DULWICH COLLEGE | SINGAPORE |

Year 9 Examination
Chemistry
May 2017

Name:.....

Time allowed: 75 minutes
Total marks available: 75 marks

- The marks for each question are show in brackets.
- Use black or blue ink.
- Answer all questions in the spaces provided.
- Read each question carefully.
- Check your answers at the end if you have time.

Total Marks available	/ 75	Teacher comment:
	%	
Level/Grade		

Student reflection

THE PERIODIC TABLE

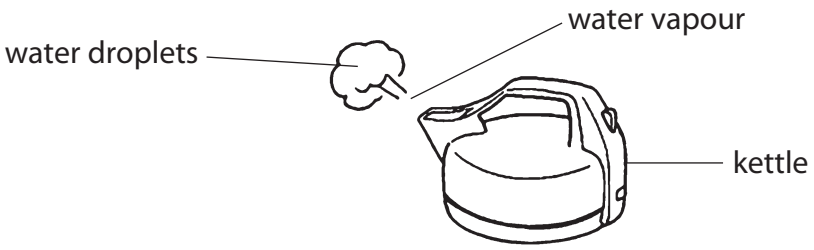
Period	1	2											3	4	5	6	7	0
	Group																	
1	1 H Hydrogen 1																	4 He Helium 2
2	7 Li Lithium 3	9 Be Beryllium 4											11 B Boron 5	12 C Carbon 6	14 N Nitrogen 7	16 O Oxygen 8	19 F Fluorine 9	20 Ne Neon 10
3	23 Na Sodium 11	24 Mg Magnesium 12											27 Al Aluminium 13	28 Si Silicon 14	31 P Phosphorus 15	32 S Sulfur 16	35.5 Cl Chlorine 17	40 Ar Argon 18
4	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
5	86 Rb Rubidium 37	88 Sr Strontium 38	89 Y Yttrium 39	91 Zr Zirconium 40	93 Nb Niobium 41	96 Mo Molybdenum 42	99 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
6	133 Cs Caesium 55	137 Ba Barium 56	139 La Lanthanum 57	179 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	210 Po Polonium 84	210 At Astatine 85	222 Rn Radon 86
7	223 Fr Francium 87	226 Ra Radium 88	227 Ac Actinium 89															

Key

Relative atomic mass
Symbol
Name
Atomic number

Answer ALL questions.

1 The diagram shows a kettle of boiling water.



As the water vapour cools it turns into droplets of liquid water.

(a) The change of state when water vapour changes into liquid water is described as

(1)

☒ **A** boiling

☒ **B** condensation

☒ **C** evaporation

☒ **D** sublimation

(b) Describe what happens when water vapour cools to form liquid water.

Your answer should include the change in the energy, arrangement and movement of the particles.

(3)

change in energy .....

.....

.....

change in arrangement .....

.....

.....

change in movement .....

.....

.....

(Total for Question 1 = 4 marks)

2. The Periodic Table is shown on page 2.

(a) In the Periodic Table, which number increases from 3 to 10 in Period 2?

(1)

.....

(b) In the Periodic Table, which number increases from 9 to 226 in Group 2?

(1)

.....

(c) An atom of boron contains protons, neutrons and electrons.

Use words from the box to complete the sentences.

Your may use each word once, more than once or not at all.

protons	neutrons	electrons

(i) The particles with the smallest mass are ..... .

(1)

(ii) The particles with a negative charge are ..... .

(1)

(iii) The two types of particle in the nucleus of a boron atom

(1)

are ..... and ..... .

(iv) In a boron atom there are equal numbers of

(1)

..... and ..... .

(v) The element boron has isotopes.

(1)

These isotopes have different numbers of ..... .

(Total for Question 2 = 7 marks)

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3 A student wants to find out if the green colouring in grass is a mixture of dyes.

He uses a solvent to dissolve the green colouring from some grass.

He then separates the solution of the green colouring from the remaining grass.

(a) Which of these methods is used to separate the solution of the green colouring from the remaining grass?

(1)

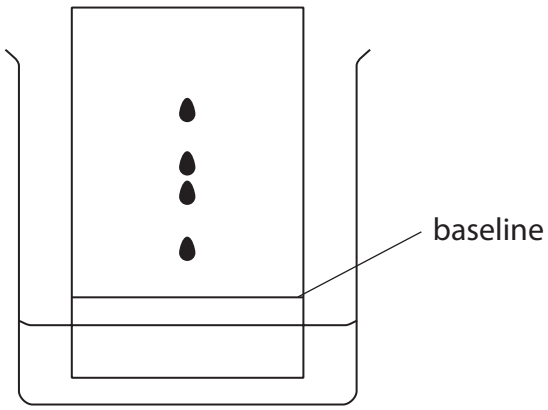
☒ **A** boiling

☒ **B** condensation

☒ **C** evaporation

☒ **D** filtration

(b) The student uses a dropping pipette to place a drop of the green solution onto a piece of chromatography paper and produces a chromatogram.
The diagram shows his results.



(i) Add three more labels to the diagram to show

- the solvent
- the chromatography paper
- the original position of the spot of the green solution

(3)

(ii) Explain how many different dyes are present in the green colouring.

(2)

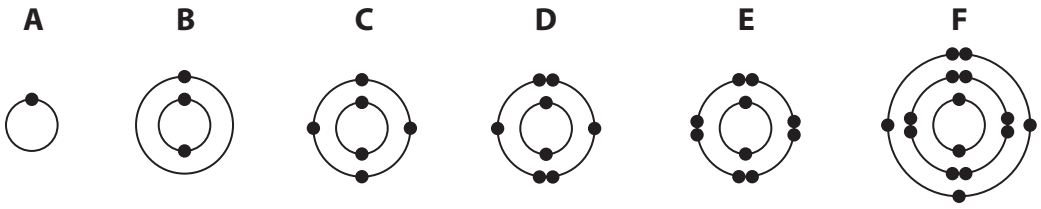
.....

.....

.....

(Total for Question 3 = 6 marks)

4 The diagram shows the electronic configurations of six different atoms.



(a) You may use the Periodic Table on page 2 to help you answer this question.
Answer each part by writing one of the letters A, B, C, D, E or F in the box provided.
You may use each letter once, more than once or not at all.

Give the letter that represents an atom

(6)

(i) of a noble gas ☐

(ii) that contains three protons ☐

(iii) of phosphorus ☐

(iv) of an element in Group 4 of the Periodic Table ☐

(v) of an element in Period 3 of the Periodic Table ☐

(vi) with a full outer shell of electrons ☐

(b) Atoms of A and D combine to form a compound containing covalent bonds.

(i) Complete the sentence to describe a covalent bond.

(2)

A covalent bond is the electrostatic attraction between a pair of .....

and the ..... of two atoms.

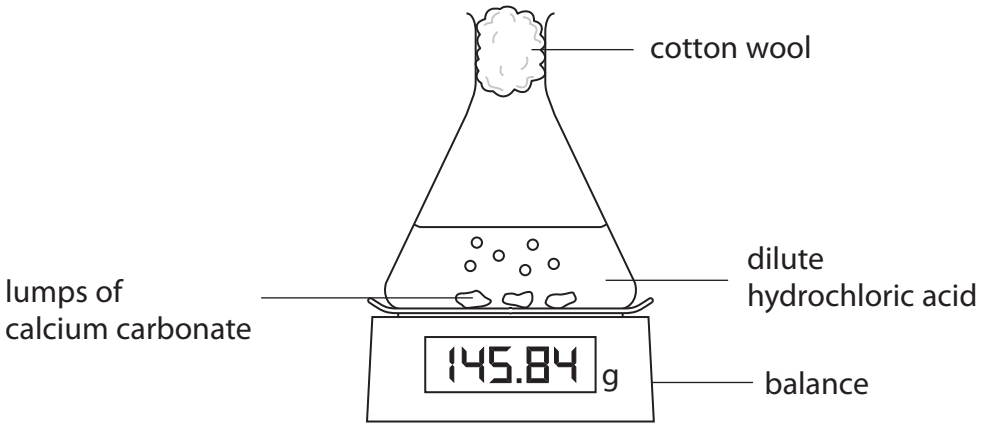
(ii) Suggest, with reference to electronic configurations, the most likely formula of the compound formed between atoms of A and D.

(1)

.....

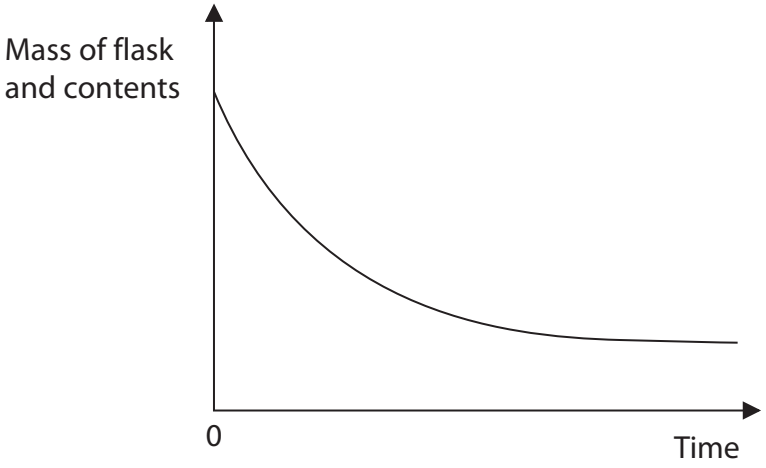
(Total for Question 4 = 9 marks)

5 The diagram shows the apparatus used to investigate the rate of reaction between calcium carbonate and an excess of dilute hydrochloric acid.



The mass of the flask and contents is measured at regular time intervals.

The graph shows the results obtained.



(a) What is the purpose of the cotton wool in the neck of the flask?

(1)

.....

.....

(b) Explain why the mass of the flask and contents decreases with time.

(1)

.....

.....

(c) (i) The experiment is repeated using

- the same mass of identical calcium carbonate lumps
- the same volume of hydrochloric acid but of a higher concentration

Sketch on the graph the curve that would be produced.

(2)

(ii) Explain, using the particle collision theory, how the rate of reaction changes with an increase in concentration of hydrochloric acid.

(3)

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(Total for Question 5 = 7 marks)

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6 The table gives information about some of the elements in Group 7 of the Periodic Table.

Element	Colour	Melting point in °C	Boiling point in °C
fluorine	yellow	–220	–188
chlorine		–101	–35
bromine	red-brown	–7	59
iodine	grey	114	

(a) What is the colour of chlorine at room temperature?

(1)

☒ **A** black

☒ **B** blue

☒ **C** green

☒ **D** orange

(b) The trend in the boiling points for these elements is similar to the trend in their melting points.

Predict a value for the boiling point of iodine.

(1)

..... °C

(c) Astatine is another element in Group 7.

Predict its colour and physical state at room temperature.

(2)

colour .....

physical state .....

(d) The elements in Group 7 have similar chemical reactions because they have the same number of

(1)

☒ **A** electrons

☒ **B** electron shells

☒ **C** outer electrons

☒ **D** protons

e A student wrote these statements about the reactions of the Group 7 elements.

- The reactivity of the elements decreases down the group.
- The elements form ions with a single positive charge.
- The formula of an astatine molecule is At_2
- The equation for the reaction between chlorine and potassium bromide solution is $Cl_2 + 2NaBr \rightarrow 2NaCl + Br_2$

Two of the statements contain **one** incorrect word.

Complete the table to show each incorrect word and the correct word that should be used to replace it. You only need to use TWO rows in the table below. Leave one row blank.

(2)

Incorrect word	Correct word

(Total for Question 6 = 7 marks)

7 The diagram shows the elements in Period 3 of the Periodic Table.

Na	Mg	Al	Si	P	S	Cl	Ar

(a) (i) Identify an element in Period 3 that forms a basic oxide.

(1)

.....

(ii) Identify an element in Period 3 that forms an acidic oxide.

(1)

.....

(b) Magnesium and chlorine react together to form magnesium chloride, a compound with ionic bonding.

The equation for the reaction is

$$Mg + Cl_2 \rightarrow MgCl_2$$

(i) Complete the dot and cross diagram to show the arrangement of the outer electrons in the magnesium and chloride ions formed.

Show the charge on each ion.

(3)

(ii) State what is meant by the term **ionic bonding**.

(2)

.....

.....

.....

.....

Total for Q7 = 7 marks

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8 Hydrated copper(II) sulfate is a soluble blue solid. A large crystal of this solid is placed at the bottom of a beaker of water.

The diagram shows the beaker immediately after placing the crystal in it, and after two days.

after placing the crystal

after two days

(a) After two days, the crystal becomes smaller and the liquid near the bottom of the beaker becomes blue.

Which statement explains these observations?

(1)

☒ **A** the crystal dissolves

☒ **B** the crystal freezes

☒ **C** the crystal melts

☒ **D** the crystal sublimes

(b) After two weeks, the crystal has disappeared.

Which statement best describes the appearance of the liquid in the beaker after two weeks?

(1)

☒ **A** it is all blue

☒ **B** it is all brown

☒ **C** only the lower part is blue

☒ **D** only the upper part is blue

(c) The formula of the compound in the crystal is $CuSO_4.5H_2O$

(i) How many different elements are shown in the formula?

(1)

.....

(ii) How many atoms are shown in the formula?

(1)

.....

(Total for Question 8 = 4 marks)

9 (a) The term species is sometimes used to refer to neutral atoms and to positive and negative ions.

The table shows the numbers of subatomic particles in eight different species.

Species	Number of protons	Number of neutrons	Number of electrons
A	5	5	5
B	5	6	5
C	6	7	5
D	6	7	7
E	7	7	7
F	7	7	10
G	8	8	10
H	8	10	10

(i) Explain which two letters represent neutral atoms of the same element.

(3)

(ii) Explain which two letters represent negative ions formed from the same element.

(3)

(iii) Explain which letter represents the atom with the lowest mass number.

(2)

.....

.....

.....

(iv) What is the electronic configuration of species E?

(1)

.....

(b) The table shows the percentage composition of a sample of magnesium.

Isotope	^{24}Mg	^{25}Mg	^{26}Mg
Percentage (%)	78.6	10.1	11.3

Calculate the relative atomic mass of magnesium.

Give your answer to one decimal place.

(3)

relative atomic mass = ...

(Total for Question 9 = 12 marks)

10 The diagram shows the positions of some elements in four periods of the Periodic Table.

Li																	
Na																	Ar
K																	
Rb										Ag							

(a) (i) What numbers are used to identify the periods shown in this diagram?

(1)

.....

(ii) Explain which element in the diagram is the least reactive.

(2)

.....

.....

.....

.....

(iii) State the similarity in the electronic configurations of Na and Ar.

(1)

.....

.....

(iv) State the similarity in the electronic configurations of Na and Rb.

(1)

.....

.....

(v) State a physical property of Na that shows it is a metal.

(1)

.....

.....

Total for Q10 = 6 marks

11 Chlorine gas is bubbled through an aqueous solution of potassium bromide until a change in colour is seen.

(a) Write a chemical equation for this reaction.

(2)

(b) Explain the reaction that occurs.

In your answer, refer to

- the final colour
- the substance that causes the final colour
- the type of reaction
- the relative reactivities of the two Group 7 elements involved

(4)

(Total for Question 11 = 6 marks)

End of paper