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## CHEMISTRY VCE UNITS 1&2 DIAGNOSTIC TOPIC TESTS 2016

### TEST 1: ATOMIC THEORY AND THE PERIODIC TABLE

TOTAL 35 MARKS (45 MINUTES)

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Student's Name: \_\_\_\_\_ Teacher's Name: \_\_\_\_\_

#### Directions to students

Write your name and your teacher's name in the spaces provided above.  
Answer all questions in the spaces provided.

#### SECTION A: MULTIPLE-CHOICE QUESTIONS

##### Instructions for Section A

For each question in Section A, choose the response that is correct and circle your choice.

Choose the response that is **correct** or **best answers** the question.

A correct answer scores 1, an incorrect answer scores 0.

Marks will **not** be deducted for incorrect answers.

No marks will be given if more than one answer is completed for any question.

#### Question 1

Atoms are far too small to be seen with the unaided human eye.

What is the approximate size of the smallest object which can be seen with the unaided human eye?

- A. 500 nm
- B. 5000 nm
- C. 50 000 nm
- D. 500 000 nm

#### Question 2

Bromine and iodine are in the same group in the periodic table.

A bromine atom and an iodine atom would be expected to have

- A. the same electronic configuration.
- B. the same number of protons in their nuclei.
- C. similar atomic mass.
- D. similar chemical properties.

## SECTION B: SHORT-ANSWER QUESTIONS

### Instructions for Section B

Answer **all** questions in the spaces provided.

To obtain full marks for your responses, you should:

- give simplified answers, with an appropriate number of significant figures, to all numerical questions; unsimplified answers will not be given full marks
- show all working in your answers to numerical questions; no marks will be given for an incorrect answer unless it is accompanied by details of the working
- make sure chemical equations are balanced and that the formulas for individual substances include an indication of state; for example,  $\text{H}_2(\text{g})$ ,  $\text{NaCl}(\text{s})$ .

### Question 1 (5 marks)

An outline of the periodic table is shown below.


Use the information given below for each element to place it in its correct position in the outline of the periodic table above. You are not required to identify the elements, but to use the letters given – D, E, G, J and M – in your answer.

- Element D is a period 3 alkali metal. 1 mark
- Atoms of element E have the largest mass in group 17. 1 mark
- Atoms of element G have 18 protons in their nuclei. 1 mark
- Element J is a non-metal with one electron in its outer shell. 1 mark
- Atoms of element M form a singly charged cation with electronic configuration  $1s^22s^22p^63s^23p^6$ . 1 mark

**Question 4** (9 marks)

**a. i.** Write the electronic configuration, using subshell notation, for a chromium atom. 1 mark

\_\_\_\_\_

**ii.** Explain why chromium is placed in period 4 of the periodic table. 1 mark

\_\_\_\_\_

\_\_\_\_\_

**b.** Explain why the radius of an aluminium atom is larger than the radius of

**i.** an atom of phosphorus. 2 marks

\_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_

**ii.** an aluminium ion. 2 marks

\_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_

**c.** The table below shows trends in properties of elements in various groups and periods of the periodic table.

Complete the table by placing ticks in the appropriate columns to indicate whether the property increases, decreases or remains constant for each of the sets of elements listed. 3 marks

	Increases	Decreases	Remains constant
<b>i.</b> chemical reactivity for group 17 elements from F to I			
<b>ii.</b> metallic character of group 2 elements from Be to Ra			
<b>iii.</b> energy required to remove an electron from the period 3 elements from Na to Ar			

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### TEST 1: ATOMIC THEORY AND THE PERIODIC TABLE

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#### SUGGESTED SOLUTIONS AND MARKING SCHEME

#### SECTION A: MULTIPLE-CHOICE QUESTIONS

**Question 1**      **C**

Most human eyes cannot see objects much smaller than the width of a hair, around 0.05 mm.

$$0.05 \text{ mm} = 0.05 \times 10^{-3} \text{ m} = 0.05 \times 10^{-3} \times 10^9 \text{ nm} = 50\,000 \text{ nm}$$

**Question 2**      **D**

Elements in the same group have the same outer-shell configuration, leading to similar chemical properties. Elements in a group do not have the same electronic configuration, atomic number or atomic mass.

**Question 3**      **B**

Protons and neutrons are both found in the nucleus (III), and both have masses of around  $10^{-24}$  g (I). Protons have a charge of  $1.6 \times 10^{-19}$  C. Neutrons have no charge, so **D** is incorrect. **A** and **C** are incorrect as they include only one common property.

**Question 4**      **A**

Electronegativity is the electron-attracting power of an atom. It increases across a period due to the increasing nuclear charge of the atoms. The greater positive charge attracts electrons more strongly. (Group 18 elements do not tend to form bonds and so are not usually assigned electronegativity values.) The graph in **A** is the only one which shows this increasing trend.

**Question 5**      **C**

If  $A^{2+}$  contains 10 electrons, then a neutral atom must contain  $10 + 2 = 12$  electrons. So the proton number of the atom is 12.

## SECTION B: SHORT-ANSWER QUESTIONS

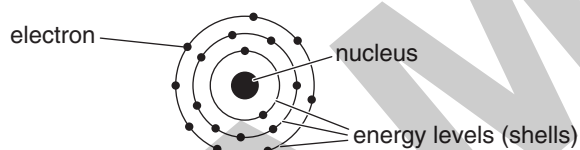
### Question 1 (5 marks)

D																			G
M																			
																			E

5 marks

### Question 2 (6 marks)

- a. a particular wavelength on the electromagnetic spectrum 1 mark
- b. Electrons are found in shells. 1 mark  
 Electrons in shells have specific fixed energies. 1 mark  
 Transitions may occur between shells if energy is absorbed or emitted by electrons. 1 mark



1 mark

- c. Electrons absorb energy when heated and move to a higher energy level. 1 mark  
 Light of specific energy is released as these electrons return to lower energy levels. The wavelengths of the emitted light correspond to the energy differences between levels. 1 mark

### Question 3 (5 marks)

- a. The transition metals correspond to elements filling the d subshell. This holds 10 electrons. 1 mark
- b. Group 18 gases are the noble or inert gases. 1 mark  
 Their lack of reactivity (and low abundance) made them hard to locate and study. 1 mark
- c.  $^{35}\text{Cl}$  and  $^{37}\text{Cl}$  are isotopes. They have the same electronic configuration. 1 mark  
 Since chemical properties are determined by electronic configuration, their chemical properties are the same, despite their difference in mass. 1 mark