3.1 Atomic structure and the Periodic Table

01. 0620_m21_qp_42 Q: 1

The table shows the numbers of protons, neutrons and electrons in particles **A** to **I**.

particle	protons	neutrons	electrons
A	1	0	0
B	6	6	6
C	6	8	6
D	10	10	10
E	16	16	18
F	17	18	17
G	18	22	18
H	19	20	19
I	20	20	18

Answer the following questions about particles **A** to **I**. Each letter may be used once, more than once or not at all.

(a) State which of the particles **A** to **I**:

(i) is an anion ..... [1]

(ii) are cations ..... and ..... [2]

(iii) are noble gas atoms ..... and ..... [2]

(iv) is a halogen atom ..... [1]

(v) is a Group I atom ..... [1]

(vi) have the same nucleon number ..... and ..... [1]

(vii) causes acidity in aqueous solutions ..... [1]

(viii) is used to define the relative atomic mass of elements. ..... [1]

(b) Explain why **B** and **C** are isotopes of the same element.

.....

..... [2]

[Total: 12]

02. 0620_s21_qp_41 Q: 2

Complete the table to:

- deduce the number of protons, electrons and neutrons in the magnesium atom and copper ion shown
- identify the atom or ion represented by the final row.

	number of protons	number of electrons	number of neutrons
$^{25}_{12}Mg$	12		
$^{65}_{29}Cu^{2+}$			36
	17	18	20

[Total: 5]

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03. 0620_s21_qp_43 Q: 2

Complete the table to:

- deduce the number of protons, electrons and neutrons in the boron atom and chloride ion shown
- identify the atom or ion represented by the final row.

formula	number of protons	number of electrons	number of neutrons
$^{11}_{5}B$		5	
$^{35}_{17}Cl^{-}$	17		
	24	21	30

[Total: 5]

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04. 0620_w21_qp_42 Q: 3

Atoms contain protons, neutrons and electrons.

(a) Complete the table to show the relative mass and the relative charge of a proton, a neutron and an electron.

	relative mass	relative charge
proton		
neutron		
electron	$\frac{1}{1840}$	

[3]

(b) The table shows the number of protons, neutrons and electrons in some atoms and ions.

Complete the table.

atom or ion	number of protons	number of neutrons	number of electrons
$^{32}_{16}S$			
$^{39}_{19}K^{+}$			
	35	44	36

[5]

[Total: 8]

05. 0620_p20_qp_40 Q: 2

The table gives the composition of three particles.

particle	number of protons	number of electrons	number of neutrons
A	15	15	16
B	15	18	16
C	15	15	17

(a) What is the evidence in the table for each of the following?

(i) Particle **A** is an atom.

.....

..... [1]

(ii) **A**, **B** and **C** are all particles of the same element.

.....

..... [1]

(iii) Particles **A** and **C** are isotopes of the same element.

.....

..... [2]

(b) **(i)** What is the electronic structure of particle **A**?

..... [1]

(ii) Is element **A**, a metal or a non-metal? Give a reason for your choice.

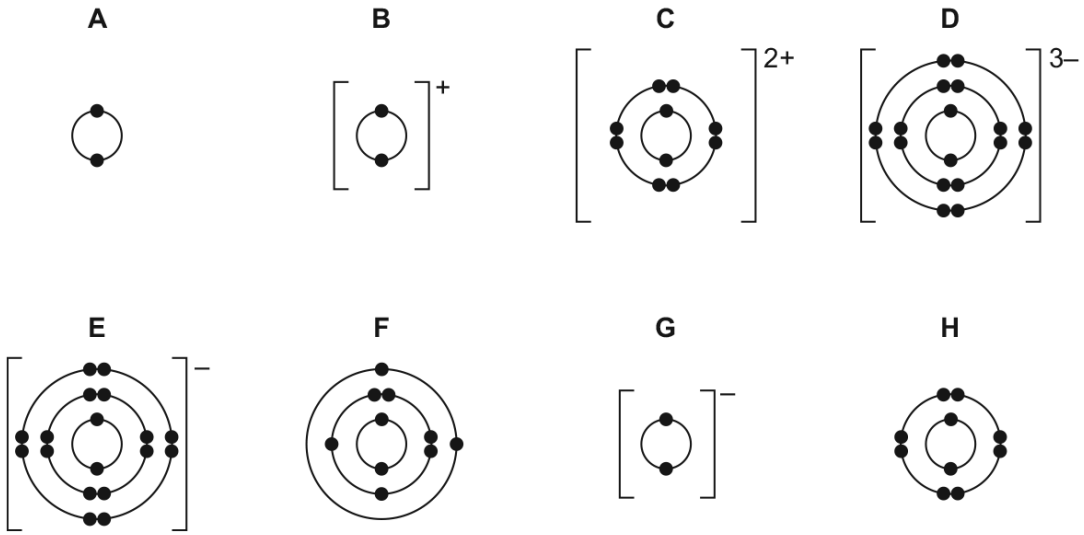
.....

..... [1]

[Total: 6]

06. 0620_w20_qp_42 Q: 1

The electronic structures of some atoms and ions are shown.



(a) Write the letters, **A**, **B**, **C**, **D**, **E**, **F**, **G** or **H**, of the electronic structures which show:

(i) atoms of two different noble gases ..... and ..... [2]

(ii) an ion of a Group I element ..... [1]

(iii) an ion of a Group V element ..... [1]

(iv) a pair of ions that could form a compound with the formula XY_2. ..... and ..... [1]

(b) State which electronic structure, **A**, **B**, **C**, **D**, **E**, **F**, **G** or **H**, is incorrect.

Explain why.

incorrect electronic structure .....

explanation .....

.....

[2]

(c) State how many protons are found in the nucleus of ion **C**. ..... [1]

(d) Use the Periodic Table to deduce:

(i) the chemical symbol for ion **G** ..... [1]

(ii) the element which forms an ion with a 3+ charge and the same electronic structure as **H**.

..... [1]

[Total: 10]

07. 0620_w20_qp_43 Q: 2

The table gives information about five particles, **A**, **B**, **C**, **D** and **E**.

particle	number of electrons	number of neutrons	number of protons
A	10	13	11
B	18	20	18
C	18	18	18
D	10	12	8
E	10	10	10

(a) State the atomic number of **A**.

..... [1]

(b) State the nucleon number of **B**.

..... [1]

(c) Write the electronic structure of **C**.

..... [1]

(d) Give the letters of all the particles which are:

(i) atoms ..... [1]

(ii) positive ions ..... [1]

(iii) negative ions ..... [1]

(iv) isotopes of each other. ..... [1]

[Total: 7]

08. 0620_m19_qp_42 Q: 2

(a) The table gives information about some atoms or ions, **A**, **B** and **C**.

Complete the table.

	number of protons	number of electrons	electronic structure	charge
A	11	10	2,8	
B		18		0
C		10	2,8	–1

[4]

(b) (i) Carbon is an element.

Define the term *element*.

.....

..... [1]

(ii) $^{12}_{6}C$, $^{13}_{6}C$ and $^{14}_{6}C$ are isotopes of carbon.

Complete the table.

	number of protons	number of neutrons
$^{12}_{6}C$		
$^{13}_{6}C$		
$^{14}_{6}C$		

[2]

[Total: 7]

09. 0620_s19_qp_41 Q: 1

This question is about the structures of atoms and ions.

(a) Define the term *proton number*.

.....

..... [2]

(b) (i) Complete the table to show the number of protons, neutrons and electrons present in atoms of $^{24}_{12}Mg$ and $^{26}_{12}Mg$.

	number of protons	number of neutrons	number of electrons
$^{24}_{12}Mg$			
$^{26}_{12}Mg$			

[2]

(ii) What term is used to describe atoms of the same element, such as $^{24}_{12}Mg$ and $^{26}_{12}Mg$?

..... [1]

(iii) Explain why the chemical properties of $^{24}_{12}Mg$ and $^{26}_{12}Mg$ are the same.

.....

..... [2]

(c) Complete the table to identify the atoms and ions which have the following numbers of protons, neutrons and electrons.

	number of protons	number of neutrons	number of electrons
$^{23}_{11}Na^{+}$	11	12	10
	4	5	4
	17	20	18

[4]

(d) State the electronic structure of the following atom and ion.

Al .....

S^{2-} .....

[2]

[Total: 13]

10. 0620_s19_qp_43 Q: 1

Atoms contain particles called electrons, neutrons and protons.

(a) Complete the table.

particle	where the particle is found in an atom	relative mass	relative charge
	orbiting the nucleus	$\frac{1}{1840}$	
			+1
	in the nucleus		

[3]

(b) How many electrons, neutrons and protons are there in the ion shown?

$^{44}_{20}Ca^{2+}$

number of electrons .....

number of neutrons .....

number of protons .....

[3]

[Total: 6]

11. 0620_w19_qp_43 Q: 1

(a) Atoms are made of smaller particles called electrons, neutrons and protons.

Complete the table.

particle	relative charge	relative mass
electron		$\frac{1}{1840}$
neutron		
proton	+1	

[2]

(b) The table gives information about atoms and ions **A**, **B** and **C**.

Complete the table.

	number of electrons	number of neutrons	number of protons	symbol
A		14	13	$^{27}_{13}Al$
B			12	$^{25}_{12}Mg^{2+}$
C	10	10	9	

[6]

[Total: 8]

12. 0620_s18_qp_42 Q: 3

Complete the following table.

particle	number of protons	number of electrons	number of neutrons	number of nucleons
$^{23}_{11}Na$	11	11	.....	23
$^{37}_{17}Cl^{-}$	.....	.....	20	.....
$^{56}_{26}$.....	26	24	30	56

[6]

[Total: 6]

13. 0620_s17_qp_43 Q: 1

Six different atoms can be represented as follows.

$^{3}_{1}\mathbf{A}$ $^{3}_{2}\mathbf{D}$ $^{12}_{6}\mathbf{E}$ $^{13}_{6}\mathbf{G}$ $^{14}_{7}\mathbf{J}$ $^{19}_{9}\mathbf{L}$

(a) Answer the following questions using atoms from the list. Each atom may be used once, more than once or not at all.

Select **one** atom from the six shown which

(i) has exactly seven protons,

..... [1]

(ii) has exactly six neutrons,

..... [1]

(iii) has more protons than neutrons,

..... [1]

(iv) has the electronic structure [2,5],

..... [1]

(v) is an atom of an element from Group VII of the Periodic Table,

..... [1]

(vi) is an atom of a noble gas.

..... [1]

(b) Two of the six atoms shown are isotopes of each other.

(i) What is meant by the term *isotopes*?

.....

..... [2]

(ii) Which **two** of the six atoms shown are isotopes of each other?

..... [1]

(iii) Why do isotopes have identical chemical properties?

.....

..... [1]

[Total: 10]

14. 0620_w17_qp_41 Q: 1

The table gives information about five particles. The particles are all atoms or ions.

particle	number of protons	number of neutrons	number of electrons
A	6	8	6
B	12	12	12
C	13	14	10
D	8	8	10
E	11	12	11

Answer the following questions using the information in the table.
Each particle may be used once, more than once or not at all.

(a) Which particle, **A**, **B**, **C**, **D** or **E**,

(i) is an atom with atomic number 12,

..... [1]

(ii) is an atom with nucleon number 14,

..... [1]

(iii) is an ion with a positive charge,

..... [1]

(iv) has only **one** electron in its outer shell?

..... [1]

(b) **D** is an ion of an element.

Identify the element and write the formula of **D**.

..... [2]

[Total: 6]

15. 0620_w17_qp_43 Q: 1

Substances can be classified as elements, compounds or mixtures.

State whether each of the following is an element, a compound or a mixture.

(a) brass ..... [1]

(b) gold ..... [1]

(c) butane ..... [1]

(d) air ..... [1]

[Total: 4]

---

16. 0620_w17_qp_43 Q: 2

(a) (i) Define the term *molecule*.

.....

..... [2]

(ii) Define the term *element*.

.....

..... [1]

(b) The table shows the composition of four atoms or ions, **A**, **B**, **C** and **D**.

	number of protons	number of neutrons	number of electrons
A	10	10	10
B	10	12	10
C	12	10	10
D	13	14	10

(i) What is the atomic number of **A**?

..... [1]

(ii) What is the nucleon number of **B**?

..... [1]

(iii) Which of **A**, **B**, **C** and **D** are isotopes of each other?

..... [1]

(iv) Which of **A**, **B**, **C** and **D** are atoms?

..... [1]

(v) Which of **A**, **B**, **C** and **D** are positive ions?

..... [1]

(c) Complete the table.

	number of protons	number of electrons
Na		
S^{2-}		
Cl_2		

[3]

[Total: 11]

17. 0620_m16_qp_42 Q: 1

(a) The table below gives information about particles.

Complete the table. The first line has been done for you.

particle	number of protons	number of electrons	electronic configuration	charge on particle
A	12	10	2,8	2+
B		18	2,8,8	1–
C	18		2,8,8	0
D	8	10		

[4]

(b) Gallium is a Group III element.

Define the term *element*.

.....

.....

..... [1]

(c) The following are gallium atoms.

$^{69}_{31}Ga$ $^{71}_{31}Ga$

Complete the following table.

atom	number of protons	number of neutrons	number of electrons
$^{69}_{31}Ga$			
$^{71}_{31}Ga$			

[3]

[Total: 8]

18. 0620_p16_qp_40 Q: 2

The table gives the composition of three particles.

particle	number of protons	number of electrons	number of neutrons
A	15	15	16
B	15	18	16
C	15	15	17

(a) What is the evidence in the table for each of the following?

(i) Particle **A** is an atom.

.....

..... [1]

(ii) **A**, **B** and **C** are all particles of the same element.

.....

..... [1]

(iii) Particles **A** and **C** are isotopes of the same element.

.....

..... [2]

(b) **(i)** What is the electronic structure of particle **A**?

..... [1]

(ii) Is element **A**, a metal or a non-metal? Give a reason for your choice.

.....

..... [1]

[Total: 6]

19. 0620_s16_qp_41 Q: 1

Protons, neutrons and electrons are subatomic particles.

(a) Complete the table to show the relative mass and relative charge of a proton, a neutron and an electron.

particle	relative mass	relative charge
proton		
neutron		
electron	$\frac{1}{1840}$	

[3]

(b) Bromine has two isotopes.

(i) Define the term *isotope*.

.....

..... [2]

(ii) Explain why the two isotopes of bromine have the same chemical properties.

.....

..... [2]

(c) The table shows the number of protons, neutrons and electrons in some atoms and ions.

Complete the table.

particle	number of protons	number of neutrons	number of electrons
$^{7}_{3}Li$			
$^{34}_{16}S^{2-}$			
	19	22	18

[5]

[Total: 12]

20. 0620_s16_qp_42 Q: 2

(a) (i) Define the term *atomic number*.

..... [1]

(ii) Define the term *nucleon number*.

.....

..... [2]

(b) The table shows the number of protons, neutrons and electrons in some atoms or ions.

Complete the table. The first line is given as an example.

particle	number of protons	number of electrons	number of neutrons	symbol or formula
A	6	6	6	$^{12}_{6}C$
B	12	12	12	
C	8			$^{16}_{8}O^{2-}$
D	11	10	13	

[6]

[Total: 9]

21. 0620_m15_qp_32 Q: 2

(a) Define the term *isotope*.

.....

..... [2]

(b) The table gives information about four particles, **A**, **B**, **C** and **D**.

Complete the table.
The first line has been done for you.

particle	number of protons	number of electrons	number of neutrons	nucleon number	symbol or formula
A	6	6	6	12	C
B	11	10	12		
C	8		8		O^{2-}
D		10		28	Al^{3+}

[7]

[Total: 9]

---

22. 0620_s15_qp_32 Q: 1

Complete the following table which gives the number of protons, electrons and neutrons in each of the five particles.

particle	number of protons	number of electrons	number of neutrons
.....	19	19	20
$^{56}_{26}Fe$	.....	.....	.....
.....	3	2	4
$^{70}_{31}Ga^{3+}$	.....	.....	.....
.....	34	36	45

[Total: 8]

---

23. 0620_w15_qp_31 Q: 1

(a) The symbols of six particles are shown below.

Na^+ Ca^{2+} Kr P Si O^{2-}

Select from the list of particles to answer the following questions. A particle may be selected once, more than once or not at all.

(i) Which **two** ions have the same electronic structure? ..... [1]

(ii) Which ion has the same electronic structure as an atom of argon? ..... [1]

(iii) Which atom can form an ion of the type X^{3-}? ..... [1]

(iv) Which atom can form a hydride which has a formula of the type XH_4? ..... [1]

(b) (i) How many protons, neutrons and electrons are there in one copper(II) ion $^{64}_{29}Cu^{2+}$?

number of protons .....

number of neutrons .....

number of electrons .....

[2]

(ii) $^{45}_{21}Sc$ represents an atom of scandium.

How many nucleons and how many charged particles are there in one atom of scandium?

number of nucleons .....

number of charged particles .....

[2]

(c) Two different atoms of sodium are $^{23}_{11}Na$ and $^{24}_{11}Na$.

(i) Explain why these two atoms are isotopes.

.....

..... [2]

(ii) $^{24}_{11}Na$ is radioactive. It changes into an atom of a different element which has one more proton.

Identify this element.

..... [1]

(iii) State **two** uses of radioactive isotopes.

.....

..... [2]

[Total: 13]

24. 0620_s14_qp_31 Q: 1

The table below gives the composition of six particles which are either atoms or ions.

particle	number of protons	number of neutrons	number of electrons
A	33	40	33
B	19	20	18
C	34	45	36
D	33	42	33
E	13	14	13
F	24	28	21

(a) Which particles are atoms? Explain your choice.

.....

..... [2]

(b) Which particle is a negative ion and why has this particle got a negative charge?

.....

..... [2]

(c) Which particles are positive ions?

..... [1]

(d) Explain why particle **A** and particle **D** are isotopes.

.....

..... [2]

[Total: 7]

25. 0620_s13_qp_32 Q: 2

(a) The table below gives the number of protons, neutrons and electrons in atoms or ions. Complete the table. The first line is given as an example.
You will need to use the Periodic Table.

particle	number of protons	number of electrons	number of neutrons	symbol or formula
A	4	4	5	$^{9}_{4}Be$
B	19	18	20	.....
C	30	30	35	.....
D	8	10	8	.....
E	31	31	39	.....

[6]

(b) Using the data in the table, explain how you can determine whether a particle is an atom, a negative ion or a positive ion.

.....

.....

..... [3]

[Total: 9]

01. 0620_m21_ms_42 Q: 1

Question	Answer	Marks
(a)(i)	E	1
(a)(ii)	A I	2
(a)(iii)	D G	2
(a)(iv)	F	1
(a)(v)	H	1
(v)(i)	G **and** I	1
(v)(ii)	A	1
(v)(iii)	B	1
(b)	same proton number different neutron number	2

02. 0620_s21_ms_41 Q: 2

Question	Answer	Marks
	Mg: 12 **and** 13 (1) Cu^{2+}: 29 **and** 27 (1) 37(**above**) **and**17(**below**) (1) *Cl* (1) 1– (1)	5

03. 0620_s21_ms_43 Q: 2

Question	Answer	Marks
	B: 5 and 6 (1) Cl^-: 18 and 18 (1) 54 and 24 (1) Cr (1) 3^+ (1)	5

04. 0620_w21_ms_42 Q: 3

Question	Answer	Marks
(a)	1 mark for each correct row Name / Relative mass / Relative charge Proton / 1 / +1 Neutron / 1 / 0 Electron / 1 / 1840 / –1	3
(b)	Particle / Number of protons / Number of neutrons / Number of electrons $^{32}_{16}S$ / 16 / 16 / 16 $^{39}_{19}K^{+}$ / 19 / 20 / 18 $^{79}_{35}Br^{-}$ / 35 / 44 / 36 M1 = row 1 (1) M2 = row 2 (1) M3 =Br (1) M4 = $^{79}_{35}$ (on left of any symbol) (1) M5 = charge (on any symbol) (1)	5

05. 0620_p20_ms_40 Q: 2

(a) (i) same number of protons and electrons [1]

(ii) all have the same number of protons / same proton number / same atomic number [1]

(iii) same number of protons / same proton number / same atomic number; [1]
different number of neutrons / different nucleon number / different mass number; [1]

(b) (i) 2, 8, 5 [1]

(ii) non-metal because it accepts electrons / needs 3e to complete outer energy level / because it is in Group V or 5e in outer shell [1]
note: need both non-metal and reason for one mark

---

06. 0620_w20_ms_42 Q: 1

Question	Answer	Marks
(a)(i)	A (1) H (1)	2
(a)(ii)	B	1
(a)(iii)	D	1
(a)(iv	C **and** G **OR** C **and** E	1
(b)	F (1) third / outer shell is being filled before second shell is full; second shell has 6 electrons: it should have 8 electrons (1)	2
(c)	12	1
(d)(i)	H^{-}	1
(d)(ii)	aluminium / A*l*	1

07. 0620_w20_ms_43 Q: 2

Question	Answer	Marks
(a)	11	1
(b)	38	1
(c)	2,8,8	1
(d)(i)	B, C and E	1
(d)(ii)	A	1
(d)(iii)	D	1
(d)(iv)	B and C	1

08. 0620_m19_ms_42 Q: 2

(a)	<table><tr><th>number of protons</th><th>electrons</th><th>electronic structure</th><th>charge on particle</th></tr><tr><td>11</td><td>10</td><td>2,8</td><td>**M4 1+ / +1(1)**</td></tr><tr><td>**M1 18(1)**</td><td>18</td><td>**M3 2,8,8(1)**</td><td>0</td></tr><tr><td>**M2 9(1)**</td><td>10</td><td>2,8</td><td>1-</td></tr></table>	4
(b)(i)	*element* **EITHER** (substance) made of **atoms** with the same atomic number / number of protons / proton number **OR** a substance that cannot be split up / broken down into two or more simple(r) substances by chemical means	1
(b)(ii)	**M1** 6 protons in all three rows(1) **M2** 6,7 and 8 neutrons(1)	2

09. 0620_s19_ms_41 Q: 1

(a)	number of protons (1) protons in the nucleus (of an atom) (1)	2
(b)(i)	12p 12n 12e (1) 12p 14n 12e (1)	2
(b)(ii)	isotope(s)	1
(b)(iii)	same number of electrons (1) (same number) of electrons in the outer shell (1)	2
(c)	$^{9}_{4}Be$ any element symbol with a single negative charge (1) use of *Cl* (1) use of $^{37}_{17}$ (1)	4
(d)	2 8 3 (1) 2 8 8 (1)	2

10. 0620_s19_ms_43 Q: 1

(a)	<table><tr><th>particle</th><th>where found in an atom</th><th>relative mass</th><th>relative charge</th></tr><tr><td>electron</td><td>orbiting nucleus</td><td>1/1840</td><td>–1</td></tr><tr><td>proton</td><td>(in the) nucleus</td><td>1</td><td>+1</td></tr><tr><td>neutron</td><td>in the nucleus</td><td>1</td><td>0 / nil</td></tr></table>	3
(b)	**M1** electrons **18** **M2** neutrons **24** **M3** protons **20**	3

11. 0620_w19_ms_43 Q: 1

(a)	<table><tr><th>particle</th><th>charge</th><th>relative mass</th></tr><tr><td>electron</td><td>**M1** –1</td><td></td></tr><tr><td>neutron</td><td>**M2** 0</td><td>**M3** 1</td></tr><tr><td>proton</td><td></td><td>**M4** 1</td></tr></table> (1) (1) **Mark by column**	**2**
(b)	<table><tr><th>number of electrons</th><th>number of neutrons</th><th>number of protons</th><th>symbol</th></tr><tr><td>**M1** 13 (1)</td><td></td><td></td><td></td></tr><tr><td>**M2** 10 (1)</td><td>**M3** 13 (1)</td><td></td><td></td></tr><tr><td></td><td></td><td></td><td>**M4** 19 9 (1) **M5** F (1) **M6** – (1)</td></tr></table>	**6**

12. 0620_s18_ms_42 Q: 3

	<table><tr><th>particles</th><th>number of protons</th><th>number of electrons</th><th>number of neutrons</th><th>number of nucleons</th></tr><tr><td></td><td></td><td></td><td>12 (1)</td><td></td></tr><tr><td></td><td>17 (1)</td><td>18 (1)</td><td></td><td>37 (1)</td></tr><tr><td>Fe (1) 2+ (1)</td><td></td><td></td><td></td><td></td></tr></table>	**6**

13. 0620_s17_ms_43 Q: 1

(a)(i)	**J**	**1**
(a)(ii)	**E**	**1**
(a)(iii)	**D**	**1**
(a)(iv)	**J**	**1**
(a)(v)	**L**	**1**
(a)(vi)	**D**	**1**
(b)(i)	(atoms with) same **number** of protons / atomic number / of same element	**1**
	different **number** of neutrons / different mass number / different nucleon number	**1**
(b)(ii)	**E AND G**	**1**
(b)(iii)	they have the same number of electrons in their outer shell	**1**

14. 0620_w17_ms_41 Q: 1

(a)(i)	**B**	**1**
(a)(ii)	**A**	**1**
(a)(iii)	**C**	**1**
(a)(iv)	**E**	**1**
(b)	O^{2-} **M1** O **M2** $^{2-}$	**2**

15. 0620_w17_ms_43 Q: 1

(a)	mixture	1
(b)	element	1
(c)	compound	1
(d)	mixture	1

16. 0620_w17_ms_43 Q: 2

(a)(i)	(two or more) **atoms**	1
	combined / joined / sharing electrons (by a covalent bond) / bonded	1
(a)(ii)	substance that cannot be split up / broken down / decomposed (into anything simpler) **OR** (substance) made of **atoms** with the same atomic number / number of protons / proton number	1
(b)(i)	10	1
(b)(ii)	22	1
(b)(iii)	A **AND** B	1
(b)(iv)	A **AND** B	1
(b)(v)	C **AND** D	1
(c)	<table><tr><th></th><th>number of protons</th><th>number of electrons</th></tr><tr><td>Na</td><td>11</td><td>11</td></tr><tr><td>S^{2-}</td><td>16</td><td>18</td></tr><tr><td>Cl_2</td><td>34</td><td>34</td></tr></table>	3

17. 0620_m16_ms_42 Q: 1

(a)	B = 17; C = 18; D = 2,8; 2^- / $^-2$;	4
(b)	Substance that cannot be broken down into anything simpler / substance that cannot be broken down (by chemical means) / substance containing **atoms** with the same atomic number or proton number;	1
(c)	<table><tr><th>number of protons</th><th>number of neutrons</th><th>number of electrons</th></tr><tr><td>31</td><td>38</td><td>31</td></tr><tr><td>31</td><td>40</td><td>31</td></tr></table> **M1** column one; **M2** column two; **M3** column three;	3

18. 0620_p16_ms_40 Q: 2

(a) (i) same number of protons and electrons [1]

(ii) all have the same number of protons / same proton number / same atomic number [1]

(iii) same number of protons / same proton number / same atomic number; [1]
different number of neutrons / different nucleon number / different mass number; [1]

(b) (i) 2, 8, 5 [1]

(ii) non-metal because it accepts electrons / needs 3e to complete outer energy level / because it is in Group V or 5e in outer shell [1]
note: need both non-metal and reason for one mark

19. 0620_s16_ms_41 Q: 1

(a)	<table><tr><th>particle</th><th>relative mass</th><th>relative charge</th></tr><tr><td>proton</td><td>1</td><td>+1</td></tr><tr><td>neutron</td><td>1</td><td>nil</td></tr><tr><td>electron</td><td>1/1840</td><td>–1</td></tr></table>	3
(b)(i)	**M1** atom(s) of the same element; **M2** with different number of neutrons;	2 1 1
(b)(ii)	**M1** (both have) the same number of electrons; **M2** in the outer shell;	2 1 1
(c)	<table><tr><th>particle</th><th>number of protons</th><th>number of neutrons</th><th>number of electrons</th></tr><tr><td>$^{7}_{3}Li$</td><td>3</td><td>4</td><td>3</td></tr><tr><td>$^{34}_{16}S^{2-}$</td><td>16</td><td>18</td><td>18</td></tr><tr><td>$^{41}_{19}K^{+}$</td><td>19</td><td>22</td><td>18</td></tr></table>	5

20. 0620_s16_ms_42 Q: 2

(a)(i)	number of protons in one atom of an element;	1
(a)(ii)	**M1** number of protons and neutrons in one atom of an element; **M2** in one atom of an element;	2 1 1
(b)	<table><tr><td>A</td><td>6</td><td>6</td><td>6</td><td>$^{12}_{6}C$</td></tr><tr><td>B</td><td>12</td><td>12</td><td>12</td><td>$^{24}_{12}Mg$;</td></tr><tr><td>C</td><td>8</td><td>10;</td><td>8;</td><td>$^{16}_{8}O^{2-}$</td></tr><tr><td>D</td><td>11</td><td>10</td><td>13</td><td>$^{24}_{11}Na^{+}$ 11, 24; Na;+;</td></tr></table>	6

21. 0620_m15_ms_32 Q: 2

(a) Atoms of the same element / atoms with same proton number / atoms with same atomic number [1]

different neutron number / nucleon number / mass number [1]

(b)

particle	number of protons	number of electrons	number of neutrons	nucleon number	symbol or formula
A					
B				23 (1)	Na(1) $^{+}$(1)
C		10(1)		16(1)	
D	13 (1)		15 (1)		

[7]

[Total:9]

22. 0620_s15_ms_32 Q: 1

	$^{39}_{19}K$; 26p 26e 30n All three for 1 mark; $^{7}_{3}Li^{+}$ numbers and symbol; charge +; 31p 28e 39n All three for 2 marks, any two for 1 mark; $^{79}_{34}Se^{2-}$ numbers and symbol; charge 2^{-};	8	

23. 0620_w15_ms_31 Q: 1

(a)(i)	Na^{+}/sodium **and** O^{2-}/oxide;	1
(a)(ii)	Ca^{2+}/calcium;	1
(a)(iii)	P/phosphorus;	1
(a)(iv)	Si/silicon;	1
(b)(i)	• *number of protons* = 29; • *number of neutrons* = 35; • *number of electrons* = 27; three correct = [2]; two correct = [1]	2
(b)(iii)	*number of nucleons* = 45; *number of charged particles* = 42;	1 1
(c)(i)	have same proton number/same element/same atomic number; different number of neutrons/nucleons/mass number;	1 1
(c)(ii)	magnesium/Mg;	1
(c)(iii)	any two from: • treating cancer or radiotherapy; • biological tracer; • thickness (of paper or foil); • (checking for) leaks/cracks (in pipes); • (carbon) dating; • (generating) energy/electricity; • smoke detectors; • fill levels in packages; • sterilising surgical instruments;	2

24. 0620_s14_ms_31 Q: 1

(a) A, D, E (1)

same number of protons and electrons/electrically neutral (1) [2]

(b) C (1)

more electrons than protons/$36e^{-}$ and $34p^{+}$/it has gained electrons (1) [2]

(c) B, F (1) [1]

(d) they have same number of protons (1)

different number of neutrons/neutron number (1) [2]

[Total: 7]

25. 0620_s13_ms_32 Q: 2

(a) B $^{39}_{19}K$ [1]
positive charge + [1]

C $^{65}_{30}Zn$ [1]

D $^{16}_{8}O$ [1]
charge 2– [1]

E $^{70}_{31}Ga$ [1]

(b) number of p = number of e [1]

number of p > number of e [1]

number of p < number of e [1]