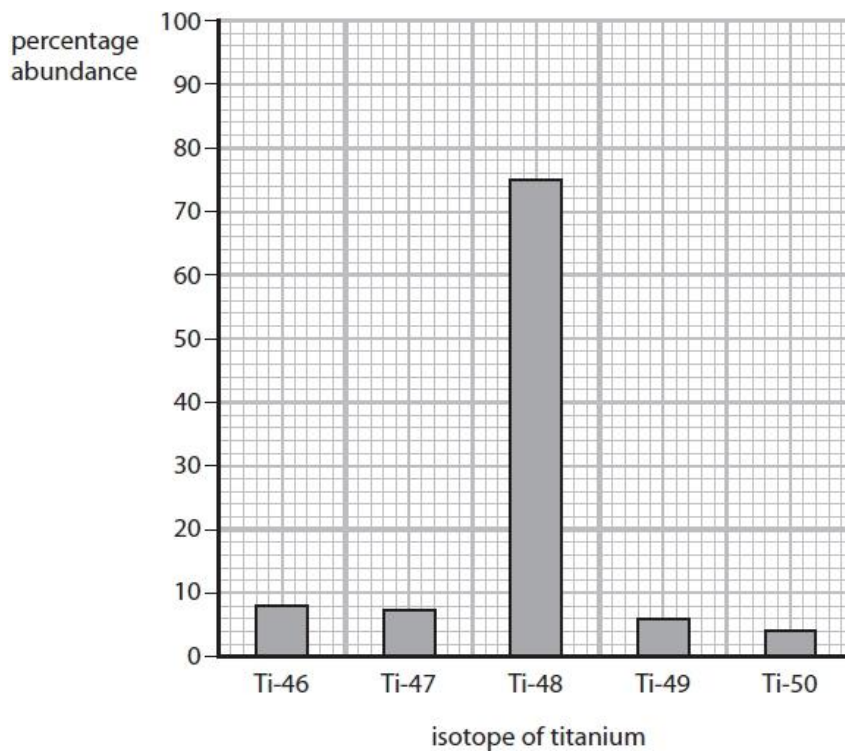


Questions

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)

.....

.....

.....

.....

.....

.....

.....

relative atomic mass =

(Total for question = 3 marks)

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)

.....

.....

.....

(Total for question = 2 marks)

Q3.

In Figure 8, the letters **A**, **E**, **G**, **J**, **X** and **Z** show the positions of six elements in the periodic table.

These letters are not the symbols of the atoms of these elements.

1		2												3	4	5	6	7	0
A													E				G		
J																			X
							Z												

Figure 8

Element **E** has an atomic number of 5.

In a sample of **E** there are two isotopes. One isotope has a mass number of 10 and the other isotope has a mass number of 11.

(i) Explain, in terms of subatomic particles, what is meant by the term **isotopes**.

(2)

.....

.....

.....

.....

(ii) All atoms of element **E** in this sample contain

(1)

- A** 5 protons
- B** 5 neutrons
- C** 6 protons
- D** 6 neutrons

(Total for question = 3 marks)

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 checked="" type="checkbox"/> B	40	20
<input checked="" type="checkbox"/> C	20	60
<input checked="" type="checkbox"/> D	60	20

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

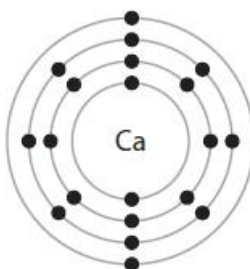


Figure 8

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

(2)

.....

.....

.....

.....

(Total for question = 3 marks)

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)

.....

.....

.....

.....

(ii) Atoms of chlorine-37 have a mass number of 37.

Calculate the number of neutrons in atoms of chlorine-37.

(1)

.....

number of neutrons =

(iii) There are two isotopes of chlorine, chlorine-35 and chlorine-37.

Explain the meaning of the term **isotopes**.

(2)

.....

.....

.....

.....

(Total for question = 5 marks)

Q6.

The scientist John Dalton lived over 200 years ago.

John Dalton suggested an early model of atoms.

When Dalton first described atoms he said that

- all elements are made of atoms
- atoms are not formed of any smaller particles
- all atoms of the same element are identical.

Give two differences between Dalton's model of atoms and today's model of atoms.

(2)

1

.....

.....

2

.....

.....

(Total for question = 2 marks)

Q7.

Atoms contain electrons, neutrons and protons.

(i) Draw one line to link each particle to its correct relative charge.

(2)

particle	relative charge
electron	+1
neutron	0
proton	-1

(ii) Which of the following is the relative mass of a proton?

(1)

- A 0
- B $\frac{1}{1837}$
- C 1
- D -1

(Total for question = 3 marks)

Q8.

A sample of silicon contains isotopes.

(i) State, in terms of subatomic particles, how atoms of these isotopes are the same.

(1)

.....
.....

(ii) This sample of silicon contains three isotopes.

92% of the atoms are silicon-28

5% of the atoms are silicon-29

3% of the atoms are silicon-30

Calculate the relative atomic mass of silicon in this sample.

(2)

.....
.....
.....
.....
.....
.....

relative atomic mass =

(Total for question = 3 marks)

Q9.

A carbon atom contains 6 electrons, 7 neutrons and 6 protons.

(i) State the mass number of this carbon atom.

(1)

.....

(ii) Give the electronic configuration of this carbon atom.

(1)

.....

(Total for question = 2 marks)

Q10.

An atom of aluminium has an atomic mass of 27.

Aluminium has an atomic number of 13.

State the number of electrons, neutrons and protons in this atom.

(3)

number of electrons =

number of neutrons =

number of protons =

(Total for question = 3 marks)

Q11.

Figure 1 shows the dot and cross diagram for a molecule of ammonia.

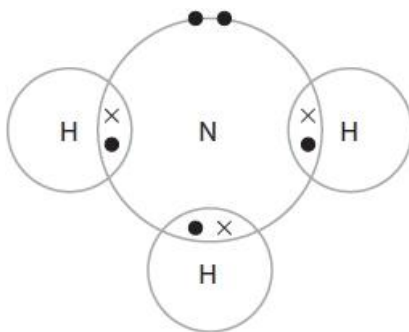


Figure 1

(i) What do the dots and crosses represent in the diagram?

(1)

- A electrons
 B neutrons
 C protons
 D nuclei

(ii) Give the formula for the molecule of ammonia.

(1)

.....

(Total for question = 2 marks)

Q12.

Figure 4 shows the atomic number and mass number of two isotopes of argon.

isotope	atomic number	mass number
argon-38	18	38
argon-40	18	40

Figure 4

Describe the structure of an atom of argon-38 and of an atom of argon-40.

(3)

.....

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.....

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.....

(Total for question = 3 marks)

Q13.

* A sample of magnesium contains

79% of magnesium-24 atoms

10% of magnesium-25 atoms

11% of magnesium-26 atoms.

In most calculations the relative atomic mass of magnesium used is 24.

Use this information to explain why, in this sample, magnesium has a relative atomic mass of 24.3.

(6)

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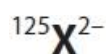
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(Total for question = 6 marks)

Q14.

An ion of element X can be represented as



This ion of element X has 54 electrons.

Calculate the number of protons and the number of neutrons in this ion.

(2)

number of protons

number of neutrons

(Total for question = 2 marks)

Q15.

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 .

An atom of potassium has atomic number 19 and mass number 39.

(i) Give the electronic configuration of this potassium atom.

(1)

.....

(ii) This potassium atom forms the ion K^+ .

Which row shows the number of protons and the number of neutrons in this potassium ion, K^+ ?

(1)

	number of protons	number of neutrons
<input checked="" type="checkbox"/> A	19	19
<input checked="" type="checkbox"/> B	19	20
<input checked="" type="checkbox"/> C	20	19
<input checked="" type="checkbox"/> D	20	20

(Total for question = 2 marks)

Q16.

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 .

Magnesium has an atomic number of 12.

Which line in the table shows the correct numbers of protons, neutrons and electrons in a positively charged magnesium ion?

(1)

				number of		
				protons	neutrons	electrons
<input type="checkbox"/>	A	10	12	12		
<input type="checkbox"/>	B	10	12	10		
<input type="checkbox"/>	C	12	10	12		
<input type="checkbox"/>	D	12	12	10		

(Total for question = 1 mark)

Q17.

An aluminium atom has the atomic number 13 and the mass number 27.

Which row shows the numbers of subatomic particles present in an aluminium ion, Al^{3+} ?

(1)

				protons	neutrons	electrons
<input type="checkbox"/>	A	13	14	13		
<input type="checkbox"/>	B	13	14	10		
<input type="checkbox"/>	C	14	13	10		
<input type="checkbox"/>	D	14	13	17		

(Total for question = 1 mark)

Q18.

An atom of an element has an atomic number and a mass number.

Draw one straight line from each of these to the numbers of subatomic particles it shows to be present in an atom.

(2)

number of subatomic particles in an atom	
atomic number ●	● number of protons
	● number of neutrons
	● total number of protons and electrons
mass number ●	● total number of protons and neutrons
	● total number of protons, neutrons and electrons

(Total for question = 2 marks)

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) $46 \times 8 = (368)$ $47 \times 7 = (329)$ $48 \times 75 = (3600)$ $49 \times 6 = (294)$ $50 \times 4 = (200)$ (= 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)

Q6.

Question number	Answer	Additional guidance	Mark
	Any two from (in modern model) <ul style="list-style-type: none"> • atoms are formed of sub-atomic particles (1) • atoms have a nucleus (1) • atoms contain protons (1) • atoms contain neutrons (1) • atoms contain (shells of) electrons (1) • atoms of same element can have different numbers of neutrons / isotopes exist (1) 	allow (for Dalton's model) atoms are indivisible ignore statements that are simply the negative of those in the question reject each comparison with 'plum pudding model'	(2) AO1

Q7.

Question Number	Answer	Additional guidance	Mark						
(i)	<p>particle</p> <table border="0" style="width: 100%;"> <tr> <td style="width: 50%; text-align: center;">electron</td> <td style="width: 50%; text-align: center;">+1</td> </tr> <tr> <td style="width: 50%; text-align: center;">neutron</td> <td style="width: 50%; text-align: center;">0</td> </tr> <tr> <td style="width: 50%; text-align: center;">proton</td> <td style="width: 50%; text-align: center;">-1</td> </tr> </table> <p>3 correct = 2 marks 1 correct = 1 mark</p>	electron	+1	neutron	0	proton	-1	do not allow more than 1 line from any particle	(2) AO 1 1
electron	+1								
neutron	0								
proton	-1								

Question Number	Answer	Mark
(ii)	<p>C 1</p> <p>1. The only correct answer is C</p> <p><i>A is not correct because mass is 1</i></p> <p><i>B is not correct because this is relative mass of electron</i></p> <p><i>D is not correct because mass cannot be negative</i></p>	(1) AO 1 1

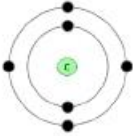
Q8.

Question number	Answer	Additional guidance	Mark
(i)	(isotopes of same element) have the same number of protons	allow same number of electrons reject same number of neutrons	(1) AO1

Question number	Answer	Additional guidance	Mark
(ii)	<p>total mass of 100 atoms = (28 × 92) + (29 × 5) + (30 × 3) (1) (= 2811)</p> <p>relative atomic mass = $\frac{2811}{100}$ (= 28.11) (1)</p>	<p>correct final answer without working (2)</p> <p>final answer must contain at least one decimal place</p>	(2) AO2

Q9.

Question number	Answer	Additional guidance	Mark
(i)	13/thirteen	allow 6 + 7	(1)

Question number	Answer	Additional guidance	Mark
(ii)	2.4 	allow commas allow 2.4.0. allow diagram	(1)

Q10.

Question number	Answer	Additional guidance	Mark
	number of electrons = 13 (1) number of neutrons = 14 (1) number of protons = 13 (1)	allow 27-13 (=14)	(3) AO1-1

Q11.

Question Number	Answer	Mark
(i)	A electrons	(1)
	1. The only correct answer is A <i>B is factually incorrect</i> <i>C is factually incorrect</i> <i>D is factually incorrect</i>	AO 1 1

Question Number	Answer	Additional guidance	Mark
(ii)	NH ₃	do not allow NH ³ / nh ₃ / NH3 etc allow H ₃ N	(1) AO 3 2b

Q12.

Question Number	Answer	Additional guidance	Mark
	A description to include <ul style="list-style-type: none">• both have 18 electrons/2.8.8 (in shells /orbits) (1)• both have 18 protons (in the nucleus) (1)• argon-38 has 20 neutrons AND argon-40 has 22 neutrons (in the nucleus) (1)	allow argon 40 has two more neutrons than argon 38 / ORA ignore generic definition of an isotope	(3) AO 3 1a AO 3 1b

Q13.

Question number	Answer	Mark
*	<p>Answers will be credited according to candidate's deployment of knowledge and understanding of the material in relation to the qualities and skills outlined in the generic mark scheme.</p> <p>The indicative content below is not prescriptive and candidates are not required to include all the material that is indicated as relevant. Additional content included in the response must be scientific and relevant.</p> <p style="text-align: center;">AO2 (6 marks)</p> <p>relative atomic mass of magnesium is 24.3 (and not 24) due to</p> <ul style="list-style-type: none"> the existence of more than one isotope accurate relative mass is calculated using weighted mean magnesium-25 and magnesium-26 are both heavier isotopes than magnesium-24 magnesium-24 has highest percentage (therefore) the relative atomic mass is closer to 24 than 25 or 26 <p>calculation of relative atomic mass</p> <ul style="list-style-type: none"> consider 100 atom sample in the given sample 79 atoms have a mass of 24 in the given sample 10 atoms have a mass of 25 in the given sample 11 atoms have a mass of 26 calculate total mass of 100 atoms divide by 100 to find relative atomic mass <p>OR</p> <ul style="list-style-type: none"> fraction of magnesium-24 = $79/100$ fraction of magnesium-25 = $10/100$ fraction of magnesium-26 = $11/100$ relative atomic mass $= (79/100 \times 24) + (10/100 \times 25) + (11/100 \times 26)$ $= 18.96 + 2.5 + 2.86$ $= 24.3$ 	(6) EXP

Level	Mark	Descriptor
	0	No rewardable material.
Level 1	1-2	<ul style="list-style-type: none"> The explanation attempts to link and apply knowledge and understanding of scientific ideas, flawed or simplistic connections made between elements in the context of the question. (AO2) Lines of reasoning are unsupported or unclear. (AO2)
Level 2	3-4	<ul style="list-style-type: none"> The explanation is mostly supported through linkage and application of knowledge and understanding of scientific ideas, some logical connections made between elements in the context of the question. (AO2) Lines of reasoning mostly supported through the application of relevant evidence. (AO2)
Level 3	5-6	<ul style="list-style-type: none"> The explanation is supported throughout by linkage and application of knowledge and understanding of scientific ideas, logical connections made between elements in the context of the question. (AO2) Lines of reasoning are supported by sustained application of relevant evidence. (AO2)

Q14.

Question number	Answer	Mark
	number of protons = 52 (1) number of neutrons = 125 - number of protons (1) (= 73)	(2) AO2

Q15.

Question number	Answer	Additional guidance	Mark
(i)	2.8.8.1	allow any separator including gaps e.g. 2 8 8 1 send to review any diagrams	(1)

Question number	Answer	Mark
(ii)	B 19 (protons) 20 (neutrons) This is the only correct answer. A is incorrect because there are 20 neutrons in the ion C is incorrect because there are 19 protons and 20 neutrons D is incorrect because there are 19 protons in the ion	(1)

Q16.

Question number	Answer	Mark
	D 12 protons, 12 neutrons, 10 electrons	(1) comp

Q17.

Question number	Answer	Mark
	<p>B 13 14 10 is the only correct answer</p> <p>A is incorrect because it is the numbers of subatomic particles in the atom not the ion</p> <p>C is incorrect because it would be an isotope of silicon with a +4 charge to it</p> <p>D is incorrect because it would be another isotope of silicon but with a 3- charge to it.</p>	(1)

Q18.

Question number	Answer	Additional guidance	Mark
	<p>1 mark for each line</p>	<p>Each line 1 mark</p> <p>Do not award mark if more than one line joins the left hand boxes with those on the right</p>	(2)