OCR
RECOGNISING ACHIEVEMENT

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A322/02

GENERAL CERTIFICATE OF SECONDARY EDUCATION

TWENTY FIRST CENTURY SCIENCE

CHEMISTRY A

Unit 2 Modules C4 C5 C6 (Higher Tier)

WEDNESDAY 18 JUNE 2008

Afternoon

Time: 40 minutes

Candidates answer on the question paper.
Additional materials (enclosed):
None

Calculators may be used.
Additional materials: Pencil
Ruler (cm/mm)

CUP/T44837

Candidate Forename		Candidate Surname	
Centre Number		Candidate Number	

INSTRUCTIONS TO CANDIDATES

- Write your name in capital letters, your Centre Number and Candidate Number in the boxes above.
- Use blue or black ink. Pencil may be used for graphs and diagrams only.
- Read each question carefully and make sure that you know what you have to do before starting your answer.
- Answer **all** the questions.
- Do **not** write in the bar codes.
- Write your answer to each question in the space provided.

INFORMATION FOR CANDIDATES

- The number of marks for each question is given in brackets [ ] at the end of each question or part question.
- The total number of marks for this paper is 42.
- The Periodic Table is printed on the back page.

FOR EXAMINER'S USE		
Qu.	**Max.**	**Mark**
1	**2**	
2	**9**	
3	**9**	
4	**2**	
5	**3**	
6	**3**	
7	**5**	
8	**3**	
9	**6**	
TOTAL	**42**	

This document consists of **17** printed pages and **3** blank pages.

[Turn over

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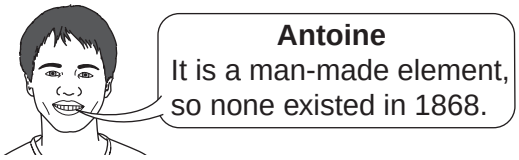
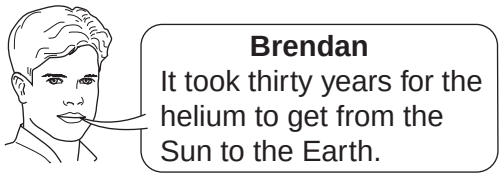
Answer **all** the questions.

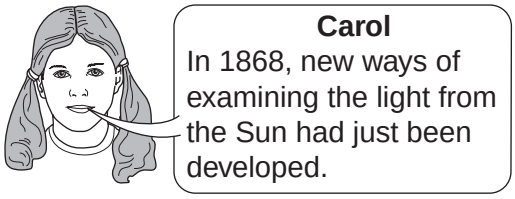
1 Bobby reads that helium was discovered on the Sun in 1868. Thirty years later it was found on Earth. He asks his friends why helium was discovered on the Sun first.



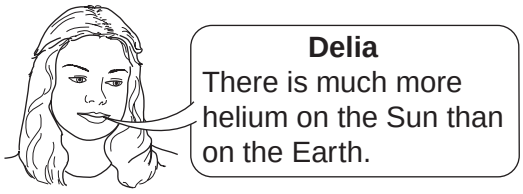
Antoine
It is a man-made element, so none existed in 1868.



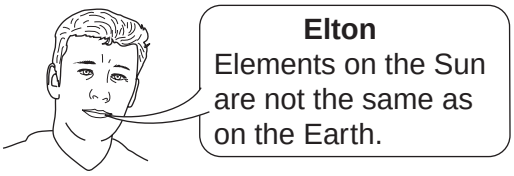
Brendan
It took thirty years for the helium to get from the Sun to the Earth.



Carol
In 1868, new ways of examining the light from the Sun had just been developed.



Delia
There is much more helium on the Sun than on the Earth.



Elton
Elements on the Sun are not the same as on the Earth.

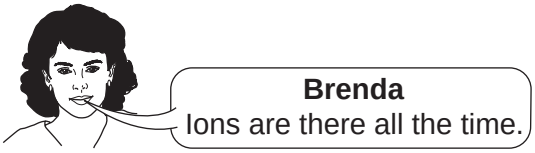
Which **two** people give the best answers?

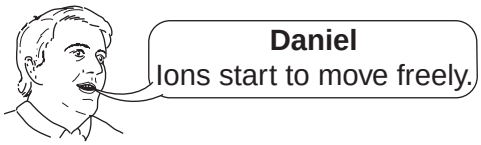
..... and .....[2]

[Total: 2]

2 Many chemicals form ionic crystals.

(a) Mary asks her friends to describe what happens when ionic crystals melt.





Which **two** people are correct?

..... and .....[2]

(b) Magnesium chloride is made of Mg^{2+} ions and Cl^{-} ions.

Put a (ring) around the formula of magnesium chloride.

$MgCl$ **Mg_2Cl** **$MgCl_2$** **Mg_2Cl_2**

[1]

(c) Lithium nitride is made of Li^{+} ions and N^{3-} ions.

Put a (ring) around the formula of lithium nitride.

LiN_3 **Li_3N_3** **Li_3N** **$LiNO_3$**

[1]

(d) Sodium chloride forms ionic crystals.

(i) Here are some statements about crystals of sodium chloride.

Write **T** in the box next to each **true** statement and **F** in the box next to each **false** one.

	T (true) or **F** (false)
Each crystal contains many molecules of NaC*l*.	
The bonds between the particles are strong.	
The bonds are all on the outside of the crystal.	
There is a very large number of bonds.	
The particles in the crystal are held together by attraction between opposite charges.	
The particles are arranged in a regular way.	

[3]

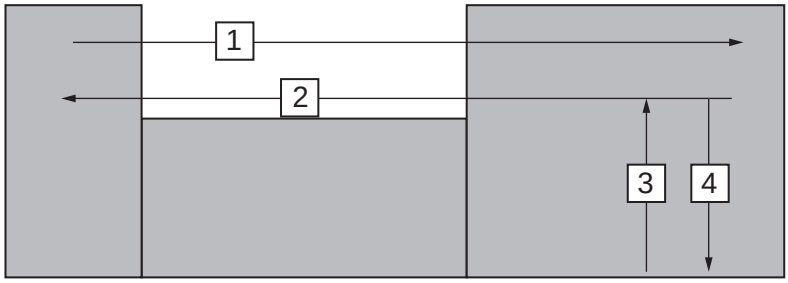
(ii) Put ticks (✓) in the boxes next to the **two** statements which explain why sodium chloride has a high melting point.

Each crystal contains many molecules of NaC*l*.	
The bonds between the particles are strong.	
The bonds are all on the outside of the crystal.	
There is a very large number of bonds.	
The particles are arranged in a regular way.	

[2]

[Total: 9]

3 Here is an outline of the Periodic Table.



(a) Which arrow or arrows show increasing numbers of electrons?

Put a tick (✓) in the box next to the correct answer.

arrow 1 only	☐
arrow 2 only	☐
arrow 3 only	☐
arrow 4 only	☐
arrows 1 & 4 only	☐
arrows 2 & 3 only	☐
arrows 1 & 3 only	☐
arrows 2 & 4 only	☐

[1]

(b) Which arrow or arrows show electrons filling within a shell?

Put a tick (✓) in the box next to the correct answer.

arrow 1 only	☐
arrow 2 only	☐
arrow 3 only	☐
arrow 4 only	☐
arrows 1 & 4 only	☐
arrows 2 & 3 only	☐
arrows 1 & 3 only	☐
arrows 2 & 4 only	☐

[1]

(c) Here are the names of four elements in the Periodic Table.

bromine iodine potassium lithium

Choose from these names to answer the following questions.

(i) Which of these elements …

… exist as diatomic molecules?

answer ..... and.....

… react with water to make hydrogen gas?

answer ..... and.....

… has a melting point below room temperature?

answer .....[3]

(ii) Which two of these elements will react together most violently?

.....and .....[1]

(d) The table shows information about some different pure chemicals.

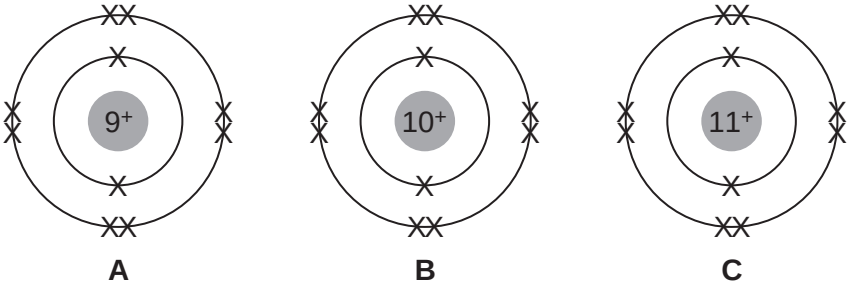
Put ticks (✓) in the correct boxes to show the type of bonding in each chemical.

chemical	melting point in °C	conducts electricity when solid	conducts electricity when melted	covalent	ionic	metallic
A	–219	no	no			
B	–39	yes	yes			
C	37	no	no			
D	119	no	no			
E	804	no	yes			
F	1539	yes	yes			

[3]

[Total: 9]

4 The diagrams show the electronic structure and the number of protons in the nucleus for each of three types of particle.



Which letter, **A**, **B** or **C**, shows the structure of …

… an **atom**?

answer .....

… the **ion** of a Group 7 element?

answer .....

… the **ion** of a Group 1 element?

answer .....[2]

[Total: 2]

5 Chemicals used in medicines are produced to high levels of purity.

Put ticks (✓) in the **three** boxes which show why.

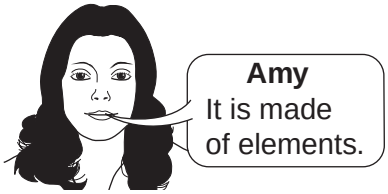
Impurities might have side effects.	☐
Manufacturers can charge more for pure chemicals.	☐
That way the dose is the same every time.	☐
Each medicine is designed to do one job only.	☐
Otherwise it would be impossible to test new medicines properly.	☐
All substances work better if they are as pure as possible.	☐
Tablets can be made smaller if the chemicals are purer.	☐

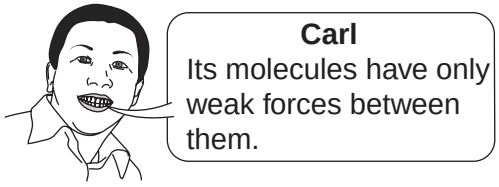
[3]

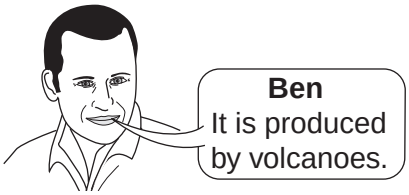
[Total: 3]

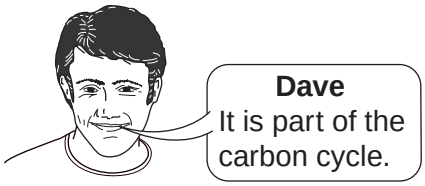
6 Jenny is learning about gases.

(a) She asks her friends why air is a gas.









Who has suggested the best reason?

answer.....[1]

(b) The equation for the reaction between hydrogen gas and oxygen gas is:

$$2H_2\,(g) + O_2\,(g) \longrightarrow 2H_2O(l)$$

(i) How much hydrogen will react with 8 g of oxygen gas?

Put a (ring) around the correct answer.

(relative atomic mass: H = 1, O = 16)

1 g **4 g** **18 g** **36 g**

[1]

(ii) How much water will be formed when 6 g of hydrogen react?

Put a (ring) around the correct answer.

18 g **36 g** **48 g** **54 g**

[1]

[Total: 3]

7 Metals can be extracted from their ores in different ways.

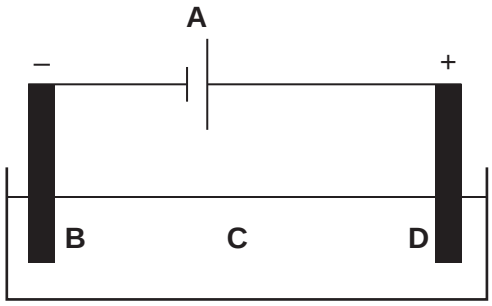
(a) When iron is extracted from iron ore, only **five** of these stages are used.
They are in the wrong order.

A Crush the ore.
B Dig the ore out of the ground.
C Electrolyse melted iron oxide.
D Heat iron oxide with carbon.
E Pour the molten iron into moulds to harden.
F Separate the mineral from the rest of the rock.

Put the **five** stages used for the extraction of iron into the correct order.

[2]

(b) Aluminium is produced by the electrolysis of aluminium oxide.



(i) Put a ring around the letter, **A**, **B**, **C** or **D**, which shows the electrode where the aluminium metal is formed.

A **B** **C** **D**

[1]

(ii) Put a ring around the equation which shows how aluminium ions are turned into aluminium atoms.

$$Al^{+} + e^{-} \longrightarrow Al$$

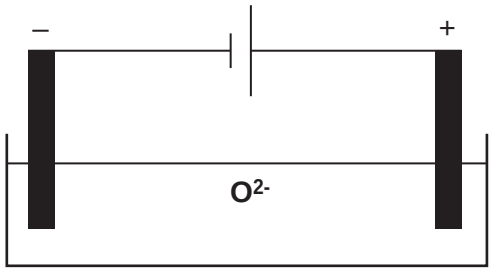
$$Al^{3+} + 3e^{-} \longrightarrow Al$$

$$Al^{+} - e^{-} \longrightarrow Al$$

$$Al^{3+} - 3e^{-} \longrightarrow Al$$

[1]

(iii) Draw an arrow on the diagram below to show the direction of movement of the oxide ion.



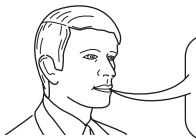
[1]

[Total: 5]

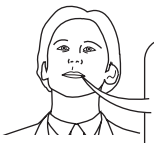
8 Bobby reacts solutions of two chemicals.

He measures the rate of the reaction and how much product is made.

(a) Bobby asks his friends what **rate of reaction** means.



Adrian
It is the total amount of chemical that reacts.



Bertram
It is how far down an element is in the Periodic Table.

Caroline
It is the amount of energy given out during the reaction.

Denise
It is the amount of chemical that reacts each second.

Who is correct?

answer .....[1]

(b) Bobby repeats the experiment.

He uses the same volumes of solution but doubles the concentration of each chemical.

Here are some statements about the particle collisions in the new reaction and about the change that Bobby observes.

Draw **one** straight line from the correct **collision statement** about the new reaction to the **change** that Bobby observes.

collision statement (choose one only)	**change** (choose one only)
There are more particle collisions every second. The number of reacting collisions during the whole reaction stays the same.	The rate increases. The amount of product increases.
There are more particle collisions every second. The number of reacting collisions during the whole reaction increases.	The rate increases. The amount of product stays the same.
Particles move faster and collide harder. The number of reacting collisions during the whole reaction increases.	The rate does not increase. The amount of product increases.
Particles move faster and collide harder. The number of reacting collisions during the whole reaction stays the same.	The rate does not increase. The amount of product stays the same.

[2]

[Total: 3]

9 **(a)** Naomi reacts sulfuric acid with sodium hydroxide.

Complete the equation for this reaction.

H_2SO_4 + ☐ NaOH $\longrightarrow$ Na_2SO_4 + ☐ H_2O [2]

(b) When hydrochloric acid reacts with sodium hydroxide, which pair of ions react?

A H^+ and Cl^-

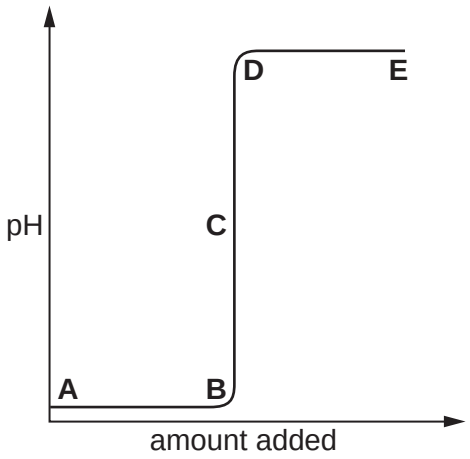
B H^+ and OH^-

C H^+ and H^+

D Na^+ and OH^-

answer.....[1]

(c) Naomi measures the pH as she adds one reactant to the other.



The chemicals in the flask change as they react.

What can you say about the amount of acid and alkali at stages **A**, **C** and **E**?

Draw a straight line from each **letter** to the correct **statement**.

letter	statement
	There is lots of acid and lots of alkali.
A	There is lots of acid and no alkali.
C	There is no acid and lots of alkali.
E	There is no acid and no alkali.
	There is some acid and some alkali.

[3]

[Total: 6]

END OF QUESTION PAPER

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The Periodic Table of the Elements

1	2											3	4	5	6	7	0
							1 **H** hydrogen 1										4 **He** helium 2
7 **Li** lithium 3	9 **Be** beryllium 4											11 **B** boron 5	12 **C** carbon 6	14 **N** nitrogen 7	16 **O** oxygen 8	19 **F** fluorine 9	20 **Ne** neon 10
23 **Na** sodium 11	24 **Mg** magnesium 12											27 **Al** aluminium 13	28 **Si** silicon 14	31 **P** phosphorus 15	32 **S** sulfur 16	35.5 **Cl** chlorine 17	40 **Ar** argon 18
39 **K** potassium 19	40 **Ca** calcium 20	45 **Sc** scandium 21	48 **Ti** titanium 22	51 **V** vanadium 23	52 **Cr** chromium 24	55 **Mn** manganese 25	56 **Fe** iron 26	59 **Co** cobalt 27	59 **Ni** nickel 28	63.5 **Cu** copper 29	65 **Zn** zinc 30	70 **Ga** gallium 31	73 **Ge** germanium 32	75 **As** arsenic 33	79 **Se** selenium 34	80 **Br** bromine 35	84 **Kr** krypton 36
85 **Rb** rubidium 37	88 **Sr** strontium 38	89 **Y** yttrium 39	91 **Zr** zirconium 40	93 **Nb** niobium 41	96 **Mo** molybdenum 42	[98] **Tc** technetium 43	101 **Ru** ruthenium 44	103 **Rh** rhodium 45	106 **Pd** palladium 46	108 **Ag** silver 47	112 **Cd** cadmium 48	115 **In** indium 49	119 **Sn** tin 50	122 **Sb** antimony 51	128 **Te** tellurium 52	127 **I** iodine 53	131 **Xe** xenon 54
133 **Cs** caesium 55	137 **Ba** barium 56	139 **La*** lanthanum 57	178 **Hf** hafnium 72	181 **Ta** tantalum 73	184 **W** tungsten 74	186 **Re** rhenium 75	190 **Os** osmium 76	192 **Ir** iridium 77	195 **Pt** platinum 78	197 **Au** gold 79	201 **Hg** mercury 80	204 **Tl** thallium 81	207 **Pb** lead 82	209 **Bi** bismuth 83	[209] **Po** polonium 84	[210] **At** astatine 85	[222] **Rn** radon 86
[223] **Fr** francium 87	[226] **Ra** radium 88	[227] **Ac*** actinium 89	[261] **Rf** rutherfordium 104	[262] **Db** dubnium 105	[266] **Sg** seaborgium 106	[264] **Bh** bohrium 107	[277] **Hs** hassium 108	[268] **Mt** meitnerium 109	[271] **Ds** darmstadtium 110	[272] **Rg** roentgenium 111	Elements with atomic numbers 112-116 have been reported but not fully authenticated						

Key

relative atomic mass
atomic symbol
name
atomic (proton) number

** The lanthanoids (atomic numbers 58-71) and the actinoids (atomic numbers 90-103) have been omitted.*

The relative atomic masses of copper and chlorine have not been rounded to the nearest whole number.