2.2 Atomic Structure, Isotopes and Relative Atomic Mass: 30-minute Pack

Total Marks

EDEXCEL 4CH1 · Calculator allowed · about 30 minutes

Name: _____ Date: ____ / ____ / _____

Answer ALL questions. Show all your working.

1 A teacher writes the nuclide notation 56 26 Fe on the whiteboard. State the atomic number and the mass number for this iron nuclide, as a short notation exercise.

(Total for Question 1 is 2 marks)

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2 State the number of protons in a neutral atom represented by 31 15 P.

(Total for Question 2 is 1 mark)

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3 State the number of neutrons in 19 9 F.

(Total for Question 3 is 1 mark)

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4 Complete the definition used in chemistry lesson notes: An isotope of an element is an atom that has the same number of protons but a different number of what? Provide the missing word.

(Total for Question 4 is 2 marks)

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5 The nuclide 27 13 Al is used in a lesson exercise. State the number of electrons in the outer shell of a neutral aluminium atom, and give its electronic configuration in shell notation.

(Total for Question 5 is 2 marks)

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6 A neutral atom is represented by 40 18 Ar. Deduce its numbers of protons and neutrons.

(Total for Question 6 is 2 marks)

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7 A chemist writes the nuclide symbol 23 11 Na when discussing the element sodium in a sample. From this nuclide symbol, deduce the number of protons, neutrons and electrons in a neutral atom of this sodium isotope.

(Total for Question 7 is 3 marks)

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8 A sample contains the radioactive nuclide carbon-14, written 14 6 C when describing its nucleus. Using this nuclide symbol, deduce the numbers of protons, neutrons and electrons in a neutral carbon-14 atom.

(Total for Question 8 is 3 marks)

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9 A synthetic mixture contains two isotopes with mass numbers 20 and 22 at abundances 30% and 70%, respectively. Calculate the relative atomic mass to 1 decimal place. Show your working.

(Total for Question 9 is 2 marks)

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10 A neutral atom has shell configuration 2,8,7. It gains 1 electron to form an ion. Deduce the number of protons in the atom, the shell configuration of the ion and the charge of the ion.

(Total for Question 10 is 3 marks)

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11 Calculate the relative atomic mass (Ar) of chlorine in a sample where 75% of the atoms are chlorine-35 and 25% are chlorine-37, a question a teacher might set for practice with weighted means.

(Total for Question 11 is 3 marks)

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12 A classroom question asks for the relative atomic mass of element X which has three isotopes: X-10 with 20% abundance, X-11 with 70% abundance and X-12 with 10% abundance. Calculate the Ar of X, showing the equation, substitution and final value.

(Total for Question 12 is 4 marks)

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Mark scheme · 2.2 Atomic Structure, Isotopes and Relative Atomic Mass: 30-minute Pack

Question 1

atomic number = 26 **B1**

mass number = 56 **B1**

Answer: Atomic number 26; Mass number 56

Question 2

15 protons **B1**

Answer: 15

Question 3

19 - 9 = 10 neutrons **B1**

Answer: 10

Question 4

neutrons **B1**

accept 'neutron number' or 'number of neutrons' **B1**

Answer: neutrons

Question 5

outer electrons = 3 **B1**

configuration = 2,8,3 **B1**

Answer: Outer electrons 3; configuration 2,8,3

Question 6

protons = 18 **B1**

neutrons = 40 - 18 = 22 **B1**

Answer: Protons 18; neutrons 22

Question 7

protons = 11 (atomic number 11) **B1**

neutrons = 23 - 11 = 12 **B1**

electrons = 11 (neutral atom has equal protons and electrons) **B1**

Answer: Protons 11; Neutrons 12; Electrons 11

Question 8

protons = 6 **B1**

neutrons = 14 - 6 = 8 **B1**

electrons = 6 (neutral atom) **B1**

Answer: Protons 6; Neutrons 8; Electrons 6

Question 9

uses 20 x 0.30 + 22 x 0.70 **M1**

Ar = 21.4 **A1**

Answer: Ar = (20 x 30 + 22 x 70) / 100 = 21.4.

Question 10

17 protons from 2 + 8 + 7 electrons in the neutral atom **B1**

ion shell configuration 2,8,8 **B1**

ion charge 1- (accept -1) **B1**

Answer: 17 protons; ion shell configuration 2,8,8; charge 1- because the ion has 18 electrons and 17 protons.

Question 11

writes Ar = (35 x 75/100) + (37 x 25/100) or equivalent weighted mean expression **M1**

substitutes values and performs multiplication correctly: 35 x 0.75 = 26.25 and 37 x 0.25 = 9.25 **M1**

Ar = 35.5 cao **A1**

Answer: 35.5

Question 12

writes Ar = (10 x 0.20) + (11 x 0.70) + (12 x 0.10) or equivalent weighted mean **M1**

performs the multiplications correctly: 10 x 0.20 = 2.0, 11 x 0.70 = 7.7, 12 x 0.10 = 1.2 **M1**

adds the contributions correctly: 2.0 + 7.7 + 1.2 **M1**

Ar = 10.9 cao **A1**

Answer: 10.9

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