Q1.

This question is about atomic structure.

(c) Why is the mass number different in the two isotopes?

_____

_____

(1)

(d) The model of the atom changed as new evidence was discovered.

The plum pudding model suggested that the atom was a ball of positive charge with electrons embedded in it.

Evidence from the alpha particle scattering experiment led to a change in the model of the atom from the plum pudding model.

Explain how.

_____

_____

_____

_____

_____

_____

_____

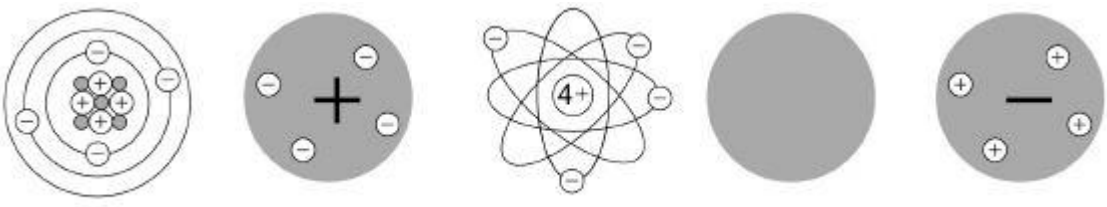
_____

(4)

(Total 8 marks)

Q2.

The diagram below represents different models of the atom.



A B C D E

(a) Which diagram shows the plum pudding model of the atom?

Tick **one** box.

A		B		C		D		E	

(1)

(b) Which diagram shows the model of the atom developed from the alpha particle scattering experiment?

Tick **one** box.

A		B		C		D		E	

(1)

(c) Which diagram shows the model of the atom resulting from Bohr's work?

Tick **one** box.

A		B		C		D		E	

(1)

(d) Define the mass number of an atom.

_____

_____

(1)

(e) Element **X** has two isotopes. Their mass numbers are 69 and 71

The percentage abundance of each isotope is:

- 60% of ^{69}**X**
- 40% of ^{71}**X**

Estimate the relative atomic mass of element **X**.

Tick **one** box.

< 69.5	
Between 69.5 and 70.0	
Between 70.0 and 70.5	
> 70.5	

(1)

(f) Chadwick's experimental work on the atom led to a better understanding of isotopes.

Explain how his work led to this understanding.

(3)

(Total 8 marks)

Q3.

(a) Dmitri Mendeleev was one of the first chemists to classify the elements by arranging them in order of their atomic weights. His periodic table was published in 1869.

How did Mendeleev know that there must be undiscovered elements **and** how did he take this into account when he designed his periodic table?

(2)

(b) By the early 20th century protons and electrons had been discovered.

Describe how knowledge of the numbers of protons and electrons in atoms allow chemists to place elements in their correct order and correct group.

(3)

(c) (TRIPLE) The transition elements are a block of elements between Groups 2 and 3

of the periodic table.

(i) Transition elements have similar properties.

Explain why, in terms of electronic structure.

_____

_____

_____

_____

(2)

(ii) There are **no** transition elements between the Group 2 element magnesium and the Group 3 element aluminium.

Give a reason why, in terms of electronic structure.

_____

_____

_____

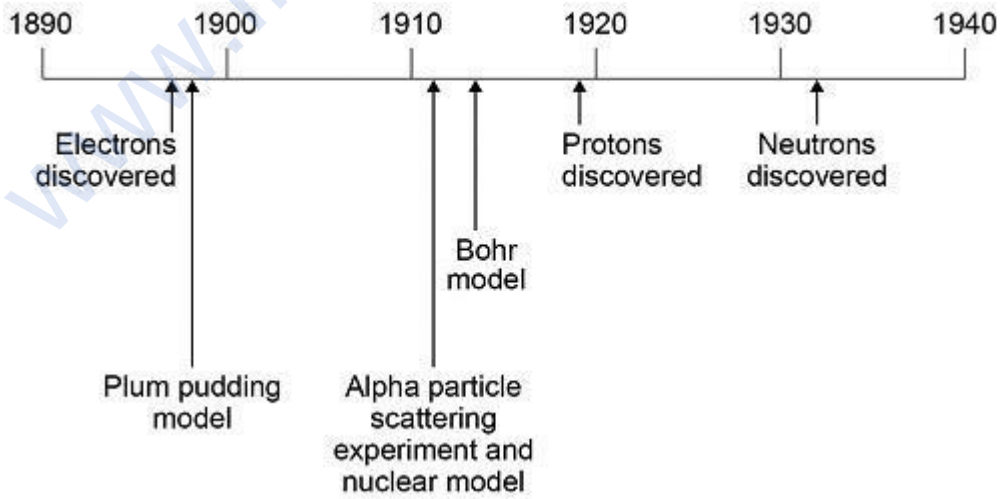
(1)

(Total 8 marks)

Q4.

This question is about the development of scientific theories.

The diagram below shows a timeline of some important steps in the development of the model of the atom.



(a) The plum pudding model did not have a nucleus.

Describe **three** other differences between the nuclear model of the atom and the plum pudding model.

1 _____

_____

_____

2 _____

_____

_____

3 _____

_____

_____

(3)

(b) Niels Bohr adapted the nuclear model.

Describe the change that Bohr made to the nuclear model.

_____

_____

_____

_____

(2)

(c) Mendeleev published his periodic table in 1869.

Mendeleev arranged the elements in order of atomic weight.

Mendeleev then reversed the order of some pairs of elements.

A student suggested Mendeleev's reason for reversing the order was to arrange the elements in order of atomic number.

Explain why the student's suggestion **cannot** be correct.

Use the diagram above.

_____

_____

_____

_____

(2)

(d) Give the correct reason why Mendeleev reversed the order of some pairs of elements.

_____

_____

(1)

(Total 8 marks)

Q5.

This question is about the periodic table.

The figure below shows an early version of the periodic table published by a scientist.

H							
Li	Be	B	C	N	O	F	
Na	Mg	Al	Si	P	S	Cl	
K Cu	Ca Zn	? ?	Ti ?	V As	Cr Se	Mn Br	Fe Co Ni
Rb Ag	Sr Cd	Y In	Zr Sn	Nb Sb	Mo Te	? I	Ru Rh Pd

(a) The scientist left gaps in the periodic table in the figure above.

Each gap is represented by a question mark (**?**).

Give **one** reason why the scientist left gaps in this periodic table.

_____

_____

(1)

(b) Which scientist published the periodic table in above figure?

Tick (✓) **one** box.

Bohr ☐

Chadwick ☐

Mendeleev ☐

(1)

(c) The modern periodic table is different from the periodic table in above figure.

One extra group of elements has been added.

What is the name of the extra group of elements in the modern periodic table?

Tick (✓) **one** box.

Alkali metals ☐

Halogens ☐

Noble gases ☐

(1)

(d) Why do the elements in Group 1 of the modern periodic table have similar chemical properties?

Tick (✓) **one** box.

The elements all form negative ions. ☐

The elements all have one electron in the outer shell. ☐

The elements all have the same number of shells. ☐

(1)

(e) **Table 1** shows the melting points of the first five elements going down Group 1.

Table 1

Element	**Melting point in °C**
Lithium	181
Sodium	98
Potassium	**X**
Rubidium	39
Caesium	29

Predict value **X**.

X = _____ °C

(1)

(f) Give **one** observation you would see when a small piece of potassium is added to water.

_____

_____

(1)

(g) **Table 2** shows information about the first five elements going down Group 7.

Table 2

Element	State at 150 °C	Symbol	Formula of the compound with hydrogen
Fluorine	gas	F	HF
Chlorine	_____	Cl	HCl
Bromine	gas	Br	HBr
Iodine	liquid	I	HI
Astatine	solid	At	_____

Complete **Table 2**.

(2)

(h) The elements in Group 7 consist of molecules.

What is the formula of a molecule of bromine?

Tick (✓) **one** box.

Br ☐

Br_2 ☐

Br^2 ☐

2Br ☐

(1)

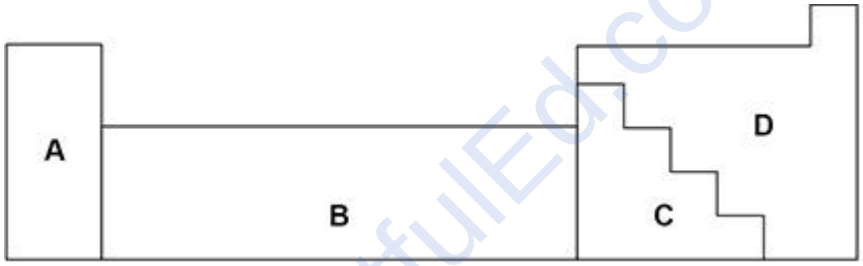
(Total 9 marks)

Q6.

This question is about metals and non-metals.

Figure 1 shows an outline of part of the periodic table.

Figure 1



(a) Element **Q** is a dull solid with a melting point of 44 °C.

Element **Q** does not conduct electricity.

Which section of the periodic table in **Figure 1** is most likely to contain element **Q**?

Tick (✓) **one** box.

A ☐ **B** ☐ **C** ☐ **D** ☐

(1)

(b) Element **R** forms ions of formula R^{2+} and R^{3+}

Which section of the periodic table in **Figure 1** is most likely to contain element **R**?

Tick (✓) **one** box.

A ☐ **B** ☐ **C** ☐ **D** ☐

(1)

(c) Give **two** differences between the physical properties of the elements in Group 1 and those of the transition elements.

1 _____

_____

2 _____

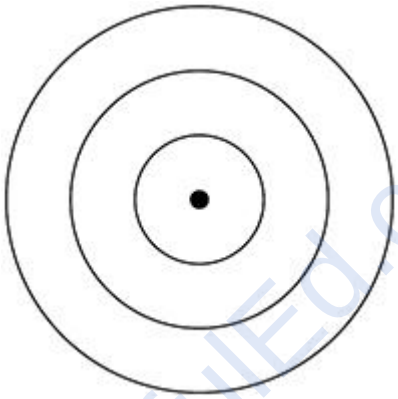
_____

(2)

(d) Complete **Figure 2** to show the electronic structure of an aluminium atom.

Use the periodic table.

Figure 2



(1)

(f) Name the type of bonding in compounds formed between metals and non-metals.

_____

(1)

Q7.

This question is about elements, compounds and mixtures.

(a) Substance **A** contains only one type of atom.

Substance **A** does **not** conduct electricity.

Which type of substance is **A**?

Tick (✓) **one** box.

Compound ☐

Metallic element ☐

Mixture ☐

Non-metallic element ☐

(1)

(b) Substance **B** contains two types of atoms.

The atoms are chemically combined together in fixed proportions.

Which type of substance is **B**?

Tick (✓) **one** box.

Compound ☐

Metallic element ☐

Mixture ☐

Non-metallic element ☐

(1)

(c) What is the name of the elements in Group 0 of the periodic table?

Tick (✓) **one** box.

Alkali metals ☐

Halogens ☐

Noble gases ☐

Transition metals ☐

(1)

(d) Which statement about the elements in Group 0 is correct?

Tick (✓) **one** box.

All elements in the group are very reactive.	☐
All elements in the group form negative ions.	☐
The boiling points increase down the group.	☐
The relative atomic masses (A_r) decrease down the group.	☐

(1)

(e) Neon is in Group 0.

What type of particles are in a sample of neon?

Tick (✓) **one** box.

Atoms	☐
Ions	☐
Molecules	☐

(1)

Q8.

The periodic table on the Data Sheet may help you to answer these questions.

Draw a ring around the correct answer to complete these sentences.

(a) The Russian chemist who introduced his periodic table in 1869 was

Brønsted.

Lowry.

Mendeleev.

(1)

groups.

(b) He put elements with similar chemical reactions in columns, known as

periods.

rows.

(1)

(c) He left gaps for elements that were

insoluble.

unreactive.

undiscovered.

(1)

(d) He did **not** put water, H_2O, into the periodic table because water is a

compound.

liquid.

mixture.

(1) (Total 4 marks)

Q9.

This question is about atomic structure and the periodic table.

Gallium (Ga) is an element

(e) Gallium was discovered six years after Mendeleev published his periodic table.

Give **two** reasons why the discovery of gallium helped Mendeleev's periodic table to become accepted.

1 _____

_____

2 _____

_____

(2)

Q10.

John Newlands was a chemist who worked in a sugar factory.

In 1866 he designed a periodic table.
He arranged the elements in order of their relative atomic masses.

He found a repeating pattern for some of the elements.
Newlands wrote, 'the eighth element starting from a given one, is a kind of repetition of the first, like the eighth note in an octave of music'.

H	**Li**	**G**	**Bo**	**C**	**N**	**O**
F	**Na**	**Mg**	**Al**	**Si**	**P**	**S**
Cl	**K**	**Ca**	**Cr**	**Ti**	**Mn**	**Fe**
Co, Ni	**Cu**	**Zn**	**Y**	**In**	**As**	**Se**
Br	**Rb**	**Sr**	**Ce, La**	**Zr**	**Di, Mo**	**Ro, Ru**
Pd	**Ag**	**Cd**	**U**	**Sn**	**Sb**	**Te**
I	**Cs**	**Ba, V**	**Ta**	**W**	**Nb**	**Au**
Pt, Ir	**Tl**	**Pb**	**Th**	**Hg**	**Bi**	**Os**

Newlands' periodic table

(a) In Newlands' periodic table, the elements lithium, sodium and potassium are grouped together.

Give **two** properties of these elements which support the idea that they should be grouped together.

1. _____

_____

2. _____

_____

(2)

(b) Newlands' periodic table was not accepted by most chemists in 1866.

Suggest reasons why.
Use the Newlands' periodic table above to help you to answer this question.

_____

_____

_____

_____

_____

_____

_____

_____

(3)

(c) State **and** explain **one** way in which Mendeleev improved Newlands' periodic table.

_____

_____

_____

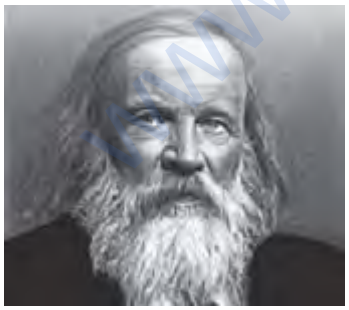
_____

(2)

(Total 7 marks)

Q11.

By 1869, about 60 elements had been discovered.
Mendeleev arranged these elements in a table, in order of their atomic weight.
He put elements with similar chemical properties in the same column.
Mendeleev and part of his table are shown below.



	Column					
1	**2**	**3**	**4**	**5**	**6**	**7**
H						
Li	Be	B	C	N	O	F
Na	Mg	Al	Si	P	S	Cl

By unknown / неизвестен (here / здесь) [Public domain], via Wikimedia Commons

Use the periodic table on the Data Sheet to help you to answer these questions.

(a) Draw a ring around the correct answer to complete the sentence.

In the periodic table the columns are known as

groups.
periods.
rows.

(1)

(b) Suggest **one** reason why hydrogen should **not** have been put in column 1.

_____

(1)

(c) In 1895, the first of a new family of elements was discovered.
One of the new elements was called helium.

Where has this new family of elements been placed in the modern periodic table?

_____

(1)

(d) Complete the sentence.

In the periodic table on your Data Sheet, the elements are arranged in order of their

atomic _____ .

(1)

(Total 4 marks)

Q12.

This question is about the periodic table.

In the 19th century, some scientists tried to classify the elements by arranging them in order of their atomic weights.

The figure below shows the periodic table Mendeleev produced in 1869.

His periodic table was more widely accepted than previous versions.

	Group 1	Group 2	Group 3	Group 4	Group 5	Group 6	Group 7
Period 1	H						
Period 2	Li	Be	B	C	N	O	F
Period 3	Na	Mg	Al	Si	P	S	Cl
Period 4	K Cu	Ca Zn	* *	Ti *	V As	Cr Se	Mn Br
Period 5	Rb Ag	Sr Cd	Y In	Zr Sn	Nb Sb	Mo Te	* I

(a) The atomic weight of tellurium (Te) is 128 and that of iodine (I) is 127

Why did Mendeleev reverse the order of these two elements?

_____

_____

(1)

(b) Mendeleev left spaces marked with an asterisk *

He left these spaces because he thought missing elements belonged there.

Why did Mendeleev's periodic table become more widely accepted than previous versions?

_____

_____

_____

_____

_____

_____

(3)

(c) Mendeleev arranged the elements in order of their atomic weight.

What is the modern name for atomic weight?

Tick (✓) **one** box.

Atomic number ☐

Mass number ☐

Relative atomic mass ☐

Relative formula mass ☐

(1)

(d) Complete the sentence.

In the modern periodic table, the elements are arranged in order of

_____

(1)

Chlorine, iodine and astatine are in Group 7 of the modern periodic table.

(e) Astatine (At) is below iodine in Group 7.

Predict:

- the formula of an astatine molecule
- the state of astatine at room temperature.

Formula of astatine molecule _____

State at room temperature _____

(2)

(f) Sodium is in Group 1 of the modern periodic table.

Describe what you would see when sodium reacts with chlorine.

_____

_____

_____

_____

(2)

(Total 10 marks)

Q13.

In 1869, Dmitri Mendeleev produced his periodic table of the elements.

Mendeleev placed the alkali metals in the same group.

(a) What evidence did Mendeleev use to decide that the alkali metals should be in the same group?

(1)

(b) Describe how the elements in the modern periodic table are arranged:

(i) in terms of protons

(1)

(ii) in terms of electrons.

(1)

(c) State **two** properties of transition elements that make them more useful than alkali metals for making water pipes.

(2)

(d) Describe and explain the trend in reactivity of the alkali metals (Group 1).

(4)
(Total 9 marks)

Q14.

This question is about the periodic table of elements.

Use the Chemistry Data Sheet to help you to answer these questions.

In 1869 Dmitri Mendeleev produced an early version of the periodic table.

(a) Draw a ring around the correct answer to complete each sentence.

(i) Mendeleev first arranged the elements in order of

their

atomic weight.
date of discovery.
electron number.

(1)

(ii) Mendeleev then placed elements with similar properties in columns

called

groups.
periods.
shells.

(1)

(iii) When the next element did not fit the pattern,

Mendeleev

ignored the element.
left a gap.
put the element at the end of the row.

(1)

(iv) Mendeleev was not able to include the noble gases (Group 0) in his periodic table because the noble gases

are not elements.
are not reactive.
had not been discovered by 1869.

(1)

(b) Use the correct word from the box to complete each sentence.

electrons	molecules	neutrons	protons

In the modern periodic table elements are arranged in order of the number of _____ in their nucleus. Elements in the same group have the same number of _____ in their highest energy level (outer shell).

(2)

(c) Sodium (Na) is in Group 1 of the periodic table.

Nickel (Ni) is a transition element.

Tick (✓) **two** correct statements about sodium and nickel.

Statement	Tick (✓)
Sodium and nickel are both metals.	
Sodium has a higher melting point than nickel.	
Sodium is more reactive than nickel.	
Sodium is harder than nickel.	

(2)

(d) Chlorine, bromine and iodine are in Group 7 of the periodic table.

Chlorine is more reactive than bromine.

(i) Complete the word equation for the reaction between chlorine and sodium bromide.

chlorine + sodium bromide ⟶ _____ + sodium chloride

(1)

(ii) (reactivity) Why does iodine **not** react with sodium bromide solution?

_____

_____

(1)

(Total 10 marks)

Q15.

In 1866 John Newlands produced an early version of the periodic table.

Part of Newlands' periodic table is shown below.

Column	1	2	3	4	5	6	7
	H	Li	Be	B	C	N	O
	F	Na	Mg	Al	Si	P	S
	Cl	K	Ca	Cr	Ti	Mn	Fe

Newlands' periodic table arranged all the known elements into columns in order of their atomic weight.

Newlands was trying to show a pattern by putting the elements into columns.

(a) Iron (Fe) does **not** fit the pattern in column 7.

Give a reason why.

_____

_____

(1)

(b) In 1869 Dmitri Mendeleev produced his version of the periodic table.

Why did Mendeleev leave gaps for undiscovered elements in his periodic table?

_____

_____

(1)

(c) Newlands and Mendeleev placed the elements in order of atomic weight.

Complete the sentence.

The modern periodic table places the elements in order of

_____ .

(1)

(d) Lithium, sodium and potassium are all in Group 1 of the modern periodic table.

Explain why.

_____

_____

_____

_____

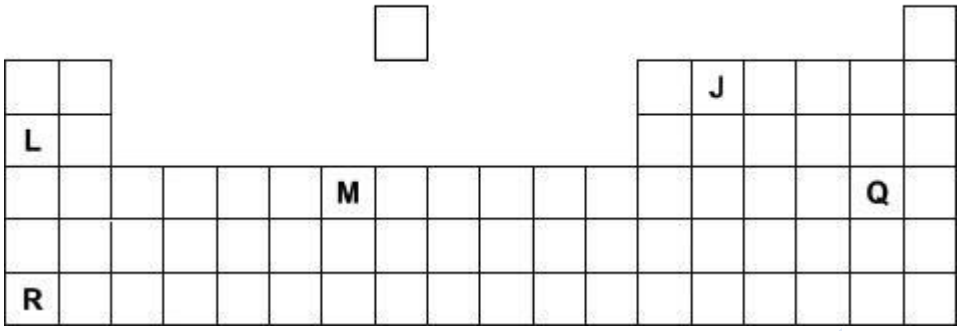
(2)

(Total 5 marks)

Q16.

Figure 1 shows an outline of the modern periodic table.

Figure 1



J, **L**, **M**, **Q** and **R** represent elements in the periodic table.

(a) Which element has four electrons in its outer shell?

Tick (✓) **one** box.

J ☐ **L** ☐ **M** ☐ **Q** ☐ **R** ☐

(1)

(b) Which **two** elements in **Figure 1** are in the same period?

_____ and _____

(1)

(c) Which element reacts with potassium to form an ionic compound?

Tick (✓) **one** box.

J ☐ **L** ☐ **M** ☐ **Q** ☐ **R** ☐

(1)

(d) Which element forms ions with different charges?

Tick (✓) **one** box.

J ☐ **L** ☐ **M** ☐ **Q** ☐ **R** ☐

(1)

(e) Which element has three electron shells?

Tick (✓) **one** box.

J ☐ **L** ☐ **M** ☐ **Q** ☐ **R** ☐

(1)

(f) In the 1860s scientists were trying to organise elements.

Figure 2 shows the table published by John Newlands in 1865.
The elements are arranged in order of their atomic weights.

Figure 2

H	Li	Be	B	C	N	O
F	Na	Mg	Al	Si	P	S
Cl	K	Ca	Cr	Ti	Mn	Fe
Co,Ni	Cu	Zn	Y	In	As	Se
Br	Rb	Sr	Ce,La	Zr	Di,Mo	Ro,Ru
Pd	Ag	Cd	U	Sn	Sb	Te

Figure 3 shows the periodic table published by Dmitri Mendeleev in 1869.

Figure 3

H							
Li	Be	B	C	N	O	F	
Na	Mg	Al	Si	P	S	Cl	
K Cu	Ca Zn	? ?	Ti ?	V As	Cr Se	Mn Br	Fe Co Ni
Rb Ag	Sr Cd	Y In	Zr Sn	Nb Sb	Mo Te	? I	Ru Rh Pd

Mendeleev's table became accepted by other scientists whereas Newlands' table was not.

Evaluate Newlands' and Mendeleev's tables.

You should include:

- a comparison of the tables
- reasons why Mendeleev's table was more acceptable.

Use **Figure 2** and **Figure 3** and your own knowledge.

(6)
(Total 11 marks)

Q17.

This question is about elements and the periodic table.

(a) Use the correct answers from the box to complete the sentences.

atoms	atomic weights	electrons	proton numbers

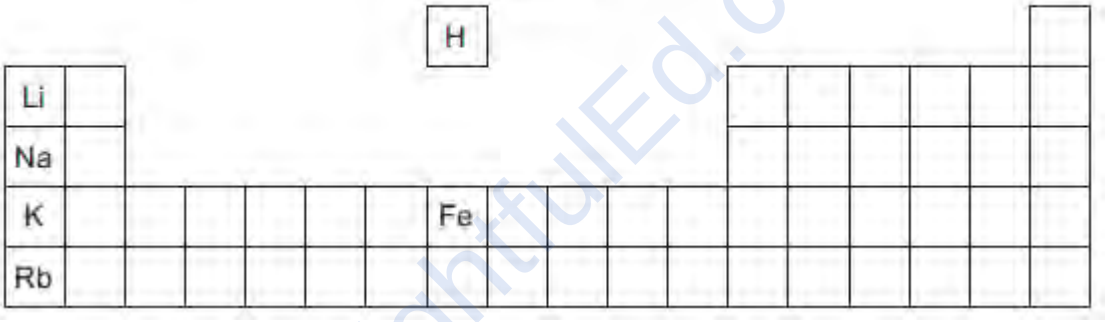
Newlands' and Mendeleev's periodic tables show the elements in order of their _____ .

Following the discovery of protons and _____, the modern periodic table shows the elements in order of their _____ .

(3)

(b) **Figure 1** shows the position of six elements in the modern periodic table.

Figure 1



(i) Which **one** of these six elements has the lowest boiling point?

_____

(1)

(ii) Complete the sentence.

In the periodic table, rubidium (Rb) is in Group _____ .

(1)

(iii) Which of these three elements is the most reactive?

Tick (✓) **one** box.

Lithium (Li) ☐

Sodium (Na) ☐

Potassium (K) ☐

(1)

(iv) Which **two** statements are correct?

Tick (✓) **two** boxes.

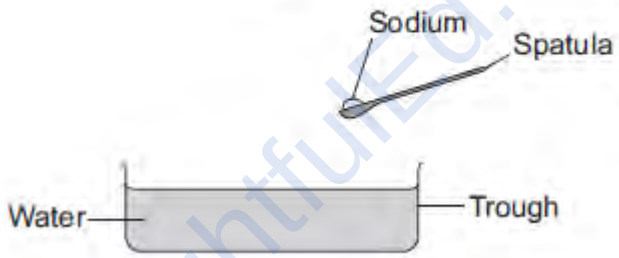
Iron has a higher density than potassium.	☐
Iron is softer than potassium.	☐
Iron reacts vigorously with water.	☐
Iron forms ions that have different charges.	☐

(2)

(c) (see group 1 Q and A doc for more Qs like this)

Figure 2 shows sodium being put into water.

Figure 2



Describe **three** observations that can be seen when sodium is put into water.

1. _____

_____

2. _____

_____

3. _____

_____

(3)

(Total 11 marks)

Mark schemes

Q1.

(c) (the isotopes contain) different numbers of neutrons

1

(d) most (alpha) particles passed (straight) through (the gold foil)

1

(so) the mass of the atom is concentrated in the nucleus / centre
or
(so) most of the atom is empty space

1

some (alpha) particles were deflected / reflected

1

(so) the atom has a (positively) charged nucleus / centre

if not awarded for MP2 allow (so) the mass of the atom is concentrated in the nucleus / centre.

1

[8]

Q2.

(a) B

1

(b) C

1

(c) A

1

(d) sum of protons and neutrons

allow number of protons and neutrons

1

(e) between 69.5 and 70.0

1

(f) Chadwick provided the evidence to show the existence of neutrons

allow Chadwick discovered neutrons

1

(this was necessary because) isotopes have the same number of protons

allow (this was necessary because) isotopes have the same atomic number

or
(this was necessary because) isotopes are atoms of the same element

ignore isotopes have the same number of electrons

1

but with different numbers of neutrons

allow but with different mass (numbers)

1

[8]

Q3.

(a) if placed consecutively, then elements would be in wrong group / have wrong properties

allow some elements didn't fit pattern

1

left gaps

1

(b) (elements placed in) atomic / proton number order

1

(elements in) same group have same number of outer electrons

1

any **one** from:

- number of protons = number of electrons
- reactions/(chemical) properties depend on the (outer) electrons
- number of shells gives the period

allow number of shells increases down the group

1

(c) (i) (transition elements usually) have same / similar number of outer / 4th shell electrons

allow 2 electrons in outer shell

1

(because) inner (3rd) shell / energy level is being filled

ignore shells overlap

1

(ii) 2nd shell / energy level can (only) have maximum of 8 electrons

accept no d-orbitals

or

2nd shell / energy level cannot have 18 electrons

1

[8]

Q4.

(a) any **three** from: (nuclear model)

- mostly empty space

allow the plum pudding model has no empty space

allow the plum pudding model is solid

- the positive charge is (all) in the nucleus

  allow in the plum pudding model the atom is a ball of positive charge (with embedded electrons)
  *do **not** accept reference to protons*

- the mass is concentrated in the nucleus

  allow in the plum pudding model the mass is spread out
  *do **not** accept reference to neutrons*

- the electrons and the nucleus are separate

  allow in the plum pudding model the electrons are embedded

  allow in the nuclear model the electrons are in orbits

3

(b) electrons orbit the nucleus

*do **not** accept reference to protons / neutrons*
allow electrons are in energy levels around the nucleus
or
allow electrons are in shells around the nucleus

1

electrons are at specific distances from the nucleus

1

(c) atomic number is the number of protons

1

(and) protons were not discovered until later

ignore electrons / neutrons were not discovered until later

1

(d) so their properties matched the rest of the group

allow converse

1

[8]

Q5.

(a) for elements that had not been discovered (at that time)

allow for missing elements

or
so that elements with similar properties are grouped together

ignore references to atomic number / mass / weight

1

(b) Mendeleev

1

(c) noble gases

1

(d) the elements all have one electron in the outer shell

1

(e) 63 (°C)

allow a value in the range 49 to 88 (°C)

1

(f) any **one** from:

- floats
- moves (on the surface)
- melts

allow forms a ball

- fizzes / bubbles
- flame

ignore colour of flame

allow explodes / disappears

ignore references to heat / temperature / sounds

1

(g)

Element	State at 150 °C	Symbol	Formula of the compound with hydrogen
Fluorine	gas	F	HF
Chlorine	**gas**	Cl	HCl
Bromine	gas	Br	HBr
Iodine	liquid	I	HI
Astatine	solid	At	**HAt**

2

(g) Br_2

1

[9]

Q6.

(a) **D**

1

(b) **B**

1

(c) any **two** from:

(Group 1 elements)

- have lower melting / boiling points
- have lower densities
- are less strong
- are softer

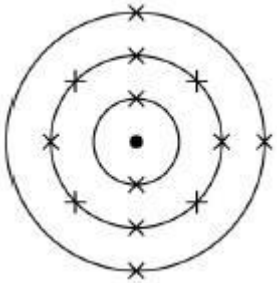
allow (Group 1 elements are) more malleable / ductile

allow (Group 1 elements) are not useful as catalysts
ignore transition elements form coloured compounds
ignore transition elements form ions with different charges
ignore references to chemical properties

2

allow converse statements for transition elements

(d)



allow any combination of x, •, o, e(–) for electrons

1

(f) ionic

1

Q7.

(a) non-metallic element

1

(b) compound

1

(c) noble gases

1

(d) the boiling points increase down the group

1

(e) atoms

1

Q8.

(a) Mendeleev

1

(b) groups

1

(c) undiscovered

1

(d) compound

1

[4]

Q9.

(e) (gallium) fitted in a gap (Mendeleev had left)

1

(gallium's) properties were predicted correctly (by Mendeleev)

allow (gallium's) properties matched the rest of the group

1

Q10.

(a) any **two** from:

- react with water **or** very reactive
- (react with water) releasing gas / hydrogen / fizzing
- (react with water) to form an alkaline / hydroxide solution
- form ions with a 1+ charge

allow lose one electron from the outer shell
ignore other references to electronic structure
ignore physical properties

2

(b) any **three** from:

- some boxes contain two elements

allow specific examples:
*Co, Ni **or** Ce, La **or** Di, Mo **or** Ro, Ru **or** Ba, V **or** Pt, Ir*

- groups / columns contain elements with different properties

allow groups / columns contain both metals and non-metals
ignore examples

- Newlands not a well-known / respected scientist

ignore references to sugar factory

- new idea (not readily accepted by other scientists)

allow musical scales thought to be silly by some scientists

3

(c) one for improvement **and** one for explanation from:

- left gaps (for undiscovered elements) (1)
- so that elements were in their correct group (1)

allow so the elements fitted the pattern of properties

or

- did not always follow order of relative atomic weights / masses (1)

ignore references to atomic number / electronic structure

- so that elements were in their correct group (1)
  allow so the elements fitted the pattern of properties

2

[7]

Q11.

(a) groups

1

(b) it is a non-metal
  allow it is not a metal

1

(c) to the right of column 7 / Group 7
  accept in Group 0
  ignore Group 8 / noble gases

1

(d) (atomic) number
  allow proton number

1

[4]

Q12.

(a)
  ignore reference to atomic structure
  ignore references to Cr, Mn and Mo

any **one** from:
- so elements / iodine / tellurium were in groups with similar properties
- iodine has similar properties to Br / Cl / F / Group 7
  allow corresponding argument in terms of tellurium
- iodine has different properties to Se / S / O / Group 6
  allow corresponding argument in terms of tellurium

1

(b)
  ignore reference to atomic structure

Mendeleev had predicted properties of missing elements

1

elements were discovered (that filled the spaces / gaps)

1

properties (of these elements) matched Mendeleev's predictions
  allow atomic weights (of these elements) fitted in the spaces / gaps

1

*if no other mark awarded, allow **1** mark for in previous versions of the periodic table the pattern of similar properties broke down*

1

(c) relative atomic mass

1

(d) (increasing) atomic / proton number

ignore (increasing) electron number

*do **not** accept relative atomic / proton number*

1

(e) (formula) At_2

ignore incorrect state symbol

1

(state) solid

allow (s)

ignore s

1

(f) any **two** from:

- flame

  allow burns
- (white) solid forms

  allow (white) smoke forms
- colour of gas / chlorine disappears / fades

2

[10]

Q13.

(a) similar properties

allow same properties

allow correct example of property

ignore answers in terms of atomic structure

1

(b) (i) in order of atomic / *proton* number

allow increasing number (of protons)

1

(ii) elements in same group have same number (*of electrons*) in outer shell **or** *highest energy level*

allow number (of electrons) increases across a period

1

(c) any **two** from:

statements must be comparative

- stronger / harder

  ignore higher densities
- less reactive
- higher melting points

  ignore boiling point

2

(d) *reactivity increases down group*

allow converse throughout

*for next three marks, outer electron needs to be mentioned once otherwise max = **2***

1

outer electron is further from nucleus

allow more energy levels / shells

allow larger atoms

1

less attraction between outer electron and nucleus

allow more shielding

1

therefore outer electron lost more easily

1

[9]

Q14.

(a) (i) atomic weight

1

(ii) groups

1

(iii) left a gap

1

(iv) had not been discovered by 1869

1

(b) protons

must be in correct order

1

electrons

1

(c) sodium and nickel are both metals

1

sodium is more reactive than nickel

1

(d) (i) bromine

allow Br_2 / Br

*do **not** allow bromide*

1

(ii) iodine is less reactive (than bromine)

it = iodine

allow converse

*do **not** allow bromide*

1

[10]

Q15.

(a) (iron) is a metal

accept transition element

allow (iron) had different properties (to oxygen and sulfur)

ignore electrons

1

(b) so that elements with similar properties could be placed together

allow to make the pattern fit

ignore undiscovered elements

1

(c) atomic number(s)

allow proton number(s)

1

(d) all have one electron in the outer shell (highest energy level)

allow same number of electrons in the outer shell (highest energy level)

1

(so they) have similar properties
or
react in the same way

allow specific reactions e.g. with water

1

[5]

Q16.

(a) **J**

1

(b) **M** and **Q**

either order

1

(c) **Q**

1

(d) **M**

1

(e) **L**

1

(f) **Level 3 (5-6 marks):**
A judgement, strongly linked and logically supported by a sufficient range of correct reasons, is given.

Level 2 (3-4 marks):
Some logically linked reasons are given. There may also be a simple judgement.

Level 1 (1-2 marks):
Relevant points are made. They are not logically linked.

Level 0
No relevant content

Indicative content

comparative points
- both tables have more than one element in a box
- both have similar elements in the same column
- both are missing the noble gases
- both arranged elements in order of atomic weight

advantages of Mendeleev / disadvantages of Newlands
- Newlands did not leave gaps for undiscovered elements
- Newlands had many more dissimilar elements in a column
- Mendeleev left gaps for undiscovered elements
- Mendeleev changed the order of some elements (e.g. Te and I)

points which led to the acceptance of Mendeleev's table
- Mendeleev predicted properties of missing elements
- elements with properties predicted by Mendeleev were discovered
- Mendeleev's predictions turned out to be correct
- elements were discovered which fitted the gaps

6

[11]

Q17.

(a) atomic weights

must be in this order

1

electrons

1

proton numbers

1

(b) (i) H/hydrogen

allow H_2 or h

1

(ii) one / 1

allow alkali metals

1

(iii) Potassium (K)

1

(iv) Iron has a higher density than potassium

1

Iron forms ions that have different charges

1

(c) any **three** from:

- melts
- fizzes / bubbles / effervesces
  allow gas produced
- sodium floats
- size of the sodium decreases
  allow dissolves / disappears
- sodium moves

  allow two marks for moves around on the surface of the water

3

[11]