



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
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4	He	Helium	2
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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																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																						
3	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																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																														
	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	127	I	Iodine	53	131	Xe	Xenon	54																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																						
5	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																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																														
	223	Fr	Francium	87	226	Ra	Radium	88	227	Ac	Actinium	89	227	Th	Thorium	90	232	Pa	Protactinium	91	238	U	Uranium	92	238	Np	Neptunium	93	241	Pu	Plutonium	94	244	Am	Americium	95	247	Cm	Curium	96	251	Bk	Berkelium	97	252	Cf	Californium	98	257	Md	Mendelevium	101	261	No	Nobelium	102	269	Lr	Lawrencium	103																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																										
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Key

Relative atomic mass
Symbol
Name
Atomic number

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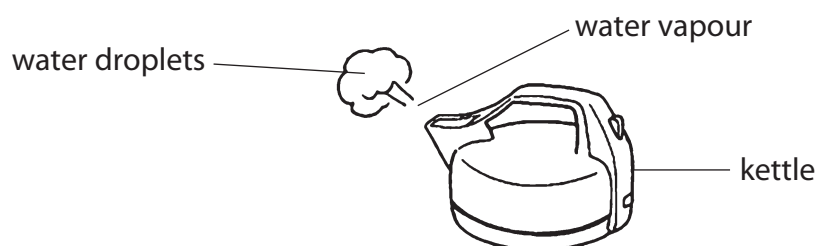
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P 4 5 7 2 8 A 0 2 2 8

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.

You 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)



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.

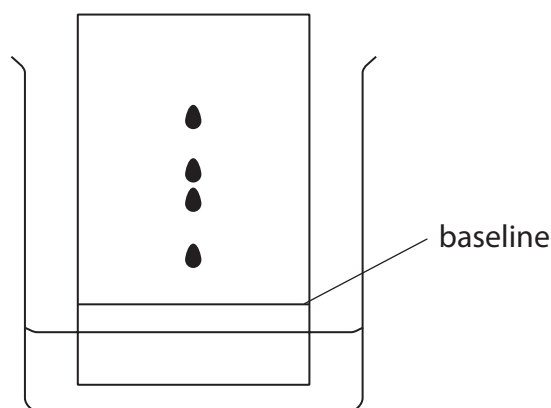
He then separates the solution of the green colouring from the remaining grass.

(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)

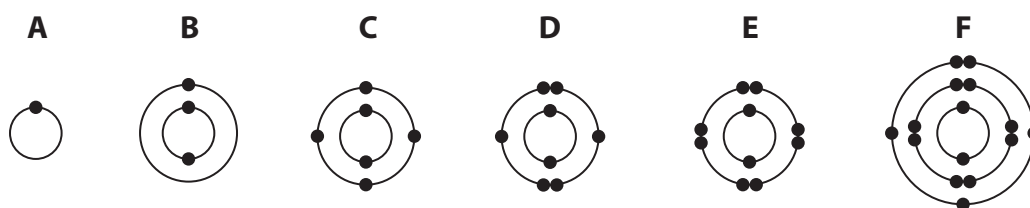
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.....

.....

(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.

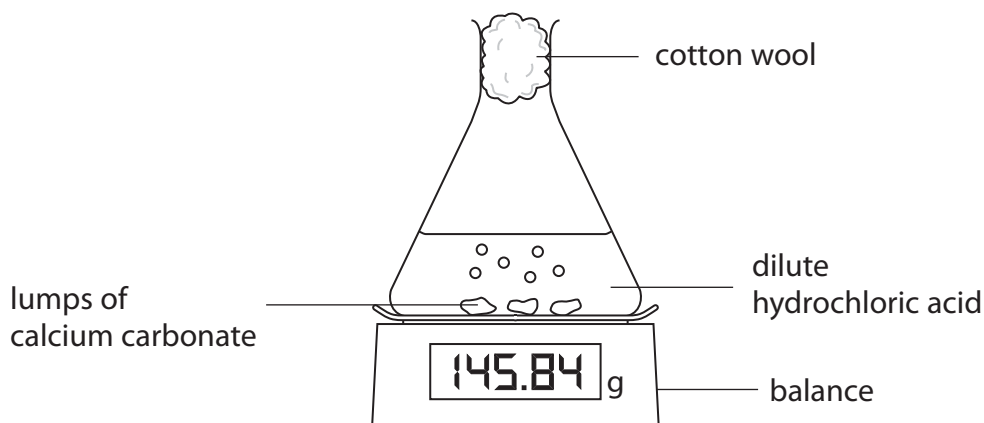
- (ii) Suggest, with reference to electronic configurations, the most likely formula of the compound formed between atoms of A and D.

(1)

(Total for Question 4 = 9 marks)

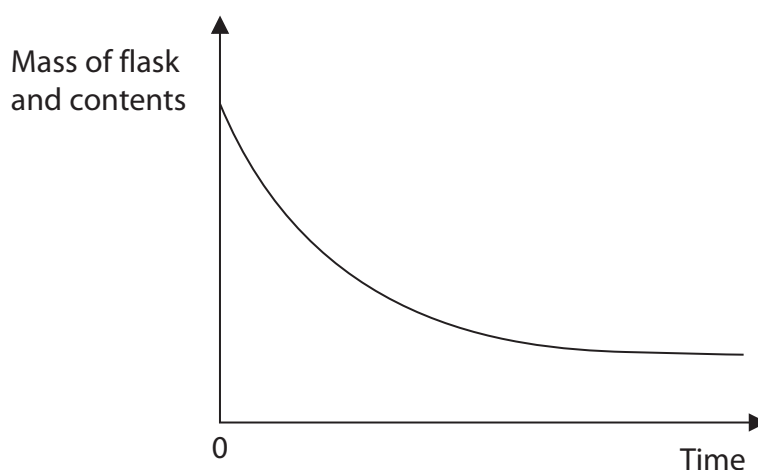


- 5 The diagram shows the apparatus used to investigate the rate of reaction between calcium carbonate and an excess of dilute hydrochloric acid.



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)

(Total for Question 5 = 7 marks)



- 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 $\text{Cl}_2 + 2\text{NaBr} \rightarrow 2\text{NaCl} + \text{Br}_2$

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

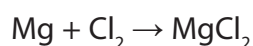
(1)

- (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



- (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**.

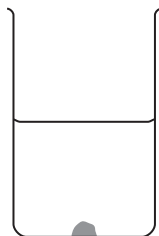
(2)

Total for Q7 = 7 marks



- 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 sublimates

- (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 $\text{CuSO}_4 \cdot 5\text{H}_2\text{O}$

(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)

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

(3)

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(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)

