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1 The table shows the ions present in a 1000 cm^3 sample of blood plasma.

ion present	formula of ion	mass present in the 1000 cm^3 sample / g
sodium	Na^+	3.25
potassium	K^+	0.16
calcium	Ca^{2+}	0.10
magnesium	Mg^{2+}	0.04
chloride	$C\ell^-$	3.65
hydrogencarbonate	HCO_3^-	1.50
phosphate	PO_4^{3-}	0.64
sulfate	SO_4^{2-}	0.10

Answer these questions using only information from the table.

(a) Which positive ion is present in the lowest concentration?

..... [1]

(b) Give the name of the compound formed from K^+ and $C\ell^-$ ions.

..... [1]

(c) Calculate the mass of potassium ions present in 200 cm^3 of this blood plasma.

mass of potassium ions = ...g [1]

(d) When the 1000 cm^3 sample of blood plasma is crystallised, several compounds are formed.

Suggest the name of the compound which forms the greatest mass of crystals.

..... [1]

[Total: 4]

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

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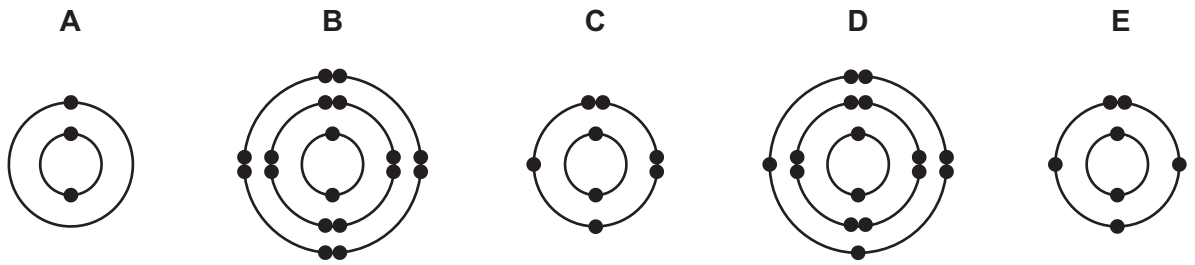

Answer the following questions about these structures.

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]

3 Complete the table to show the number of electrons, neutrons and protons in the carbon atom and potassium ion shown.

	number of electrons	number of neutrons	number of protons
$^{14}_{6}C$	6		
$^{40}_{19}K^{+}$		21	

[3]

[Total: 3]

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

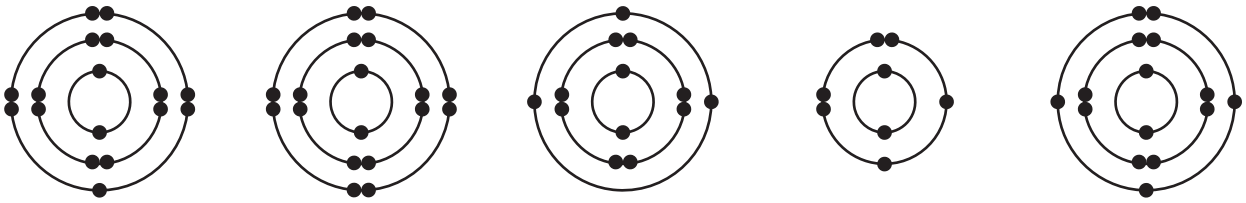
	number of electrons	number of neutrons	number of protons
$^{22}_{10}Ne$	10		
$^{65}_{29}Cu^{+}$		36	

[3]

[Total: 3]

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

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



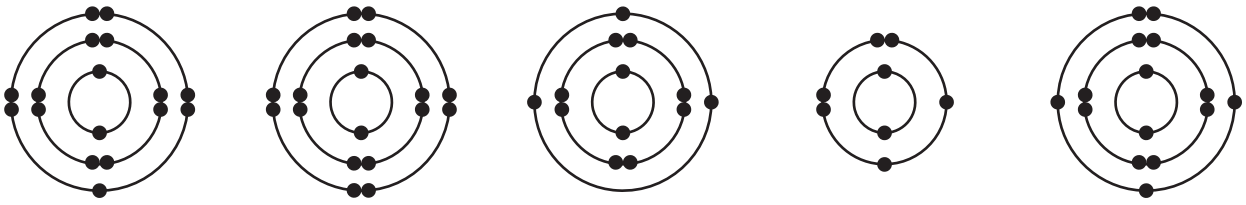
State which structure, **A**, **B**, **C**, **D** or **E**, represents an atom of phosphorus.

..... [1]

[Total: 1]

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

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



State which structure, **A**, **B**, **C**, **D** or **E**, represents an atom with a proton number of 13.

..... [1]

[Total: 1]

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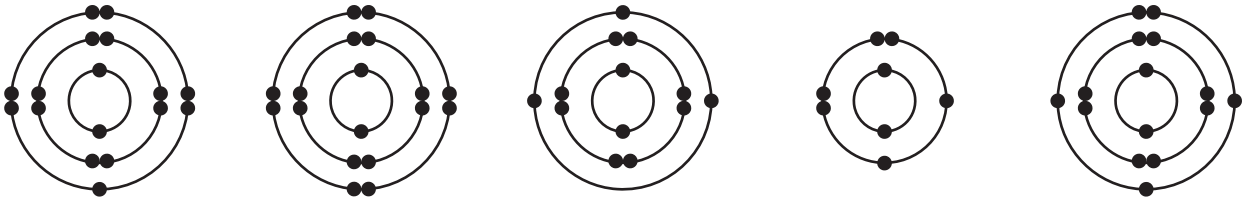
7 The electronic structures of five atoms, **A**, **B**, **C**, **D** and **E**, are shown.

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



State which structure, **A**, **B**, **C**, **D** or **E**, represents an atom which forms a stable ion with a single negative charge.

..... [1]

[Total: 1]

8 Magnesium, calcium and strontium are Group II elements.

Complete the table to show the arrangement of electrons in a calcium atom.

shell number	1	2	3	4
number of electrons				

[1]

[Total: 1]

9 Magnesium, calcium and strontium are Group II elements.

Describe how the arrangement of electrons in a strontium atom is:

(a) similar to the arrangement of electrons in a calcium atom

.....

..... [1]

(b) different from the arrangement of electrons in a calcium atom.

.....

..... [1]

[Total: 2]

10 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

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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]

11 What is meant by the term *isotopes*?

.....

.....

..... [2]

[Total: 2]

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12 An atom of an isotope of fluorine is represented by the symbol shown.

$$^{19}_{9}F$$

Describe the structure of an atom of this isotope of fluorine.

In your answer, include:

- the position of the protons, neutrons and electrons in the atom
- the number of protons, neutrons and electrons present in the atom.

.....

.....

.....

.....

.....

.....

..... [5]

[Total: 5]

13 The names of nine gases are given.

ammonia

carbon monoxide

chlorine

ethane

ethene

helium

hydrogen

neon

oxygen

State which gas is a monatomic gas with ten protons in its nucleus.

..... [1]

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[Total: 1]

14 Complete the sentence about isotopes using words from the list.

atomic compound element ions molecular nucleons

Isotopes are atoms of the same ..... which have the same

..... number but different numbers of ..... . [3]

[Total: 3]

15 The names of seven gases are given.

ammonia
ethene
helium
hydrogen
hydrogen chloride
methane
nitrogen

State which gas has molecules which each contain 14 protons.

..... [1]

[Total: 1]

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16 An atom of an isotope of oxygen is represented by the symbol shown.

$^{17}_{8}O$

Describe the structure of an atom of this isotope of oxygen.

In your answer, include:

- the position of the protons, neutrons and electrons in the atom
- the number of protons, neutrons and electrons present in the atom.

.....

.....

.....

.....

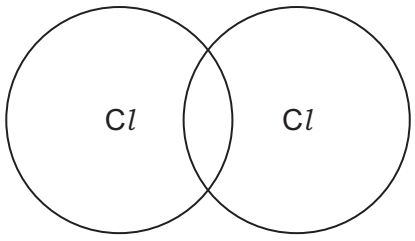
.....

.....

..... [5]

[Total: 5]

17 Complete the dot-and-cross diagram to show the electron arrangement in a molecule of chlorine. Show outer shell electrons only.



[2]

[Total: 2]

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18 An atom of an isotope of nitrogen is represented by the symbol shown.

$^{15}_{7}N$

Describe the structure of an atom of this isotope of nitrogen.
In your answer, include:

- the position of the protons, neutrons and electrons in the atom
- the number of protons, neutrons and electrons present in the atom.

.....

.....

.....

.....

.....

.....

..... [5]

[Total: 5]

19 Which **two** statements about isotopes are correct?

Tick **two** boxes.

Isotopes of the same element have different numbers of protons. ☐

Isotopes of the same element have different numbers of neutrons ☐

Isotopes are always radioactive. ☐

The isotope $^{235}_{92}U$ is a source of energy. ☐

$^{14}_{6}C$ and $^{14}_{7}N$ are isotopes of each other. ☐

[2]

[Total: 2]

20 Write the electronic structure of a sodium atom.

..... [1]

[Total: 1]

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21 Substances can be classified as elements, compounds or mixtures.

What is meant by the term *compound*?

.....

.....

..... [2]

[Total: 2]

22 Two isotopes of flerovium, atomic number 114, are ^{286}Fl and ^{289}Fl. 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}Fl			
^{289}Fl			

[2]

[Total: 3]

23 Flerovium, F*l*, 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]

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

..... [1]

[Total: 3]

24 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]

25 ^{29}Al is a radioactive isotope of aluminium. The only non-radioactive isotope of aluminium is ^{27}Al.

Describe, in terms of protons, neutrons and electrons, how the isotopes ^{29}Al and ^{27}Al are similar and how they are different.

how they are similar.....

how they are different..... [2]

[Total: 2]

26 A compound of cobalt is $Co(OH)_3$.

Deduce the charge on the cobalt ion in $Co(OH)_3$.

..... [1]

[Total: 1]

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27 An isotope of oxygen is represented by the symbol shown.

$^{17}_{8}O$

Deduce the number of protons, neutrons and electrons in this isotope of oxygen.

number of protons .....

number of neutrons .....

number of electrons ..... [3]

[Total: 3]

28 The table shows the mass of each type of ion present in a 100 cm^3 sample of milk.

name of ion	formula of ion	mass of ion present in 100 cm^3 milk / mg
calcium	Ca^{2+}	125
chloride	Cl^-	120
	Mg^{2+}	12
phosphate	PO_4^{3-}	95
potassium	K^+	140
sodium	Na^+	58
	SO_4^{2-}	30
negative ions of organic acids		160

(a) Calculate the mass of calcium ions present in a 20 cm^3 sample of this milk.

mass of calcium ions = ... mg [1]

(b) Which positive ion is present in the highest concentration in this sample of milk?

..... [1]

(c) Name the compound formed from Mg^{2+} and SO_4^{2-} ions.

..... [1]

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(d) Describe a test for chloride ions.

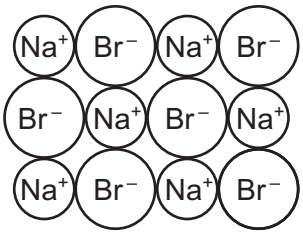
test .....

.....

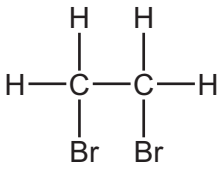
result ..... [3]

[Total: 6]

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



A



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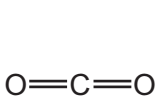
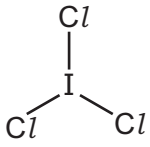
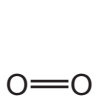


C



D



E

Answer the following questions using only the substances in the diagram.

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

(a) State which substance, **A**, **B**, **C**, **D** or **E** is a diatomic molecule.

..... [1]

(b) State which substance, **A**, **B**, **C**, **D** or **E** contains bromide ions.

..... [1]

(c) State which substance, **A**, **B**, **C**, **D** or **E** is an element.

..... [1]

[Total: 3]

30 Isotopes of hydrogen are present in Neptune's atmosphere.

What is meant by the term *isotopes*?

.....

..... [1]

[Total: 1]

31 The table shows the properties of four substances.

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substance	boiling point	electrical conductivity of solid	electrical conductivity when molten	density in g / cm^3
graphite				2.25
iodine	low	does not conduct	does not conduct	4.93
potassium	high		conducts	0.86
zinc chloride	high	does not conduct	conducts	2.91

(a) Complete the table to show the electrical conductivity of solid graphite and solid potassium. [2]

(b) Give **one** piece of evidence from the table that shows that iodine is a simple covalent substance.

..... [1]

(c) What information in the table shows that zinc chloride is an ionic compound?

.....

..... [2]

[Total: 5]

32 An atom of phosphorus has 31 nucleons.

Deduce the number of protons and neutrons present in **one** atom of phosphorus.
Use your Periodic Table to help you.

number of protons .....

number of neutrons ..... [2]

[Total: 2]

33 An atom of hydrogen has three nucleons.

Deduce the number of protons and neutrons present in **one** atom of this isotope of hydrogen.
Use your Periodic Table to help you.

number of protons.....

number of neutrons..... [2]

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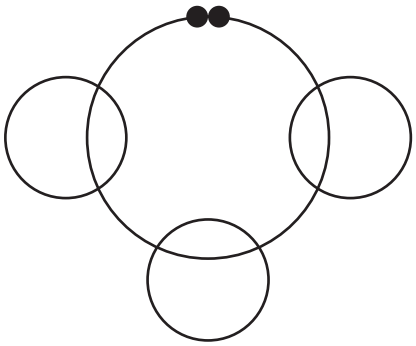
[Total: 2]

34 Ammonia is a covalent compound.

Complete the diagram to show:

- the arrangement of electrons in a molecule of ammonia,
- the symbols of the atoms present.

Show outer electrons only.



[2]

[Total: 2]

35 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]

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

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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]

37 Complete the table.

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

[3]

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[Total: 3]

38 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

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

..... [1]

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

..... [1]

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

..... [1]

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

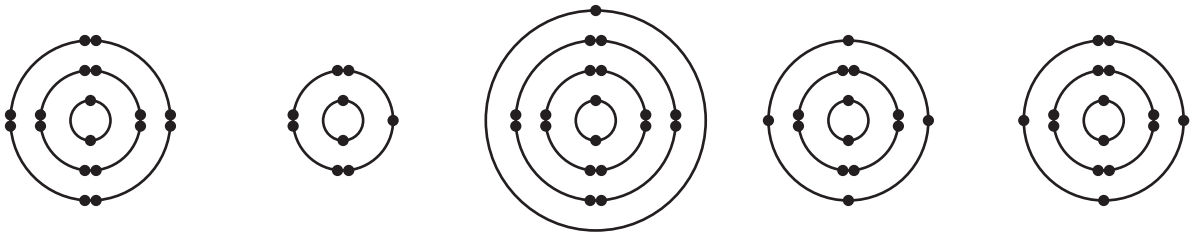
..... [1]

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

..... [1]

[Total: 5]

39 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 atoms.
Each atom may be used once, more than once or not at all.

Which atom, **A**, **B**, **C**, **D** or **E**,

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(a) has a complete outer shell of electrons,

..... [1]

(b) has a proton number of 15,

..... [1]

(c) has 4 shells containing electrons,

..... [1]

(d) is a fluorine atom,

..... [1]

(e) is an atom of a metallic element?

..... [1]

[Total: 5]

40 Complete the table to show the number of electrons, neutrons and protons in the chlorine atom and bromide ion shown.

	number of electrons	number of neutrons	number of protons
$^{35}_{17}Cl$	17		
$^{79}_{35}Br^-$		44	

[3]

[Total: 3]

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