3.26 Atomic Structure and the Development of the Model: Test Pack

AQA 8464 · Calculator allowed · about 25 minutes

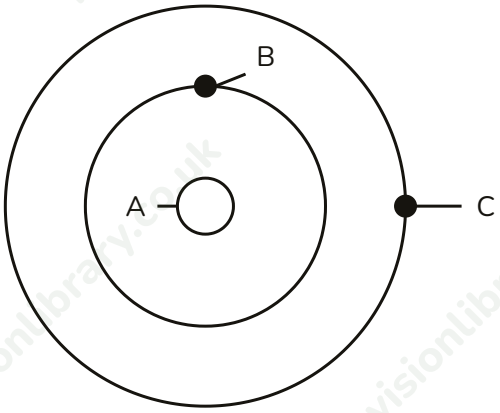
Total Marks

Name: _____ Date: ____ / ____ / _____

Answer ALL questions. Show all your working.

1 The diagram below (not drawn to scale) represents a simple model of an atom. It shows a small circle at the centre, labelled A. Two smaller particles are shown moving on circular paths around it: particle B, on a path close to the centre, and particle C, on a path further from the centre.

Diagram NOT accurately drawn



(a) What does label A represent? **(1)**

(b) What do labels B and C represent? **(1)**

(c) What term is used to describe the fixed circular paths followed by the electrons around the nucleus? **(1)**

(Total for Question 1 is 3 marks)

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2 This question is about the particles that make up an atom.

(a) The table shows the relative charge and relative mass of the three particles found in atoms. The row for the proton has been completed for you. Complete the two blank rows. **(4)**

Particle	Relative charge	Relative mass
Proton	+1	1
Neutron	...	...
Electron	...	...

(b) Name the two types of particle found in the nucleus of an atom. **(2)**

(c) An atom of sodium has 11 protons and 11 electrons. Explain why the sodium atom has no overall electrical charge. **(2)**

(Total for Question 2 is 8 marks)

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3 Higher tier only. An iron-56 nucleus contains 56 nucleons (protons and neutrons), each with a mass of approximately 1.67×10^{-27} kg. Electron mass can be ignored, as it is very small compared with a nucleon's mass.

(a) Show that the mass of one iron-56 atom is approximately 9.4×10^{-26} kg. **(2)**

(b) An iron nail contains approximately 5.4×10^{22} atoms of iron-56. Using the mass from part (a), 9.4×10^{-26} kg, calculate the total mass of the nail. Give your answer in kg, in standard form, to 2 significant figures. **(3)**

.....

(c) A typical steel nail has a mass of about 5 g. Comment on whether your answer to part (b) is a reasonable value for the mass of an iron nail. **(1)**

(Total for Question 3 is 6 marks)

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Mark scheme · 3.26 Atomic Structure and the Development of the Model: Test Pack

Question 1

(a) the nucleus **B1**

(a) Answer: The nucleus.

(b) electrons **B1**

(b) Answer: Electrons.

(c) shells (oe energy levels) **B1**

(c) Answer: Shells (energy levels).

Question 2

(a) neutron relative charge = 0 **B1**

(a) neutron relative mass = 1 (oe same as proton) **B1**

(a) electron relative charge = -1 **B1**

(a) electron relative mass = very small (oe negligible / about 1/2000 of a proton); accept any answer indicating a mass much less than 1 **B1**

(a) Answer: Neutron: charge 0, mass 1. Electron: charge -1, mass very small (about 1/2000 of a proton).

(b) protons **B1**

(b) neutrons **B1**

(b) Answer: Protons and neutrons.

(c) the number of protons equals the number of electrons (11 = 11), oe equal numbers of positive and negative charges **B1**

(c) the positive charge of the protons and negative charge of the electrons cancel out (balance), so there is no overall/net charge, oe **B1**

(c) Answer: The atom has equal numbers of protons (+) and electrons (-), 11 = 11, so their charges cancel out and there is no overall charge.

Question 3

(a) 56 x (1.67×10^{-27}), oe **M1**

(a) = 9.352×10^{-26} kg, which rounds to 9.4×10^{-26} kg (2 s.f.), confirming the given value **A1**

(a) Answer: 9.4×10^{-26} kg (2 s.f.), shown from $56 \times 1.67 \times 10^{-27} = 9.352 \times 10^{-26}$ kg.

(b) total mass = number of atoms x mass of one atom, oe **M1**

(b) (5.4×10^{22}) x (9.4×10^{-26}), oe correct handling of the powers of ten **M1**

(b) = 5.1×10^{-3} kg (2 s.f.), cao, awrt 5.1×10^{-3} kg (allow 5.1 g) **A1**

(b) Answer: 5.1×10^{-3} kg (2 s.f.), equivalent to about 5.1 g.

(c) yes, the answer to part (b) is 5.1×10^{-3} kg, which is 5.1 g; this is close to the mass of a typical nail (about 5 g), so the answer is reasonable, oe **B1**

(c) Answer: Yes, 5.1×10^{-3} kg equals 5.1 g, which is close to the mass of a typical nail (about 5 g), so it is a reasonable value.

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