

Atomic Structure

Total marks: 16

Q1.

Titanium and iron are examples of transition metals.

Figure 6 shows the percentage abundance of each isotope in a sample of titanium.

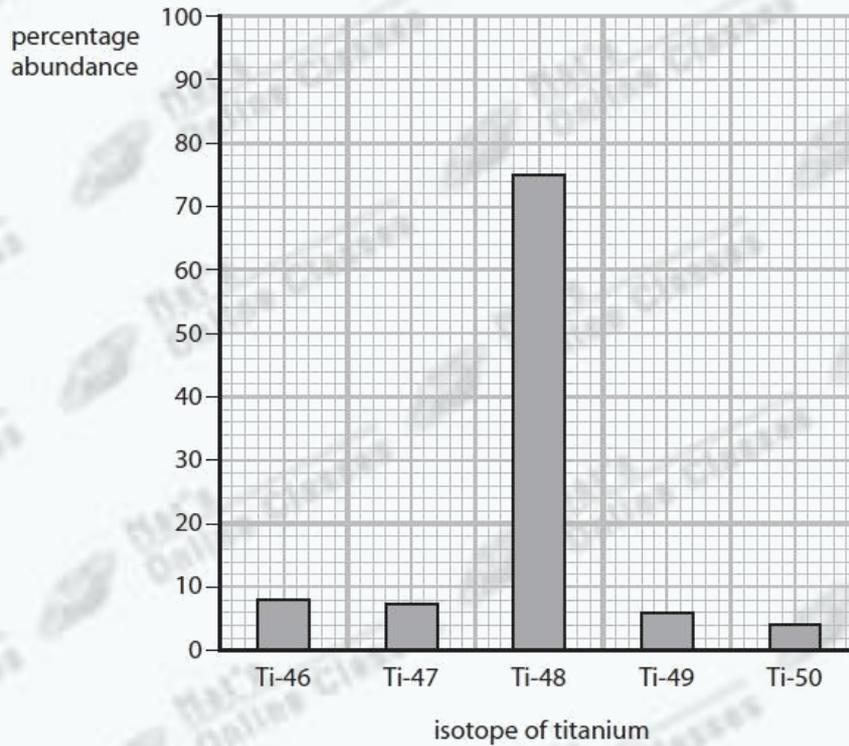


Figure 6

Calculate the relative atomic mass of titanium in this sample.

(3)

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relative atomic mass =

Q2.

The atomic number of magnesium is 12.

Magnesium exists as three isotopes: magnesium-24, magnesium-25 and magnesium-26.

Describe, by referring to the numbers of subatomic particles, the differences between one atom of each of these isotopes.

(2)

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Q4.

Answer the question with a cross in the box you think is correct . If you change your mind about an answer, put a line through the box and then mark your new answer with a cross .

Calcium has an atomic number of 20.
A calcium atom has a mass number of 40.

(i) Which row of the table shows the number of protons and number of neutrons in this atom of calcium?

(1)

	number of protons	number of neutrons
<input checked="" type="checkbox"/> A	20	20
<input type="checkbox"/> B	40	20
<input type="checkbox"/> C	20	60
<input type="checkbox"/> D	60	20

(ii) Figure 8 shows the arrangement of electrons in an atom of calcium.

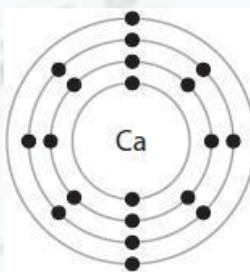


Figure 8

Explain, using the information in Figure 8, in which period of the periodic table calcium can be found.

(2)

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Q5.

Chlorine has an atomic number of 17.

The nucleus of an atom is made up of protons and neutrons.
Atoms of chlorine contain 17 protons.

Figure 4 shows some information about a proton, a neutron and an electron.

	relative mass	relative charge
proton	1	+1
neutron	1	0
electron	very small	-1

Figure 4

(i) Explain, using the information in Figure 3 and Figure 4, why atoms of chlorine have no overall charge.

(2)

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(ii) Atoms of chlorine-37 have a mass number of 37. Calculate the number of neutrons in atoms of chlorine-37.

(1)

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number of neutrons =

(iii) There are two isotopes of chlorine, chlorine-35 and chlorine-37. Explain the meaning of the term **isotopes**.

(2)

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Mark Scheme

Q1.

Question number	Answer	Additional guidance	Mark
	final answer of 47.91 / 47.9 with or without working (3) All percentages given as: Ti-46 = 8 Ti-47 = 7 Ti-48 = 75 Ti-49 = 6 Ti-50 = 4 (1) 46 x 8 = (368) 47 x 7 = (329) 48 x 75 = (3600) 49 x 6 = (294) 50 x 4 = (200) (= 4791) (1) $\frac{4791}{100} = 47.91$ (1)	48 without working = 0 allow 7-7.5 for Ti-47 (7.5 gives 48.145) allow ECF for MP2 [Note: answer of 48 can score MP3 but must have correct working] Allow ECF but answer for MP3 must be between 46 and 50	(3)

Q2.

Question number	Answer	Additional guidance	Mark
	^{24}Mg , ^{25}Mg and ^{26}Mg have 12, 13 and 14 neutrons respectively / ^{25}Mg , ^{26}Mg have 1 and 2 more neutrons than ^{24}Mg respectively (2)	allow {each isotope has / they have} a different number of neutrons (in nucleus) / different numbers in two of the isotopes (1) ignore any similarities	(2) EXP

Q3.

Question number	Answer	Additional guidance	Mark
(i)	<p>An explanation linking:</p> <ul style="list-style-type: none"> (atoms with) same (number of) protons (1) (atoms with) different (number of) neutrons (1) 	<p>ignore any mention of electrons reject answers in terms of elements (plural) but allow element (singular)</p> <p>if no other mark: allow same atomic number and different mass number (1)</p>	(2)

Question number	Answer	Mark
(ii)	<p>A 5 protons is the only correct answer</p> <p>B is not correct because there are 5 or 6 neutrons</p> <p>C is not correct because the atomic number is 5</p> <p>D is not correct because there are 5 or 6 neutrons</p>	(1)

Q4.

Question number	Answer	Additional guidance	Mark
(i)	<p>A 20 20 is the only correct answer</p> <p>B, C and D are incorrect because calcium does not have 40 protons; calcium does not have 60 neutrons; calcium does not have 60 protons</p>		(1)

Question number	Answer	Additional guidance	Mark
(ii)	<p>an explanation linking</p> <ul style="list-style-type: none"> period 4 (1) four shells of electrons (1) 	reject four outer shells	(2)

Q5.

Question number	Answer	Additional guidance	Mark
(i)	An explanation linking <ul style="list-style-type: none">• same number of electrons and protons (1)• so charges {cancel / balance one another} (1)	allow same number of positive and negative charges	(2)

Question number	Answer	Additional guidance	Mark
(ii)	$37 - 17 (1) (= 20)$ (neutrons)	allow 20 without working reject '- 20'	(1)

Question number	Answer	Additional guidance	Mark
(iii)	An explanation linking <ul style="list-style-type: none">• atoms {of same element / with same number of protons} / same atomic number (1)• different number of neutrons / different mass number (1)	ignore electrons reject neutrons reject protons /electrons	(2)