Surname	Centre Number	Candidate Number
Other Names		0

GCSE

0240/02

ADDITIONAL SCIENCE
HIGHER TIER
CHEMISTRY 2

A.M. THURSDAY, 26 January 2012

45 minutes

For Examiner's use only		
Question	**Maximum Mark**	**Mark Awarded**
1.	**6**	
2.	**3**	
3.	**6**	
4.	**4**	
5.	**6**	
6.	**4**	
7.	**6**	
8.	**7**	
9.	**5**	
10.	**3**	
Total	**50**	

0240
020001

ADDITIONAL MATERIALS

In addition to this paper you may require 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.

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.

1. *(a)* Complete the following table of information about some elements.

The Periodic Table of Elements shown on the **back cover of this examination paper** may help in answering this question. [4]

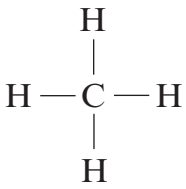
Element	Symbol	Number of protons	Number of neutrons	Number of electrons
carbon	$^{12}_{6}C$		6	6
magnesium	$^{24}_{12}Mg$	12	12	
phosphorus	$^{31}_{15}P$	15		15
argon		18	22	18

(b) Calculate the relative molecular mass (M_r) of sulphuric acid, H_2SO_4. [2]

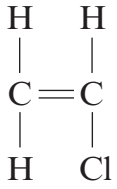
$A_r(H) = 1$ $A_r(O) = 16$ $A_r(S) = 32$

$M_r(H_2SO_4)$ = ...

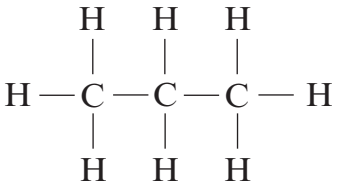
2. The following diagrams show the structural formulae of four substances, **A**, **B**, **C** and **D**.



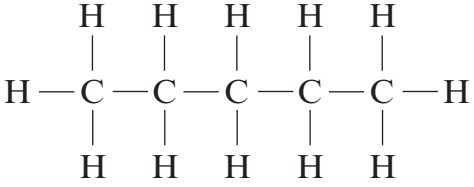
A



B



C



D

(a) The molecular formula of **A** is CH_4.

Give the molecular formula of **D**. ..... [1]

(b) Give the letter for the substance that is **not** a hydrocarbon. ..... [1]

(c) Butane contains four carbon atoms.

Draw the **structural** formula of butane. [1]

Examiner only

3. *(a)* The following table contains the chemical names and formulae of some common fertilisers.

Name	Formula
sodium nitrate	$NaNO_3$
ammonium phosphate	$(NH_4)_3PO_4$
ammonium sulphate	$(NH_4)_2SO_4$
calcium nitrate	$Ca(NO_3)_2$

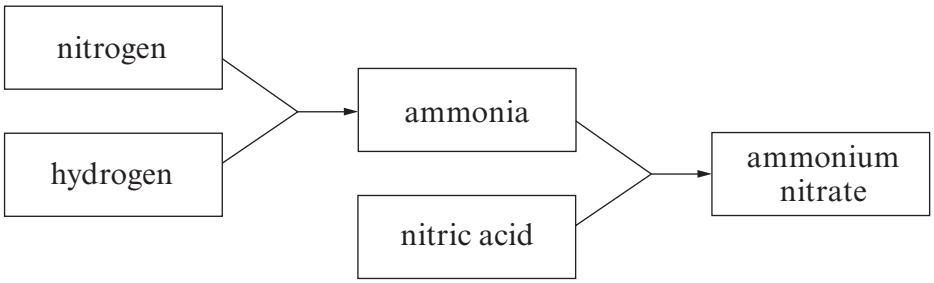
(i) **Name** the **two** elements that are found in all the above fertilisers. [1]

..... and .....

(ii) Name the acid used to neutralise ammonia in the production of ammonium sulphate. [1]

.....

(b) The following flow diagram shows how ammonium nitrate is manufactured from nitrogen, hydrogen and nitric acid.



(i) Which substance appearing in the flow diagram comes from the atmosphere? [1]

.....

(ii) Complete the **word equation** for the formation of ammonium nitrate. [1]

..... + ... ⟶ ammonium nitrate

Examiner only

(c) When farmers use fertilisers, some fertiliser can be washed out of the soil into lakes. This can result in the overgrowth of algae. When algae die and decay, oxygen is removed from the lakes.

(i) State why farmers use fertilisers. [1]

.....

.....

(ii) Give **one** consequence of the removal of oxygen from lakes. [1]

.....

.....

4. The following table shows five substances and examples of their uses.

Substance	Use
nitinol	spectacle frames
aluminium	greenhouse frames
photochromic pigment	lenses for glasses
polymer gel	nappies
shape memory polymer	car bodies

The main reason for using nitinol in spectacle frames is that the frame, if bent, can return to its original shape.

Give the **main reason** for the given use of each of the remaining four substances.

(a) Aluminium in greenhouse frames. [1]

.....

.....

(b) Photochromic pigment in lenses for glasses. [1]

.....

.....

(c) Polymer gel in nappies. [1]

.....

.....

(d) Shape memory polymer in car bodies. [1]

.....

.....

4

Examiner only

5. *(a)* Iron can be extracted from iron oxide by heating with carbon.

The word equation for the reaction is

iron oxide + carbon ⟶ iron + carbon monoxide

(i) State which substance is oxidised during the reaction. [1]

.....

(ii) Balance the chemical equation for this reaction by giving the appropriate numbers in the boxes. [1]

Fe_2O_3 + ☐ C ⟶ ☐ Fe + ☐ CO

(b) Iron can also be extracted from iron oxide using aluminium powder.

Complete the **word equation** for this reaction. [1]

iron oxide + aluminium ⟶ ..... + ...

(c) You are given some iron filings, copper foil, copper sulphate solution, iron sulphate solution and a few test tubes.

Describe an experiment that you could carry out to determine which of the two metals is the more reactive. Give the expected observation(s) and the conclusion you would reach. [3]

.....

.....

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.....

Examiner only

6. *(a)* Water is often described as being soft or hard.

State what is meant by *hard water*. [1]

.....

.....

(b) Pupils in a year 11 class were asked to determine the relative hardness of water samples **A** and **B**. Details of the experiments carried out by two different groups are given below.

Experiment 1

In this experiment, water and soap solution were mixed and shaken and the height of the lather measured.

The results for experiment 1 are given in the following table.

Water sample	Volume of water used / cm^3	Volume of soap solution used / cm^3	Time of shaking / s	Height of lather produced / cm
A	100	24	20	4
B	100	12	20	3

Experiment 2

In this experiment 1 cm^3 soap solution was added to the water samples and shaken. This procedure was then repeated until the height of the lather was 4 cm in both samples. The volume of soap solution required to obtain a lather height of 4 cm was then recorded.

The results for experiment 2 are given below.

Water sample	Volume of water used / cm^3	Time of shaking / s	Height of lather / cm	Volume of soap solution required / cm^3
A	50	20	4	12
B	50	20	4	6

Examiner only

(i) State how experiment 1 could be changed to make it a **fair test**. [1]

.....

.....

(ii) State which water sample is the harder, giving a reason for your answer. [1]

Harder water .....

Reason .....

.....

(iii) Both water samples were passed through an ion exchange resin and experiment 2 was repeated. State what you would expect to happen, giving a reason for your answer. [1]

.....

.....

.....

Examiner only

7. *(a)* Calcium reacts with chlorine to form calcium chloride.

Using the electronic structures below, show by means of a **diagram** the electronic changes that take place during the formation of calcium chloride. **Show the charges on the ions formed**. [3]

calcium = 2,8,8,2 chlorine = 2,8,7

(b) (i) Using the electronic structures below, show by means of a **diagram** the bonding in an ammonia molecule, NH_3. [2]

nitrogen = 2,5 hydrogen = 1

(ii) State the type of **bonding** that is present in ammonia. [1]

.....

6

Examiner only

8. *(a)* Ethane, C_2H_6, and ethene, C_2H_4, are hydrocarbons.

Draw the **structural** formulae for **both** of these hydrocarbons. [2]

Ethane Ethene

(b) The polymer polythene is obtained from ethene.

(i) Name the process used to obtain ethene from large hydrocarbons. [1]

.....

(ii) State whether polythene is an example of a saturated or an unsaturated hydrocarbon, giving a reason for your answer. [1]

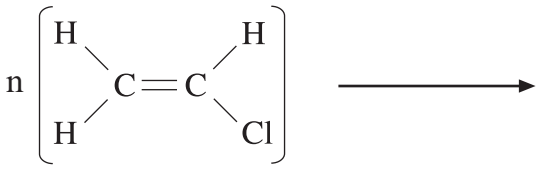
Polythene is .....

Reason .....

.....

(c) (i) Polyvinyl chloride, PVC, is formed by addition polymerisation of vinyl chloride.

Complete the **symbol** equation for making PVC. [2]



.....

(ii) When PVC is warmed it softens.

State the name given to this **type** of plastic. [1]

.....

Examiner only

9. Copper can be extracted from copper oxide using hydrogen. The equation for the reaction is shown below.

$$CuO + H_2 \longrightarrow Cu + H_2O$$

(a) Calculate the mass of copper oxide that is required to extract 127 tonnes of copper. [3]

$M_r(CuO) = 79.5$ $A_r(Cu) = 63.5$

.....

.....

.....

.....

.....

Mass of copper oxide = ... tonnes

(b) If only 101.6 tonnes of copper was obtained during the extraction, calculate the percentage yield for the reaction. [2]

.....

.....

.....

.....

Percentage yield of copper = ... %

5

Examiner only

10. Describe how the gas ammonia can be produced from ammonium chloride and how this gas can be identified. [3]

.....

.....

.....

.....

.....

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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^{+}	Sulphate	SO_4^{2-}
Magnesium	Mg^{2+}		
Nickel	Ni^{2+}		
Potassium	K^{+}		
Silver	Ag^{+}		
Sodium	Na^{+}		

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: