



IG.C3 Periodic Table: Organisation and Predicting Properties

EDEXCEL 4CH1 · Calculator allowed · about 60 minutes

Total Marks

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Name: _____ Date: ____ / ____ / ____

Answer ALL questions. Show all your working.

- 1** Describe how elements are arranged in the modern periodic table, stating the main ordering principle used.

(Total for Question 1 is 1 mark)

- 2** Describe what a period is in the periodic table, naming what is the same for elements across a period.

(Total for Question 2 is 1 mark)

- 3** Describe what a group is in the periodic table and state what property elements in the same group share that affects chemical reactions.

(Total for Question 3 is 2 marks)

- 4** Predict whether an element in period 3 with an outer-shell electronic configuration of 3,5 (that is, five electrons in the outer shell) is likely to be a metal or a non-metal, in the context of periodic table position.

(Total for Question 4 is 1 mark)

- 5 Deduce the group number for an element that has the outer-shell electron arrangement of 2,8,1, giving a brief reason based on outer electrons and periodic table structure.

(Total for Question 5 is 2 marks)

- 6 Predict the period number for an element with proton number 16, and give a one line justification referring to electron shells.

(Total for Question 6 is 2 marks)

- 7 Describe, using periodic table position, how metals and non-metals are broadly separated and where metals are found compared with non-metals.

(Total for Question 7 is 1 mark)

- 8 Deduce the likely chemical property that elements in group 0 (noble gases) share, referring to outer-shell electron configuration. Do not state specific reactions, just the general propensity.

(Total for Question 8 is 2 marks)

- 9 A student is told an element X is in group 7 and period 3 of the periodic table. Predict the number of electron shells and the number of electrons in the outer shell for element X, stating both numbers.

(Total for Question 9 is 2 marks)

- 10** Describe how atomic radius generally changes across a period from left to right in the periodic table, giving a brief explanation based on nuclear charge and electron shells.

(Total for Question 10 is 1 mark)

- 11** Deduce from periodic table reasoning whether an element with electron configuration 2,8,2 is likely to form ions by losing or gaining electrons, and give a short justification.

(Total for Question 11 is 3 marks)

- 12** Explain, in about four lines, why elements in the same group of the periodic table show similar chemical properties. Include a clear reference to electrons.

(Total for Question 12 is 4 marks)

- 13** Predict the position (group and period) of an element whose atoms have three electron shells and are electrically neutral with 13 protons. Give both group and period and a one line justification from electronic structure.

(Total for Question 13 is 1 mark)

- 14** Deduce whether the element represented by the symbol 'Y' placed to the left of the staircase line but near the right side of the periodic table is more likely to be metallic or non-metallic, and give a brief reason referring to position and typical properties.

(Total for Question 14 is 2 marks)

- 15** Levels response: Explain how you could use an element's position in the periodic table to predict its physical properties and likely chemical behaviour. In your answer include reference to period number, group number, electron shells, and whether it is metal or non-metal. Give examples of the kinds of properties you would predict.

(Total for Question 15 is 6 marks)

Mark scheme · IG.C3 Periodic Table: Organisation and Predicting Properties

Question 1

- **B1** arranged in order of increasing atomic number (number of protons)
- **Answer: Elements are arranged in order of increasing atomic number**

Question 2

- **B1** a period is a horizontal row; elements in the same period have the same number of electron shells
- **Answer: A period is a horizontal row; elements in the same period have the same number of electron shells**

Question 3

- **B1** a group is a vertical column of elements
- **B1** elements in the same group have the same number of outer-shell electrons
- **Answer: A group is a vertical column; elements in the same group have the same number of outer-shell electrons**

Question 4

- **B1** non-metal
- **Answer: Non-metal**

Question 5

- **B1** group 1
- **B1** reason: it has 1 outer-shell electron so it is in group 1
- **Answer: Group 1, because it has one electron in its outer shell**

Question 6

- **M1** recognises electron configuration fills shells until 16 electrons accounted for: 2,8,6
- **A1** period 3
- **Answer: Period 3, because proton number 16 gives electron configuration 2,8,6 so there are three shells**

Question 7

- **B1** metals are on the left and centre of the table; non-metals are on the right
- **Answer: Metals are on the left and centre of the table; non-metals are on the right**

Question 8

- **B1** they have full outer shells
- **B1** so they are generally unreactive/chemically stable
- **Answer: They have full outer shells and so are generally unreactive or chemically stable**

Question 9

- **B1** 3 electron shells
- **B1** 7 electrons in outer shell
- **Answer: Three shells; seven electrons in the outer shell**

Question 10

- **B1** atomic radius decreases from left to right across a period
- **Answer: Atomic radius decreases left to right across a period**

Question 11

- **B1** it will tend to lose 2 electrons
- **B1** reason: losing 2 electrons gives a full outer shell like a noble gas
- **B1** losing electrons makes a positive ion (cation)
- **Answer: It will tend to lose two electrons to form a 2+ cation, because that gives a full outer shell**

Question 12

- **B1** states that elements in the same group have the same number of outer-shell electrons
- **B1** explains that chemical reactions involve gaining, losing or sharing outer-shell electrons
- **B1** links same outer electron number to similar tendencies in electron transfer or sharing
- **B1** concludes that this leads to similar chemical properties among group members
- **Answer: Elements in a group have the same number of outer electrons. Chemical behaviour depends on how atoms gain, lose or share their outer electrons. If group members have the same valence electron count they tend to form similar ions or bonds. Therefore they display similar chemical properties.**

Question 13

- **B1** group 3, period 3
- **Answer: Group 3, period 3, because 13 electrons give configuration 2,8,3 so three shells and three outer electrons**

Question 14

- **B1** metallic
- **B1** reason: left of the staircase indicates metallic character even if near the boundary, so tends to show metal properties
- **Answer: Metallic, because being left of the staircase indicates metal character even when near the metalloid boundary**

Question 15

- **Level 1** (1-2): Simple statements linking one or two periodic table features to a general property, limited development.
- **Level 2** (3-4): Clear explanation using period and group to predict one or two properties, with reference to electron shells and outer electrons, and at least one specific prediction.
- **Level 3** (5-6): Detailed explanation using period number, group number, electron configuration and table position to predict multiple physical and chemical properties. Uses examples and explains the underlying electronic reasons, showing evaluation or comparison of predictions.
- **Indicative content:**
 - Period number tells how many electron shells are present and so relates to atomic size and shell-related properties
 - Group number tells number of outer-shell electrons and so predicts tendency to lose, gain or share electrons and likely ionic charge for main-group elements
 - Position left or right of the staircase indicates metal or non-metal and predicts physical properties such as conductivity, malleability and appearance
 - Across a period, atomic radius and metallic character change so elements to the left are more metallic and to the right more non-metallic
 - Examples: an element in group 1 will have 1 outer electron and tend to form positive ions and be metallic; an element in period 4 will have four shells and larger atomic radius than period 2 elements
 - Use of these predictions to infer likely bonding type, electrical conductivity and reactivity trends without stating specific group reaction details