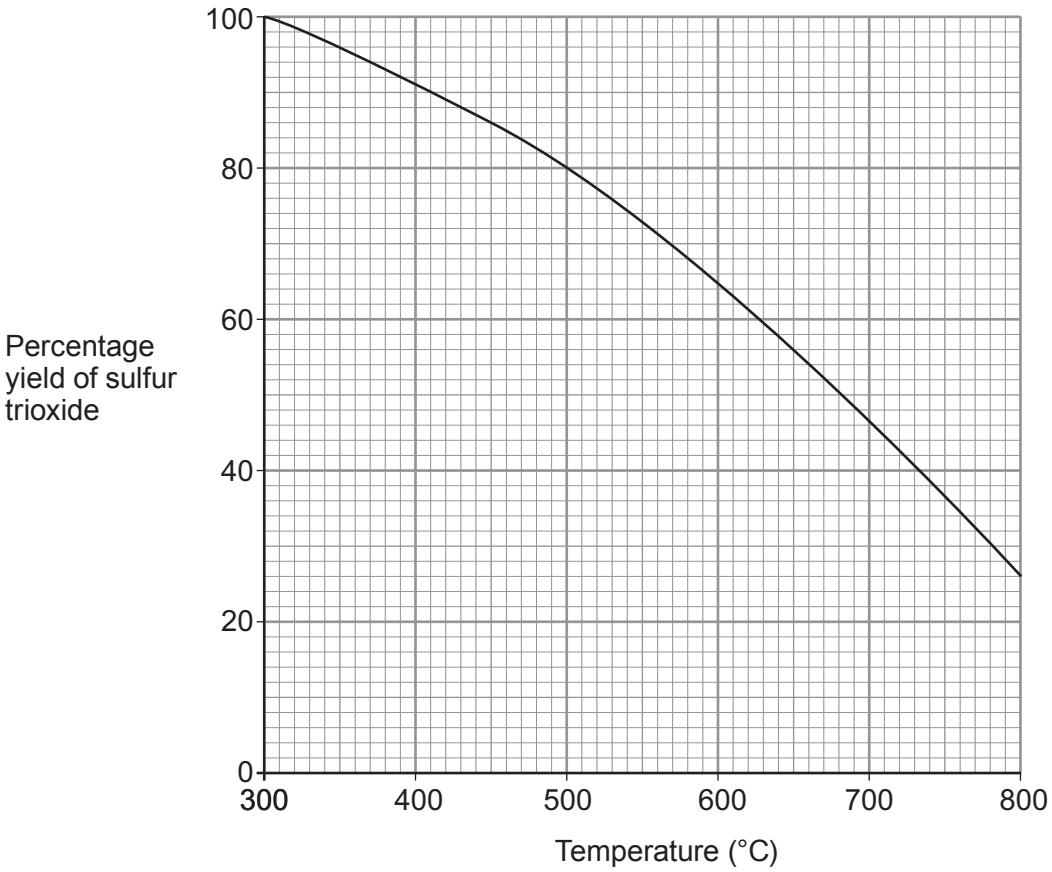
Examiner only

6. *(a)* One of the main stages in the manufacture of sulfuric acid is the reaction between sulfur dioxide and oxygen to form sulfur trioxide.

(i) Write the balanced **symbol** equation which represents this reaction. [3]

..... + ... ⇌ .....

(ii) The graph below shows how the percentage yield of sulfur trioxide changes with temperature between 300 °C and 800 °C.



Use the graph to find the increase in percentage yield if the temperature is reduced from 650 °C to 450 °C. [2]

Increase in percentage yield = ... %

(iii) One molecule of sulfur trioxide reacts with one molecule of sulfuric acid to form one molecule of oleum as the **only** product.

Write a balanced **symbol** equation for this reaction. [2]

..... + ... ⟶ .....

Examiner only

(b) State what you would observe when a few drops of concentrated sulfuric acid are added to a beaker containing a small amount of sugar. Name the product left in the beaker. [3]

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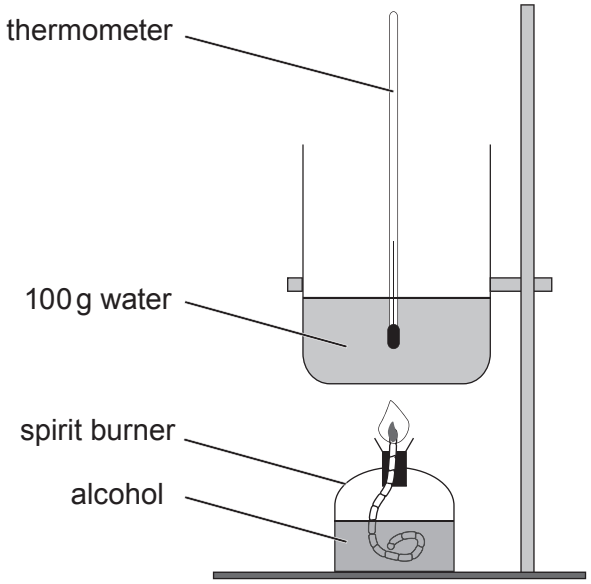
10

Turn over.

Examiner only

7. Methanol, ethanol, propanol and butanol belong to the alcohol family.

An experiment was carried out to discover which alcohol gives out the most energy when burned. The diagram below shows the apparatus used.



1 g of each alcohol was used to heat 100 g of water. The results are shown below.

Alcohol	Initial temperature of water (°C)	Final temperature of water (°C)	Temperature change (°C)	Energy given out (J / g)
methanol	18	31	13	5 460
ethanol	20	45	25	10 500
propanol	19	48	29	12 180
butanol	20	50	30	

Examiner only

(a) The energy given out by each alcohol can be calculated using the formula:

energy given out = mass of water × 4.2 × temperature change

Calculate the energy given out in burning 1 g of butanol. [2]

Energy given out = ... J / g

(b) Apart from using 1 g of each alcohol and 100 g of water, give **one** other step that should be taken to ensure a fair test. [1]

.....

(c) The theoretical values for the energy given out by each alcohol are given in the table below.

Alcohol	Theoretical value for energy given out (J / g)
methanol	22 700
ethanol	29 700
propanol	33 600
butanol	36 100

Compare the experimental and theoretical values and give the **main** reason for the difference between them. [3]

.....

.....

.....

.....

(d) Some people are opposed to the large-scale use of bioethanol as a fuel. Describe briefly why someone could take this view. [2]

.....

.....

.....

Turn over.

Examiner only

8. Describe the benefits of the use of nitrogenous fertilisers and the problems that arise when they are washed into rivers. [6 QWC]

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END OF PAPER

6

FORMULAE FOR SOME COMMON IONS

POSITIVE IONS		NEGATIVE IONS	
Name	**Formula**	**Name**	**Formula**
Aluminium	Al^{3+}	Bromide	Br^{-}
Ammonium	NH_4^{+}	Carbonate	CO_3^{2-}
Barium	Ba^{2+}	Chloride	Cl^{-}
Calcium	Ca^{2+}	Fluoride	F^{-}
Copper(II)	Cu^{2+}	Hydroxide	OH^{-}
Hydrogen	H^{+}	Iodide	I^{-}
Iron(II)	Fe^{2+}	Nitrate	NO_3^{-}
Iron(III)	Fe^{3+}	Oxide	O^{2-}
Lithium	Li^{+}	Sulfate	SO_4^{2-}
Magnesium	Mg^{2+}		
Nickel	Ni^{2+}		
Potassium	K^{+}		
Silver	Ag^{+}		
Sodium	Na^{+}		
Zinc	Zn^{2+}		

Turn over.

PERIODIC TABLE OF ELEMENTS

1	2	Group										3	4	5	6	7	0
								$^{1}_{1}H$ Hydrogen									$^{4}_{2}He$ Helium
$^{7}_{3}Li$ Lithium	$^{9}_{4}Be$ Beryllium											$^{11}_{5}B$ Boron	$^{12}_{6}C$ Carbon	$^{14}_{7}N$ Nitrogen	$^{16}_{8}O$ Oxygen	$^{19}_{9}F$ Fluorine	$^{20}_{10}Ne$ Neon
$^{23}_{11}Na$ Sodium	$^{24}_{12}Mg$ Magnesium											$^{27}_{13}Al$ Aluminium	$^{28}_{14}Si$ Silicon	$^{31}_{15}P$ Phosphorus	$^{32}_{16}S$ Sulfur	$^{35}_{17}Cl$ Chlorine	$^{40}_{18}Ar$ Argon
$^{39}_{19}K$ Potassium	$^{40}_{20}Ca$ Calcium	$^{45}_{21}Sc$ Scandium	$^{48}_{22}Ti$ Titanium	$^{51}_{23}V$ Vanadium	$^{52}_{24}Cr$ Chromium	$^{55}_{25}Mn$ Manganese	$^{56}_{26}Fe$ Iron	$^{59}_{27}Co$ Cobalt	$^{59}_{28}Ni$ Nickel	$^{64}_{29}Cu$ Copper	$^{65}_{30}Zn$ Zinc	$^{70}_{31}Ga$ Gallium	$^{73}_{32}Ge$ Germanium	$^{75}_{33}As$ Arsenic	$^{79}_{34}Se$ Selenium	$^{80}_{35}Br$ Bromine	$^{84}_{36}Kr$ Krypton
$^{86}_{37}Rb$ Rubidium	$^{88}_{38}Sr$ Strontium	$^{89}_{39}Y$ Yttrium	$^{91}_{40}Zr$ Zirconium	$^{93}_{41}Nb$ Niobium	$^{96}_{42}Mo$ Molybdenum	$^{99}_{43}Tc$ Technetium	$^{101}_{44}Ru$ Ruthenium	$^{103}_{45}Rh$ Rhodium	$^{106}_{46}Pd$ Palladium	$^{108}_{47}Ag$ Silver	$^{112}_{48}Cd$ Cadmium	$^{115}_{49}In$ Indium	$^{119}_{50}Sn$ Tin	$^{122}_{51}Sb$ Antimony	$^{128}_{52}Te$ Tellurium	$^{127}_{53}I$ Iodine	$^{131}_{54}Xe$ Xenon
$^{133}_{55}Cs$ Caesium	$^{137}_{56}Ba$ Barium	$^{139}_{57}La$ Lanthanum	$^{179}_{72}Hf$ Hafnium	$^{181}_{73}Ta$ Tantalum	$^{184}_{74}W$ Tungsten	$^{186}_{75}Re$ Rhenium	$^{190}_{76}Os$ Osmium	$^{192}_{77}Ir$ Iridium	$^{195}_{78}Pt$ Platinum	$^{197}_{79}Au$ Gold	$^{201}_{80}Hg$ Mercury	$^{204}_{81}Tl$ Thallium	$^{207}_{82}Pb$ Lead	$^{209}_{83}Bi$ Bismuth	$^{210}_{84}Po$ Polonium	$^{210}_{85}At$ Astatine	$^{222}_{86}Rn$ Radon
$^{223}_{87}Fr$ Francium	$^{226}_{88}Ra$ Radium	$^{227}_{89}Ac$ Actinium															

Key: