1 The Periodic Table is very useful to chemists.

Refer only to elements with atomic numbers 1 to 36 in the Periodic Table provided when answering this question.

Use information from the Periodic Table provided to identify one element which:

(a) has atoms with exactly 9 protons ..... [1]

(b) has atoms with 0 neutrons ..... [1]

(c) has atoms with exactly 23 electrons ..... [1]

(d) has atoms with an electronic structure of 2,8,6 ..... [1]

(e) forms ions with a charge of 3– containing 18 electrons ..... [1]

(f) forms ions with a charge of 2+ containing 10 electrons ..... [1]

(g) has a relative atomic mass that shows it has at least **two** isotopes. ..... [1]

[Total: 7]

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

[5]

[Total: 5]

3 This question is about the structures of atoms and ions.

(a) 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]

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

..... [1]

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

.....

..... [2]

[Total: 5]

4 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]

[Total: 4]

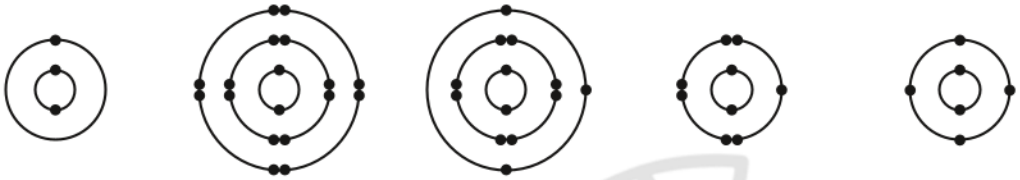
5 Complete the table to show the number of electrons, neutrons and protons in each atom and ion.

	number of electrons	number of neutrons	number of protons
$^{35}_{17}Cl$			
$^{37}_{17}Cl^-$			

[3]

[Total: 3]

6 The electronic structures of five atoms, **A**, **B**, **C**, **D** and **E**, are shown.



A **B** **C** **D** **E**

Answer the following questions about these electronic structures.
Each electronic structure may be used once, more than once or not at all.

State which electronic structure, **A**, **B**, **C**, **D** or **E**, represents an atom:

(a) of an element in Group III of the Periodic Table.

..... [1]

(b) of a monatomic gas

..... [1]

(c) of carbon

..... [1]

(d) which has 18 protons

..... [1]

(e) which forms a stable ion with a single negative charge.

..... [1]

[Total: 5]

7 A sulfide ion has the symbol shown.

$$^{34}_{16}S^{2-}$$

(a) How many neutrons are contained in this sulfide ion?

..... [1]

(b) How is a sulfide ion, S^{2-}, formed from a sulfur atom?

..... [1]

(c) Which element forms an ion with a 2+ charge that has the same number of electrons as a S^{2-} ion?

..... [1]

[Total: 3]

8 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: 3]

9 Atoms contain particles called electrons, neutrons and protons.

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		

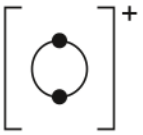
[3]

[Total: 3]

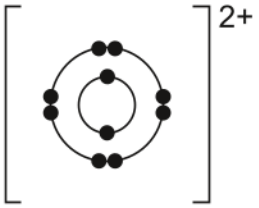
10 The electronic structures of some atoms and ions are shown.

A

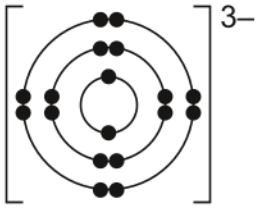
B



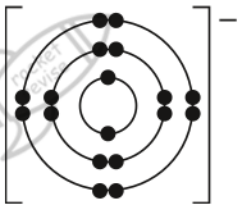
C



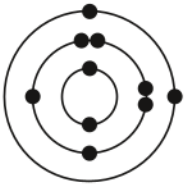
D



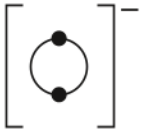
E



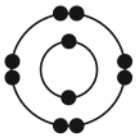
F



G



H



(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]

11 Two isotopes of flerovium, atomic number 114, are $^{286}\mathrm{F}l$ and $^{289}\mathrm{F}l$. The nuclei of both of these isotopes are unstable and emit energy when they split up.

(a) State the term used to describe isotopes with unstable nuclei.

..... [1]

(b) Complete the table to show the number of protons, neutrons and electrons in the atoms of the isotopes shown.

isotope	number of protons	number of neutrons	number of electrons
$^{286}\mathrm{F}l$			
$^{289}\mathrm{F}l$			

[2]

[Total: 3]

12 Flerovium, Fl, atomic number 114, was first made in research laboratories in 1998.

(a) Flerovium was made by bombarding atoms of plutonium, Pu, atomic number 94, with atoms of element **Z**.

- The nucleus of one atom of plutonium combined with the nucleus of one atom of element **Z**.
- This formed the nucleus of **one** atom of flerovium.

Suggest the identity of element **Z**.

..... [1]

(b) In which period of the Periodic Table is flerovium?

..... [1]

(c) Predict the number of outer shell electrons in an atom of flerovium.

..... [1]

[Total: 3]

13 Complete the table to show the number of nucleons, neutrons and electrons in an $^{27}_{13}Al^{3+}$ ion.

	number in $^{27}_{13}Al^{3+}$
nucleons	
neutrons	
electrons	

[3]

[Total: 3]

14 Complete the table.

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

[3]

[Total: 3]

15 Complete the table to show the electronic structure of the atoms and ions.

	electronic structure
F	2,7
Si	
Ca^{2+}	
N^{3-}	

[3]

[Total: 3]

16 Chlorine is in Group VII of the Periodic Table.

Two isotopes of chlorine are chlorine-35 and chlorine-37.

State why these two isotopes of chlorine have the same chemical properties.

.....

.....

..... [2]

[Total: 2]

17 Sulfur exists as a number of different isotopes.

What is meant by the term *isotopes*?

.....

.....

..... [2]

[Total: 2]

18 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]

[Total: 2]

19 $^{22}_{11}Na$, $^{23}_{11}Na$ and $^{24}_{11}Na$ are isotopes of sodium.

(a) Describe how these sodium isotopes are the same and how they are different in terms of the total number of protons, neutrons and electrons in each.

same .....

.....

different .....

..... [3]

(b) Why do all **three** isotopes have an overall charge of zero?

.....

..... [1]

(c) Why do all **three** isotopes have the same chemical properties?

.....

..... [2]

(d) Why do sodium ions have a charge of +1?

.....

..... [1]

[Total: 7]

20 The table gives some information about four different particles, **A**, **B**, **C** and **D**.

particle	number of electrons	number of neutrons	number of protons	electronic structure	charge on particle
A	11	12	11	2,8,1	0
B		14	11	2,8,1	0
C	18	20		2,8,8	0
D	18	20	17		

(a) Complete the table. The first row has been done for you. [4]

(b) Give **two** particles from the table which are isotopes of each other.

..... [1]

(c) Element **Z** is in the same group of the Periodic Table as **A** and is less reactive than **A**.

State the identity of element **Z**.

..... [1]

(d) **C** is unreactive.

Use information from the table to explain why.

..... [1]

[Total: 7]

21 The table gives information about atoms and ions **A**, **B** and **C**.

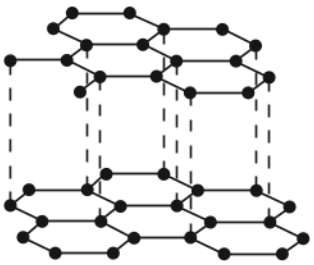
Complete the table.

	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	

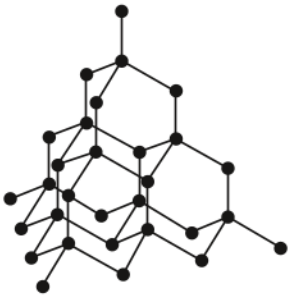
[6]

[Total: 6]

22 Two macromolecular forms of carbon are graphite and diamond. The structures of graphite and diamond are given below.



graphite



diamond

(a) Explain in terms of its structure why graphite is soft and is a good conductor of electricity.

.....

.....

.....

.....

..... [3]

(b) State **two** uses of graphite which depend on the above properties.

It is soft .....

.....

It is a good conductor of electricity .....

..... [2]

[Total: 5]

23 Define the term *proton number*.

.....

..... [2]

[Total: 2]

24 Complete the table to show the number of electrons, protons and neutrons in the sulfur atom and copper ion shown.

	number of electrons	number of neutrons	number of protons
$^{34}_{16}S$			
$^{63}_{29}Cu^{2+}$			29

[4]

[Total: 4]

25 Sodium is in Group I of the Periodic Table.

Describe the structure of a sodium atom.
In your answer refer to,

- the type and number of each subatomic particle present,
- the charges on each type of subatomic particle,
- the position of each type of subatomic particle in the atom.

.....

.....

.....

.....

.....

.....

..... [5]

[Total: 5]

26 In the Periodic Table, the elements are arranged in columns called Groups and in rows called Periods.

(a) Complete the table for some of the elements in Period 3.

group number	I	II	III	IV	V	VI	VII
symbol	Na	Mg	A*l*	Si	P	S	C*l*
number of valency electrons							
valency							

[2]

(b) What is the relationship between the group number and the number of valency electrons?

.....

..... [1]

(c) Explain the relationship between the number of valency electrons and the valency

for the elements Na to A*l*,

.....

.....

.....

for the elements P to C*l*.

.....

.....

.....

[4]

[Total: 7]

27 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]

28 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]

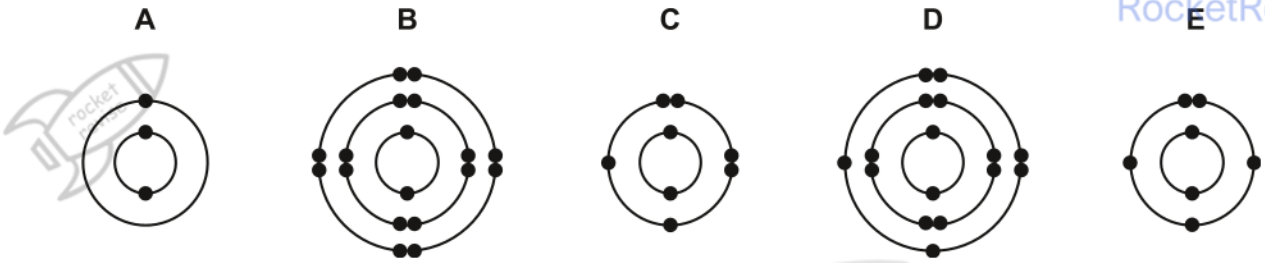
(b) **D** is an ion of an element.

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

..... [2]

[Total: 6]

29 The electronic structures of five atoms, **A**, **B**, **C**, **D** and **E**, are shown.



Answer the following questions about these structures.

Each structure may be used once, more than once or not at all.

State which structure, **A**, **B**, **C**, **D** or **E**, represents:

(a) an atom with a total of eight electrons ..... [1]

(b) an atom in Group V of the Periodic Table ..... [1]

(c) an atom with a complete outer shell of electrons ..... [1]

(d) an atom of a metallic element ..... [1]

(e) an atom which forms a stable ion with a single positive charge..... [1]

[Total: 5]

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

Complete the table

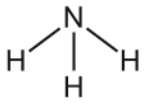
	number of protons	number of electrons	electronic structure	charge
A	11	10	2,8	
B		18		0
C		10	2,8	–1

[4]

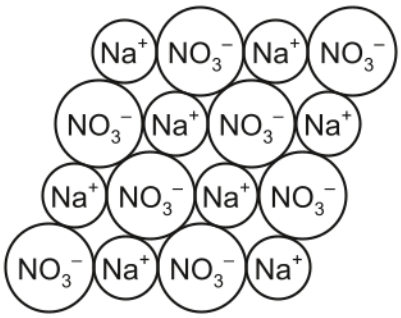
[Total: 4]

31 The structures of five substances are shown below.

A

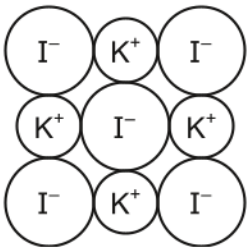


B

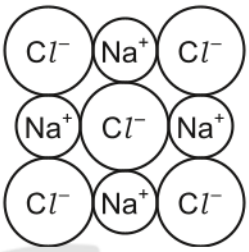


C

D



E



Complete the following sentences about compounds **A** and **E** using words from the list below.

atoms **gas** **giant** **ions** **liquid** **molecular** **polymer** **solid**

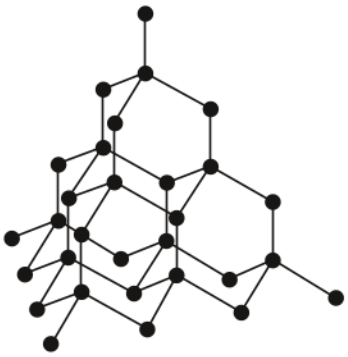
Compound **A** is a ..... at room temperature. It does not conduct electricity

because it has a simple ..... structure. Compound **E** does not conduct

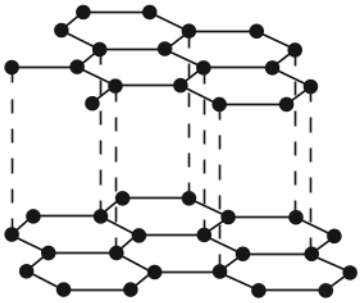
electricity when it is ..... because its ..... cannot move. [4]

[Total: 4]

32 The structures of diamond and graphite are shown below.



diamond



graphite

(a) Explain how the structure of diamond relates to its use in cutting hard materials.

.....

.....

..... [2]

(b) Explain how the structure of graphite relates to its use as a lubricant.

.....

.....

..... [2]

[Total: 4]

33 In the 1860s, John Newlands listed the elements in order of increasing atomic mass. Part of his table is shown.

H 1	Li 2	Be 3	B 4	C 5	N 6	O 7
F 8	Na 9	Mg 10	Al 11	Si 12	P 13	S 14
Cl 15	K 16	Ca 17	Cr 18	Ti 19	Mn 20	Fe 21

(a) **(i)** Describe the differences between Newlands' table and the Periodic Table we use today.

.....

.....

.....

.....

..... [3]

(ii) What evidence is there, from Newlands' table, that some elements with similar properties are grouped together?

.....

..... [1]

[Total: 4]

34 The table below shows the number of electrons, protons and neutrons in some isotopes of helium, argon and neon.

Complete the table.

element	number of electrons	number of protons	number of neutrons
$^{3}_{2}He$	2	2	.....
$^{38}_{18}Ar$	.....	18	20
.....	10	10	11

[3]

[Total: 3]

35 State the electronic structure of the following atom and ion.

Al .....

S^{2-} .....

[2]

[Total: 2]