AQA GCSE CHEMISTRY (HIGHER) · 8462

CHEMISTRY



EXAM QUESTION PACK

4.1.2 THE PERIODIC TABLE (PACK 2)

SCORE	PERCENTAGE
/217	%

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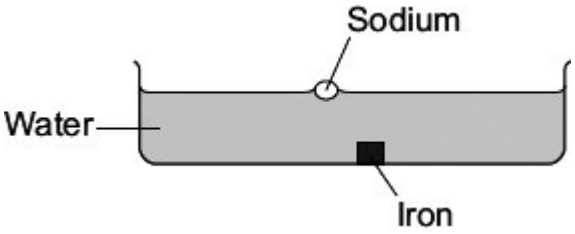
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Q1.

How a metal is used depends on its properties.

A teacher demonstrated some of the properties of sodium (an alkali metal) and iron (a transition element) by placing a small cube of each metal into water.



A student observed that:

Sodium	Iron
floated on the surface of the water	sank to the bottom of the water
melted to form a molten ball of sodium	did not melt
reacted to produce a gas	did not react
no sodium was left after 5 minutes	the cube of iron remained after 5 minutes

(a) Tick (✓) **two** properties of sodium compared with iron that are shown by the student's observations.

Sodium compared with iron	Tick(✓)
sodium has a higher boiling point	
sodium has a lower density	
sodium is harder	
sodium is more reactive	
sodium is softer	

(2)

(b) Draw a ring around the correct answer to complete the word equation.

carbon dioxide

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sodium + water → sodium hydroxide + | hydrogen / oxygen |

(1)

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

Sodium hydroxide is an alkali because it produces | $H^+(aq)$ / $OH^-(aq)$ / $Na^+(aq)$ | ions

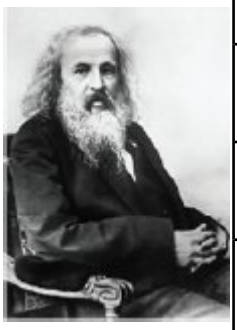
in aqueous solution.

(1)
(Total 4 marks)

Q2.

By 1869, about 60 elements had been discovered.
Mendeleev arranged these elements in a table, in order of their atomic weight.
He also put elements with similar chemical properties in the same columns.

Mendeleev and part of his table are shown below.



	Group							
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**
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	Fe Co Ni

(a) (i) Name **one** element in Group 1 of Mendeleev's table that is not in Group 1 of the periodic table on the Data Sheet.
Give a reason why this element should not be in Group 1.

Name of element _____

Reason _____

_____

(2)

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(ii) Which group of the periodic table on the Data Sheet is missing from Mendeleev's table?

_____

(1)

(b) The gaps (–) in Mendeleev's table were for elements that had not been discovered.

(i) Compare Mendeleev's table with the periodic table on the Data Sheet.

Name **one** of the elements in Period 4 that had not been discovered by 1869.

_____

(1)

(ii) Mendeleev was able to make predictions about the undiscovered elements. This eventually led most scientists to accept his table.

Suggest what predictions Mendeleev was able to make about these undiscovered elements.

_____

_____

_____

_____

_____

(2)

(c) In terms of their electronic structure:

(i) state why lithium and sodium are both in Group 1

_____

_____

_____

(1)

(ii) explain why sodium is more reactive than lithium.

_____

_____

_____

_____

_____

_____

_____

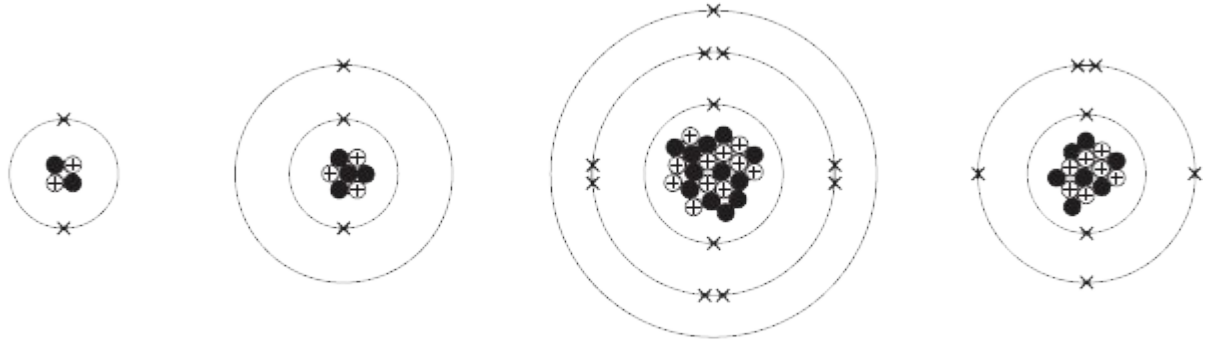
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(3)

(Total 10 marks)

Q3.

The diagrams show the sub-atomic particles in four different atoms.



Atom A Atom B Atom C Atom D

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

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

(i) The centre of each atom is called the

energy level.
molecule.
nucleus.

(1)

(ii) The centre of each atom contains neutrons and

bonds.
electrons.
protons.

(1)

(b) Complete the sentence.

There is no overall electrical charge on each atom because the

number of _____ is equal to the number of _____

(1)

(c) What is the name of the element represented by atom **D**? _____

(1)

(d) Which **two** of the atoms, **A**, **B**, **C** and **D**, are in the same group of the periodic table?

Give a reason for your answer.

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Atom ☐ and atom ☐

Reason _____

_____

(2)

(Total 6 marks)

Q4.

The table shows some properties of gases in dry air

Gas in dry air	Density in kg/m^3	Melting point in °C	Boiling point in °C	Percentage (%) in air
Nitrogen	1.2506	–210	–196	78.08
Oxygen	1.4290	–219	–183	20.95
Carbon dioxide	1.977	–57	–57	0.033
Helium	0.1785	–272	–269	0.00052
Neon	0.8999	–249	–246	0.0019
Argon	1.7837	–189	–186	0.934
Krypton	3.74	–157	–153	0.00011
Xenon	5.86	–112	–108	0.0000087

(a) In 1895, Lord Rayleigh isolated nitrogen from dry air by removing the other known gases, oxygen and carbon dioxide.
He then discovered that nitrogen from dry air had a different density to pure nitrogen produced from chemical reactions.
He concluded that nitrogen extracted from dry air was mixed with another gas.
The density of nitrogen extracted from dry air was higher than the density of pure nitrogen.

Use the information above to explain why.

_____

_____

_____

_____

(2)

(b) Gases from the air are separated to provide raw materials used in many different industrial processes.

Steps in dry air separation:

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Step 1: Filter to remove solid particles

Step 2: Remove carbon dioxide

Step 3: Cool the remaining air to –200 °C

Step 4: Separate by allowing the liquefied gases to warm up.

(i) Carbon dioxide is removed before the air is cooled to –200 °C.

Suggest **one** reason why.

_____

_____

(1)

(ii) Which two gases do **not** condense when the remaining air is cooled to –200 °C?

_____and _____

(1)

(iii) Two gases in air do **not** separate completely when the liquefied gases are allowed to warm up.

Name these **two** gases and give a reason for your answer.

_____

_____

_____

_____

(2)

(Total 6 marks)

Q5.

Platinum and gold can both be used to make wedding rings.



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

(a) Draw a ring around the part of the periodic table in the list below to which platinum and gold belong.

group 1 **group 2** **transition elements** **group 7**

(1)

(b) Platinum and gold have properties that make them suitable for wedding rings.

Tick (✓) **two** of these properties.

Property	Tick (✓)
These metals do not react with air.	
These metals have low melting points.	
These metals do not react with water.	
These metals have low densities.	

(2)
(Total 3 marks)

Q6.

The halogens are in Group 7 of the periodic table.

(a) Why, in terms of electrons, are the halogens in Group 7?

_____

_____

(1)

(b) Sea water contains bromide ions (Br^-).
The bromide ions can be changed to bromine by bubbling chlorine gas into sea water.
Chlorine is able to displace bromine from sea water because chlorine is more reactive than bromine.

$$2Br^-(aq) + Cl_2(g) \rightarrow Br_2(g) + 2Cl^-(aq)$$

Explain, in terms of electrons, why chlorine is more reactive than bromine.

_____

_____

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_____

_____

_____

_____

_____

_____

(3)

(Total 4 marks)

Q7.

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. _____

_____

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(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.

_____

_____

_____

_____

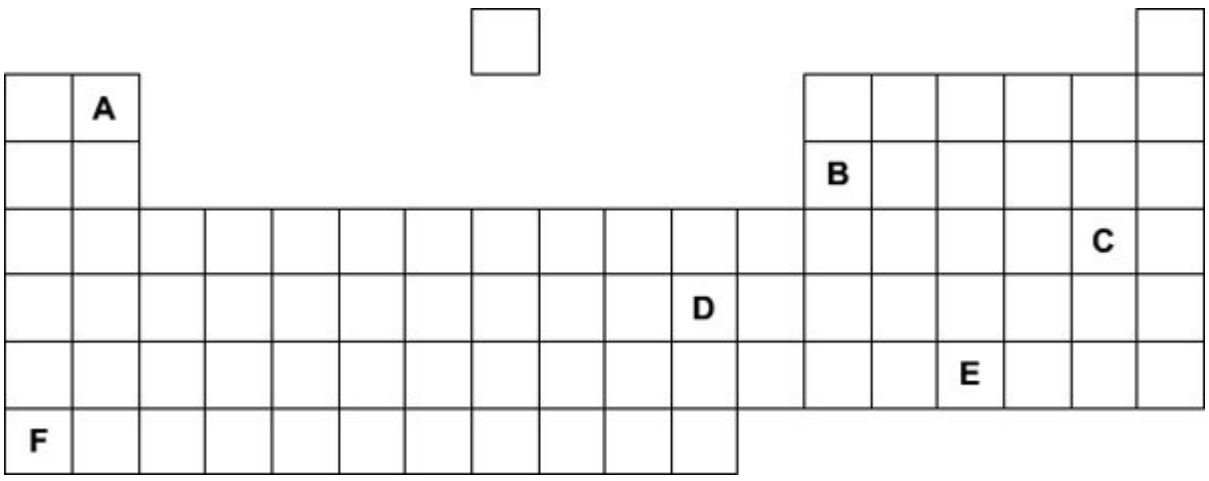
(2)

(Total 7 marks)

Q8.

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

(a) Part of the periodic table is shown below.



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The letters are **not** the symbols of the elements.

Choose your answers **only** from the letters shown in the periodic table above.

Which letter, **A**, **B**, **C**, **D**, **E** or **F**, represents

(i) aluminium

(1)

(ii) a Group 5 element

(1)

(iii) an alkali metal

(1)

(iv) the element with atomic (proton) number of 47

(1)

(v) an element with seven electrons in its outer shell?

(1)

(b) The table shows the boiling points of the Group 7 elements.

The elements are arranged **in alphabetical order**.

Group 7 element		
Name	**Symbol**	**Boiling point in °C**
Astatine	At	337
Bromine		58
Chlorine	Cl	-34
Fluorine	F	-188
Iodine	I	184

(i) The symbol for bromine is missing from the table.

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What is the symbol for bromine? Symbol = _____

(1)

(ii) Arrange these elements in order of **decreasing** boiling point. The first one and the last one have been done for you.

At _____ _____ _____ F

Highest boiling point ▸ Lowest boiling point

(1)

(c) The table shows some statements about Group 7 elements.

Tick (✓) the **two** correct statements.

	Tick (✓)
They are halogens.	
They are metals.	
They become less reactive down Group 7.	
They are compounds.	

(2)

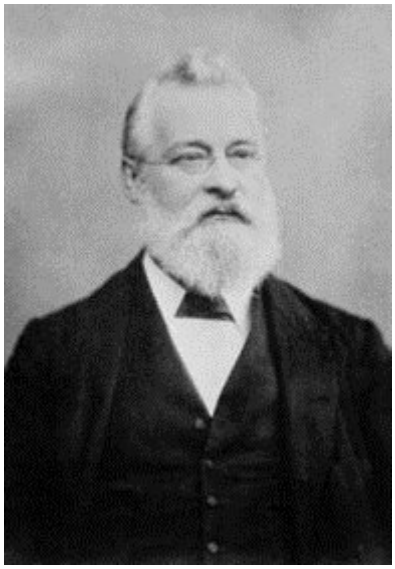
(Total 9 marks)

Q9.

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

(a) Many chemists have contributed to the development of the periodic table.

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John Newlands was one of the first chemists who attempted to classify elements in a systematic way based on atomic weight. In 1866 he suggested that there was a repeating pattern of elements with similar properties every eighth element.
Part of Newlands' periodic table is shown below.

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

Many chemists in 1866 did not accept Newland's; periodic table.

By Conget at nl.wikipedia [Public domain], from Wikimedia Commons

(i) Give **one** piece of evidence which supports Newlands' ideas.

_____

_____

(1)

(ii) Suggest **two** reasons why many chemists in 1866 did not accept Newlands' ideas.

1. _____

_____

_____

2. _____

_____

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_____

(2)

(b) Chlorine, bromine and iodine are Group 7 elements.

A student investigated the reactivity of these elements.
The student added:

- aqueous chlorine to potassium bromide and potassium iodide solutions
- aqueous bromine to potassium chloride and potassium iodide solutions
- aqueous iodine to potassium chloride and potassium bromide solutions.

The student's results are shown below.

Solution	Potassium chloride	Potassium bromide	Potassium iodide
Chlorine		Solution turned orange-brown	Solution turned brown
Bromine	No reaction		Solution turned brown
Iodine	No reaction	No reaction	

(i) Use these results to state **and** explain the trend in reactivity of these Group 7 elements.

_____

_____

_____

_____

(2)

(ii) Complete the equation below, which represents the reaction between chlorine and potassium bromide.

Cl_2 + 2KBr ⟶ ____ + 2KCl

(1)

(iii) In terms of electronic structure, state why chlorine, bromine and iodine are in Group 7.

_____

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_____

(1)

(c) Lithium, sodium and potassium are Group 1 elements.

Group 1 elements become **more** reactive down the group.

Explain why in terms of electronic structure.

_____

_____

_____

_____

_____

_____

(3)

(Total 10 marks)

Q10.

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

(a) The following is a list of symbols of some elements.

Sb	**Se**	**Si**	**Sn**	**Sr**

Choose your answers **only** from the symbols shown in the box above.

Which symbol represents

(i) a Group 5 element ☐

(1)

(ii) the element in the same group as oxygen (O) ☐

(1)

(iii) the element with atomic (proton) number of 50 ☐

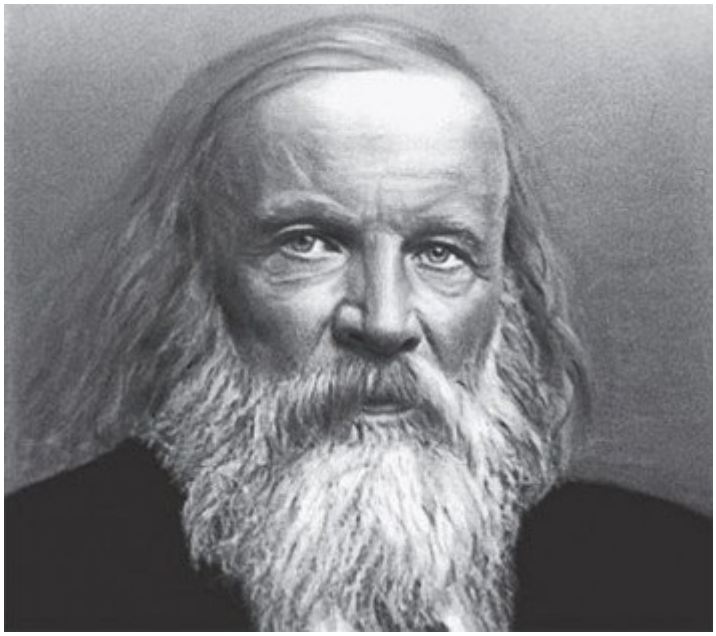
(1)

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(iv) silicon?

(1)

(b)



Mendeleev suggested his version of the periodic table in 1869.

Part of Mendeleev's table is shown below.

Group 1	**Group 2**	**Group 3**	**Group 4**	**Group 5**	**Group 6**	**Group 7**
H						
Li	Be	B	C	N	O	F
Na	Mg	Al	Si	P	S	Cl
K	Ca	#	Ti	V	Cr	Mn
Cu	Zn	#	#	As	Se	Br

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There are differences between Mendeleev's table and the periodic table on the Data Sheet.

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

(i) Mendeleev left gaps (shown by #) in his table.

Mendeleev left gaps for [compounds / elements / mixtures] that had not been discovered.

(1)

(ii) Mendeleev put copper (Cu) in the same box as [bromine (Br). / chromium (Cr). / potassium (K).]

(1)

(iii) Mendeleev did **not** have a Group [0. / 3. / 5.]

(1)

(Total 7 marks)

Q11.

Read the information about protecting the bottoms of ships.

A Copper-bottomed Investment



From the 16th to the 19th century, the bottoms of many wooden ships were protected from marine organisms by being covered with sheets of metal.

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At first lead was used on the bottoms of ships, then copper was used until 1832 when Muntz Metal replaced it. Muntz Metal is an alloy of two transition metals, copper and zinc.

Table of data

	Lead	**Copper**	**Muntz Metal**
Cost (£/kg)	£1.20	£3.20	£2.30
Melting point (°C)	327	1083	904
Stops sea worms attacking wood	Yes	Yes	Yes
Stops barnacles and seaweed sticking to the bottom of the ship	No	Yes	Yes

(a) Use the information to answer the following questions.

(i) Suggest why copper replaced lead.

_____

_____

(1)

(ii) Suggest why Muntz Metal replaced copper.

_____

_____

(1)

(b) A sample of Muntz Metal contains a very small amount of iron as an impurity.

(i) Name an instrumental method of analysis that could be used to detect iron.

_____

(1)

(ii) Suggest why an instrumental method would detect the iron in this sample of Muntz Metal but a chemical method is **not** likely to be successful.

_____

_____

(1)

(c) Today, ships are made from steel. Steels are alloys of iron, a transition metal.

Give **two** properties of transition metals that make them suitable for making ships.

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Property 1 _____

_____

Property 2 _____

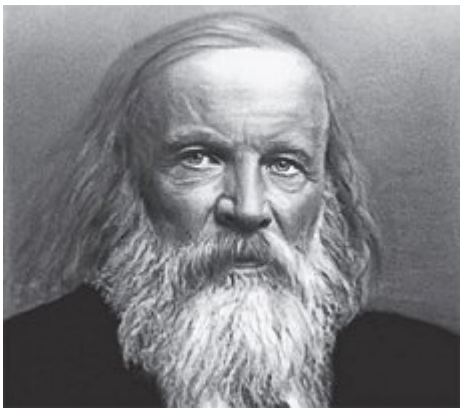
_____

(2)

(Total 6 marks)

Q12.

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



Mendeleev was one of the first chemists who classified elements in a systematic way based on atomic weight. He suggested his version of the periodic table in 1869.

He put the elements in order of their atomic weights but reversed the order for some pairs of elements. Then he arranged them in a table so that chemically similar elements were in columns known as Groups. He also left gaps and made predictions.

Part of Mendeleev's table is shown below.

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

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Cu	Zn	#	#	As	Se	Br
Rb Ag	Sr Cd	Y In	Zr Sn	Nb Sb	Mo Te	# I

The gaps Mendeleev left are shown by #.

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(a) Which group of elements in the modern periodic table is missing from Mendeleev's table?

_____

(1)

(b) Mendeleev reversed the order for some pairs of elements. For example, he put tellurium (Te, atomic weight 128) before iodine (I, atomic weight 127), as shown in his table.

Why did he do this?

_____

_____

(1)

(c) In 1869 many chemists did **not** agree with Mendeleev's periodic table.

Suggest **three** reasons why.

_____

_____

_____

_____

_____

_____

_____

(3)

(d) In the 20th century, the arrangement of elements in the periodic table was explained in terms of atomic structure.

Describe the links between atomic structure and the periodic table.

_____

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_____

_____

_____

_____

_____

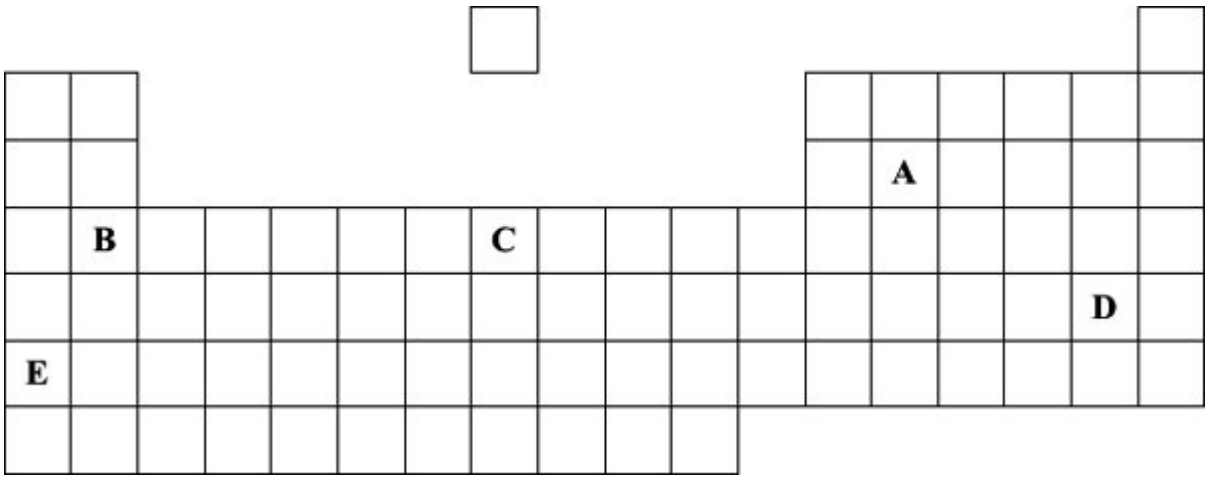
(2)

(Total 7 marks)

Q13.

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

Part of the periodic table is shown below.



The letters are **not** the symbols of these elements.

Choose your answers **only** from the letters shown in the periodic table above.

Which letter, **A**, **B**, **C**, **D** or **E**, represents:

(i) an alkali metal Letter ☐

(1)

(ii) the element calcium Letter ☐

(1)

(iii) a transition element Letter ☐

(1)

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(iv) a Group 4 element? Letter ☐

(1)

(b) A chemistry teacher demonstrated the reaction between sodium and water to some students. One of the students wrote the following notes.

The reaction between sodium and water

A piece of sodium was cut easily into smaller pieces with a knife.

The sodium was added to water in a trough.

The sodium:
- floated
- melted quickly to give a silvery ball
- moved on the surface of the water
- fizzed.

Use the information in the box to help you to answer these questions.

What evidence is there that:

(i) sodium has a low melting point

_____

_____

(1)

(ii) sodium is soft

_____

_____

(1)

(iii) a gas was produced?

_____

_____

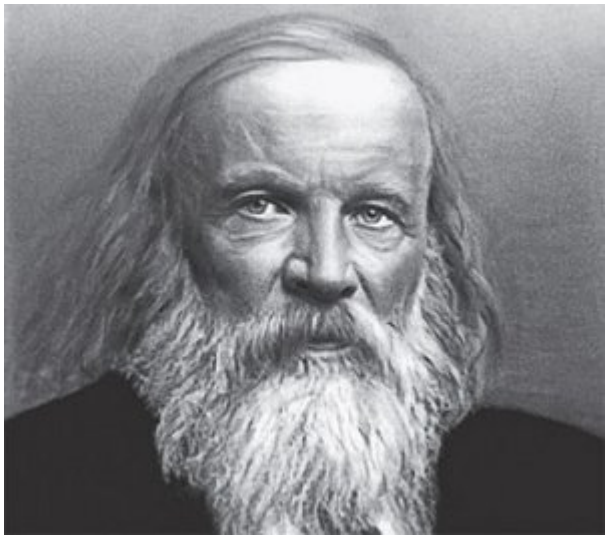
(1)

(Total 7 marks)

Q14.

(a) Dimitri 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.

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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 this discovery allowed chemists to place elements in their correct order and correct group.

_____

_____

_____

_____

_____

_____

_____

(3)

(c) The transition elements are a block of elements between Groups 2 and 3 of the periodic table.

(i) Transition elements have similar properties.

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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.

Explain why in terms of electronic structure.

_____

_____

_____

(1)

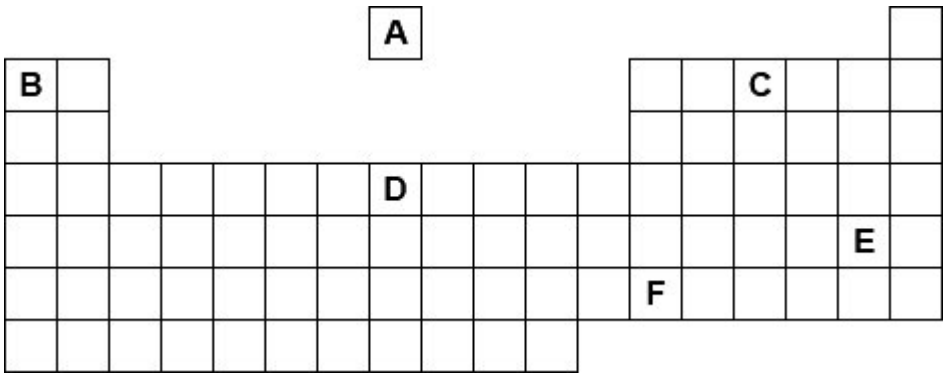
(Total 8 marks)

Q15.

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

Part of the periodic table is shown below.

The letters are **not** the symbols of the elements.



Choose your answers **only** from the letters shown in the periodic table above.

Which letter, **A**, **B**, **C**, **D**, **E** or **F**, represents

(i) hydrogen Letter ☐

(1)

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(ii) a Group 3 element Letter ☐

(1)

(iii) a halogen Letter ☐

(1)

(iv) the element with atomic (proton) number of 7 Letter ☐

(1)

(v) an element with one electron in its outer shell? Letter ☐

(1)

(b) The table shows the melting points of the Group 1 metals arranged in alphabetical order.

Group 1 metal		
Name	**Symbol**	**Melting point in °C**
Caesium	Cs	29
Francium	Fr	27
Lithium	Li	180
Potassium	K	64
Rubidium	Rb	39
Sodium	Na	98

(i) Arrange these metals in order of increasing melting point. Three have been done for you.

Fr Cs _____ _____ _____ Li

Lowest ⟶ Highest

(1)

(ii) Use the periodic table on the Data Sheet **and** your answer in part (b)(i) above to complete this sentence about how the melting points change.

Going down Group 1, the melting points _____

(1)

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(c) The transition metals are a block of elements between Groups 2 and 3 of the periodic table. Transition metals have different properties to Group 1 metals.

Put ticks (✓) next to the **three** correct statements about transition metals in the table below.

Statement	(✓)
They are harder than Group 1 metals	
They have lower densities than Group 1 metals	
They have higher melting points than Group 1 metals	
They are more reactive with water than Group 1 metals	
They often form coloured compounds but Group 1 compounds are usually white	

(3)

(Total 10 marks)

Q16.

Sodium is a Group 1 element.

(a) (i) A small piece of sodium is added to some water containing Universal Indicator solution.

Describe what you would **see** happening.

_____

_____

_____

_____

_____

_____

(3)

(ii) Complete **and** balance the equation for the reaction of sodium with water.

___Na + ___H_2O → _____ + H_2

(2)

(b) Francium is the most reactive element in Group 1.

Explain why in terms of electronic structure.

_____

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_____

_____

_____

_____

_____

(3)

(c) The transition elements have different properties from the elements in Group 1.

Give **two** of these different properties of transition elements.

1. _____

_____

2. _____

_____

(2)

(Total 10 marks)

Q17.

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

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

(i)

Dimitri Mendeleev attempted to classify

compounds.
elements.
mixtures.

(1)

(ii)

He arranged them in order of their

atomic weight.
boiling point.
electrical conductivity.

(1)

(iii)

They are now arranged in order of their

atomic (proton) number.
atomic weight.

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mass number.

(1)

(b) In the periodic table between Groups 2 and 3 there is a block of metals which includes chromium, iron and nickel.

(i) Which **one** of the following is the correct name for this block of metals?

Draw a ring around the correct answer.

alkali metals **reactive metals** **transition metals**

(1)

(ii) The properties of iron and those of the Group 1 metal sodium are different.

Put a tick (✓) next to the **two** correct phrases which could complete the following sentence.

Compared to sodium, iron

	(✓)
has a higher melting point.	
has a lower density.	
is harder.	
is more reactive.	
is weaker.	

(2)

(Total 6 marks)

Q18.

Read the information about the development of the periodic table and answer the questions that follow:

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Johann Döbereiner was a chemist who realised there was a link between atomic weight and chemical properties. Although it was difficult to measure atomic weights accurately, by 1829 Döbereiner had arranged many elements with similar chemical reactions in groups of three. He noticed that the middle element had an atomic weight that was approximately the average of the other two. These groupings were known as triads. Three of these triads are shown below:

Li 7	S 32	Cl 35.5
Na 23	Se 79	Br 80
K 39	Te 128	I 127

As new elements were discovered, it became difficult to group them in triads, and it was left to others to build on Döbereiner's work. The result was the first periodic table, suggested by Dimitri Mendeleev in 1869.

Our modern periodic table has evolved from Mendeleev's Table. Lithium, sodium and potassium are still together in Group 1, and chlorine, bromine and iodine are in Group 7.

It was many years before chemists understood the nature of the transition elements.

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

(a) Döbereiner suggested that calcium (Ca), strontium (Sr) and barium (Ba) were also a triad.

Use relative atomic masses to explain why.

_____

_____

_____

_____

(1)

(b) Suggest why Döbereiner's ideas were replaced by those of Mendeleev.

_____

_____

(1)

(c) Lithium, sodium and potassium are in Group 1. All these elements react with water.

Describe what you **see** when potassium is added to water.

_____

_____

_____

(2)

(d) In terms of electronic structure, explain why:

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(i) elements in the same group of the periodic table have similar chemical properties

_____

_____

(1)

(ii) transition elements have similar properties even though they are not in the same group

_____

_____

_____

_____

(2)

(iii) in Group 1, lithium is **less** reactive than potassium.

_____

_____

_____

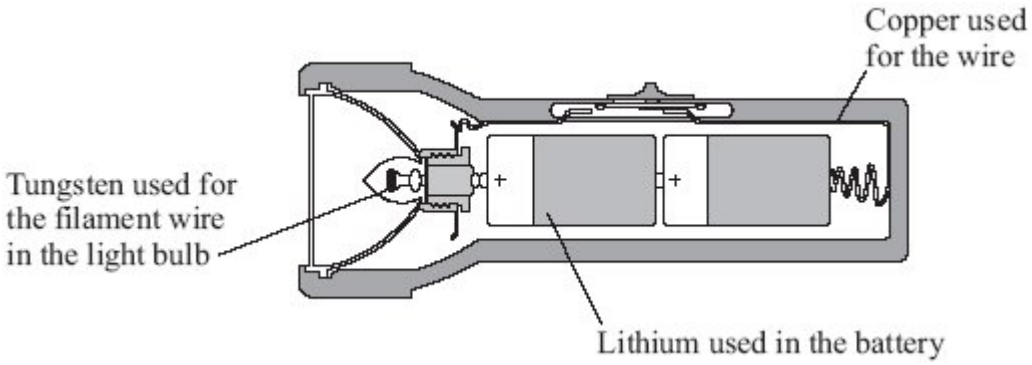
_____

(2)

(Total 9 marks)

Q19.

The diagram shows a circuit that is used in a torch. Electrons flow through this circuit.



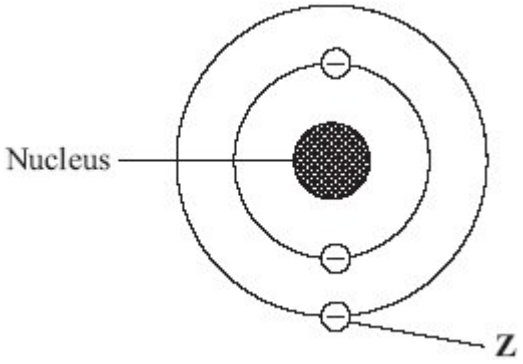
(a) Why is copper used for the wire?

_____

(1)

(b) The diagram shows the structure of an atom of lithium.

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Name the particle labelled **Z**.

_____

(1)

(c) The table shows some properties of the metals used in the electrical circuit.

Metal	Melting point in °C	Boiling point in °C	Reaction with oxygen
Copper	1083	2582	Reacts **slowly** to form a thin oxide layer on surface
Lithium	179	1317	Reacts **rapidly** to form oxide
Tungsten	3370	5930	Reacts **only** when very hot to form oxide

(i) Use information from the table to suggest the order of reactivity for copper, lithium and tungsten.

most reactive _____

_____

least reactive _____

(2)

(ii) The filament wire glows because it gets very hot.

Use information from the table to suggest **one** reason why tungsten is used for the filament wire in the light bulb.

_____

_____

(1)

(d) The gas used in the light bulb is argon.

Draw a ring around the correct word in the box to complete the sentence.

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Argon is used in the light bulb because it is

dense.
solid.
unreactive.

.

(1)

(Total 6 marks)

Q20.

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)

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

groups.
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)

Q21.

Group 7 is an important family of elements in the periodic table.

(a) (i) What name is given to the Group 7 elements?

Draw a ring around your answer.

Halogens **Noble gases** **Transition elements**

(1)

(ii) The grid shows some statements about Group 7 elements.

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Tick (✓) the **two** correct statements.

Statement	(✓)
They are metals	
They consist of molecules	
They have coloured vapours	
They have high melting points	

(2)

(b) The table gives information about some of the Group 7 elements.

Name of element	Melting point in °C	Boiling point in °C	Electronic structure
Fluorine	–220	–188	2, 7
Chlorine	–101	–35	2, 8, 7
Bromine	–7	58	2, 8, 18, 7
Iodine	114	183	2, 8, 18, 18, 7

Use information from the table to help you to answer these questions.

Write the correct number in the box to complete the sentence.

(i) All these elements are in Group 7 because they have ☐ electrons in their outer shell.

(1)

(ii) Draw a ring around the correct word in the box to complete the sentence.

At 20 °C bromine is a

gas.
liquid.
solid.

(1)

(iii) Use the periodic table on the **Data Sheet** to name the Group 7 element that is **not** shown in the table.

_____

(1)

(c) A student investigated the reactivity of three Group 7 elements.

The student added:

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- aqueous chlorine to potassium bromide and potassium iodide solutions
- aqueous bromine to potassium chloride and potassium iodide solutions
- aqueous iodine to potassium chloride and potassium bromide solutions.

The student's results are shown in the table.

Solutions of	Potassium chloride	Potassium bromide	Potassium iodide
Chlorine		Solution turned orange-brown	Solution turned brown
Bromine	No change		Solution turned brown
Iodine	No change	No change	

Explain how these results show that chlorine is more reactive than bromine and iodine.

_____

_____

_____

_____

(2)

(Total 8 marks)

Q22.

Chlorine and bromine are important Group 7 elements.

(a) Explain why chlorine is added to drinking water.

_____

_____

(1)

(b) Describe what you would **see** when bromine water is added to an unsaturated organic compound.

_____

_____

(1)

(c) Bromine can be extracted from seawater. The dissolved bromide ions are reacted with chlorine. Bromine and chloride ions are formed.

(i) Complete and balance the equation below, which represents the reaction between chlorine and bromide ions.

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$Cl_2 + 2Br^- \rightarrow$ _____ + _____

(1)

(ii) Describe what you **see** when chlorine is added to a solution containing bromide ions.

_____

_____

(1)

(d) In terms of electronic structure:

(i) state why bromine and chlorine are both in Group 7

_____

_____

(1)

(ii) explain why bromine is less reactive than chlorine.

_____

_____

_____

_____

_____

_____

_____

(3)

(e) What is the result of adding acidified silver nitrate solution to a solution containing:

(i) chloride ions

_____

(1)

(ii) bromide ions?

_____

(1)

(Total 10 marks)

Q23.

Read the information about the periodic table.

In 1869 Dimitri Mendeleev classified the elements by first putting them in order of their atomic weights.

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Then he arranged them in a table, so that elements with similar properties and reactions were in columns known as Groups.

He also left gaps in his table for undiscovered elements.

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

(a) Some elements were **not** placed in order of increasing atomic weights.

In terms of properties, suggest why potassium (atomic weight 39) should be placed after argon (atomic weight 40).

_____

_____

_____

(1)

(b) Some scientists thought that Mendeleev's table was **not** correct.

Suggest why, by referring to the elements in Group 4.

_____

_____

_____

(1)

(c) In the 1890s a new group of elements (Group 0) was discovered.

Suggest why they were easily fitted into Mendeleev's table.

_____

_____

_____

(1)

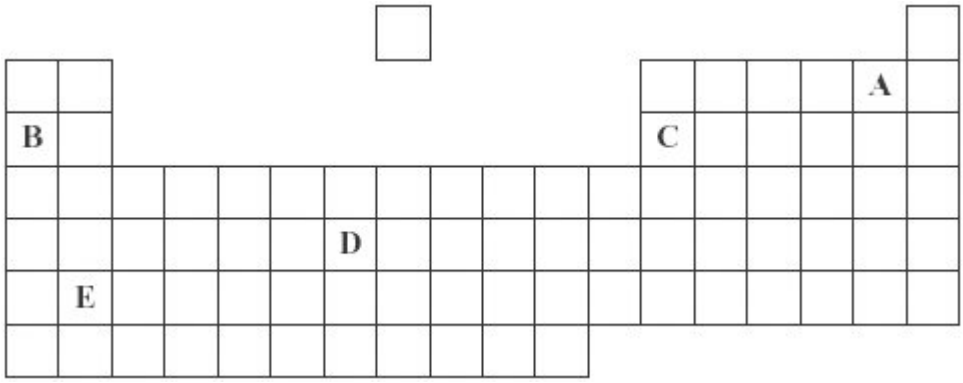
(Total 3 marks)

Q24.

(a) The periodic table on the Data Sheet may help you to answer this question.

Part of the periodic table is shown below.

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Choose your answers **only** from the letters shown in the periodic table above.

Which letter, **A** to **E**, represents:

(i) sodium

Letter _____

(1)

(ii) a non-metal

Letter _____

(1)

(iii) a Group 2 element

Letter _____

(1)

(iv) a transition element?

Letter _____

(1)

(b) Complete these sentences by drawing a ring around the correct answer.

(i) Attempts to classify the elements into a periodic table were made

by

Arrhenius and Dalton
Brønsted and Lowry
Mendeleev and Newlands

(1)

(ii) They arranged the elements in order of their

atomic weight
melting point

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reactivity

(1)

(iii) They put elements in the same Group if they had similar

boiling points

chemical reactions

electrical conductivities

(1)

(iv) We now know that elements in the same Group have the same number of

electrons

neutrons

protons

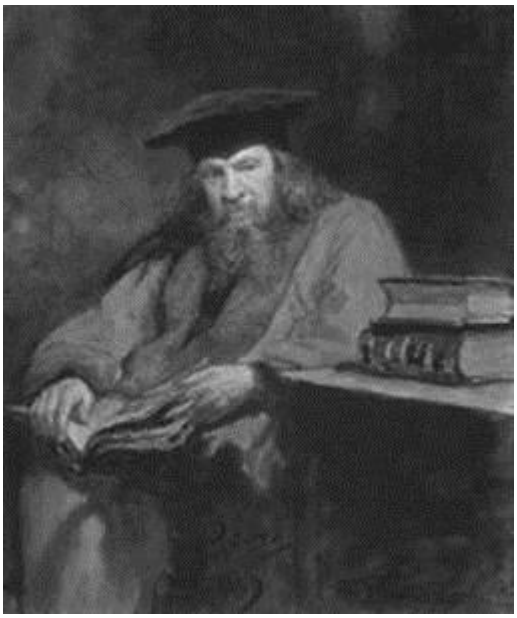
in their outer shell (energy level).

(1)

(Total 8 marks)

Q25.

Read the information about the periodic table.



Portrait of Dimitri Mendeleev by Ilya Repin

When the Russian chemist Dimitri Mendeleev put forward his periodic table in 1869, the atomic structure of elements was unknown.

Mendeleev tried to arrange the elements in a meaningful way based on their

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chemical reactions. First he put the elements in order of their increasing atomic weight.
He then put elements with similar properties in the same column.

However, he left gaps, and sometimes did not follow the order of increasing atomic weight – for example, he placed iodine (atomic weight 127) after tellurium (atomic weight 128).

Within a few years there was sufficient evidence to prove that Mendeleev was correct.

Our modern periodic table has evolved from Mendeleev's table.

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

(a) (i) State why Mendeleev left gaps.

_____

_____

(1)

(ii) State why some elements were **not** placed in order of increasing atomic weight.

_____

_____

(1)

(b) (i) The periodic table is now based on atomic structure.

Explain how.

_____

_____

_____

_____

_____

_____

_____

(3)

(ii) Suggest why it is impossible to have an undiscovered element that would fit between sodium and magnesium.

_____

_____

(1)

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(c) Explain, in terms of electrons, why fluorine is the most reactive element in Group 7.

_____

_____

_____

_____

_____

_____

_____

(3)

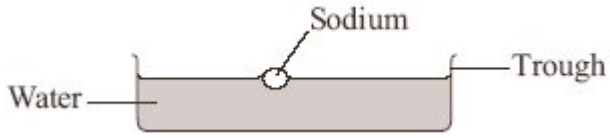
(Total 9 marks)

Q26.

(a) Read a student's report about the reaction between sodium and water.

The reaction between sodium and water

A small piece of sodium was added to some water in a trough.



The sodium floated and started to react.

The sodium moved along the surface of the water and melted to give a ball of molten metal.

The ball became smaller and smaller until it had all gone.

A gas was given off and a colourless solution was left.

The word equation for this reaction is:

sodium + water → sodium hydroxide + hydrogen

Use the information from the student's report to answer these questions.

(i) Which information shows that sodium has a low density?

_____

(1)

(ii) Which information shows that the reaction is exothermic?

_____

(1)

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(iii) Name the gas given off.

_____

(1)

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

(i) Sodium is in Group 1.

Name a Group 1 element that is more reactive than sodium.

_____

(1)

(ii) Here are some statements about Group 1 elements.

Only **two** of these statements are correct.

Put a tick (✓) next to the two correct statements.

Statement	(✓)
They are halogens	
They are metals	
They form covalent compounds	
They form ions with a +1 charge	

(2)

(c) Dimitri Mendeleev put forward his periodic table in 1869.

Complete these sentences by drawing a ring around the correct answer.

(i) Mendeleev arranged the elements in order of their

atomic weight
density
reactivity

(1)

(ii) The table is called a periodic table because elements with

identical
the same
similar

properties occur at regular intervals.

(1)

groups

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(iii) The vertical columns are known as

periods
rows

(1)

(d) How did Mendeleev overcome the problem of undiscovered elements when he designed his table?

_____

(1)

(Total 10 marks)

Q27.

The following article appeared recently in the *Manchester Gazette*.

Sodium Drum Blaze Scare

A 20 litre drum containing sodium burst into flames when it reacted violently with rainwater at a Manchester factory. It is believed that the sodium, which is normally stored under oil, had been accidentally left outside with the lid off.

A factory worker put out the blaze before the fire services arrived, and a leading fire fighter said, "It was fortunate that potassium wasn't involved as it would have reacted more violently and exploded. These Group 1 *alkali metals* can be very dangerous".

(a) Group 1 metals are stored under oil.

Suggest why.

_____

(1)

(b) Balance the equation which represents the reaction between sodium and water.

$$Na + H_2O \rightarrow NaOH + H_2$$

(1)

(c) Explain why the Group 1 metals are called the *alkali metals*.

_____

_____

(1)

(d) Explain, in terms of electrons, why potassium reacts more violently than sodium.

_____

_____

_____

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_____

_____

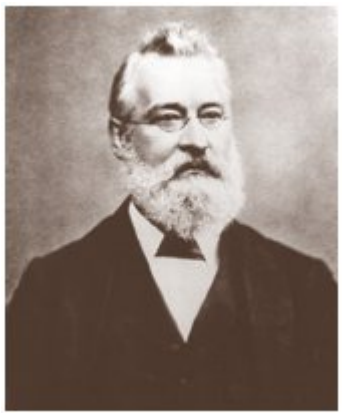
_____

(3)

(Total 6 marks)

Q28.

Read the information about the development of the periodic table and answer the questions that follow.



John Newlands was one of the first chemists to arrange the known elements in order of increasing atomic mass. In 1866, he put forward the Law of Octaves. He suggested that there was a repeating pattern of elements with similar chemical properties every eighth element, just like the eighth note of an octave of music. A version of his periodic table is shown below.

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	Os	Hg	Tl	Pb	Bi	Th

However, other chemists did not accept Newlands' ideas. It was not until much later that his contribution to the development of the modern periodic table was recognised.

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

(a) What is the modern symbol for the element 'Bo'? _____

(1)

(b) Describe **one** piece of evidence to support the Law of Octaves.

_____

_____

_____

_____

(2)

(c) Suggest **two** reasons why other chemists did not accept Newlands' ideas.

1. _____

_____

_____

2. _____

_____

_____

(2)

(d) The alkanes are a series of hydrocarbons with similar chemical properties. They have the general formula C_nH_{2n+2}.

Suggest why the alkanes do not appear in the periodic table.

_____

_____

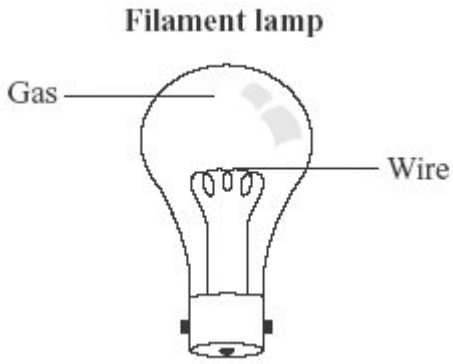
(1)

(Total 6 marks)

Q29.

When electricity passes through a thin wire, the wire gets hot. If the wire gets very hot, it may glow. This idea is used in filament lamps.

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(a) The table shows some metals and their melting points.

Metal	Melting point in °C
Aluminium	660
Copper	1084
Iron	1540
Tungsten	3410

Which metal in the table should be used to make the wire in a filament lamp?

Give a reason for your answer.

_____

_____

_____

_____

(2)

(b) The table shows some gases.

Gas
Argon
Carbon dioxide
Oxygen
Sulfur dioxide

Which gas in the table should be used in a filament lamp?

Give a reason for your answer.

_____

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_____

_____

_____

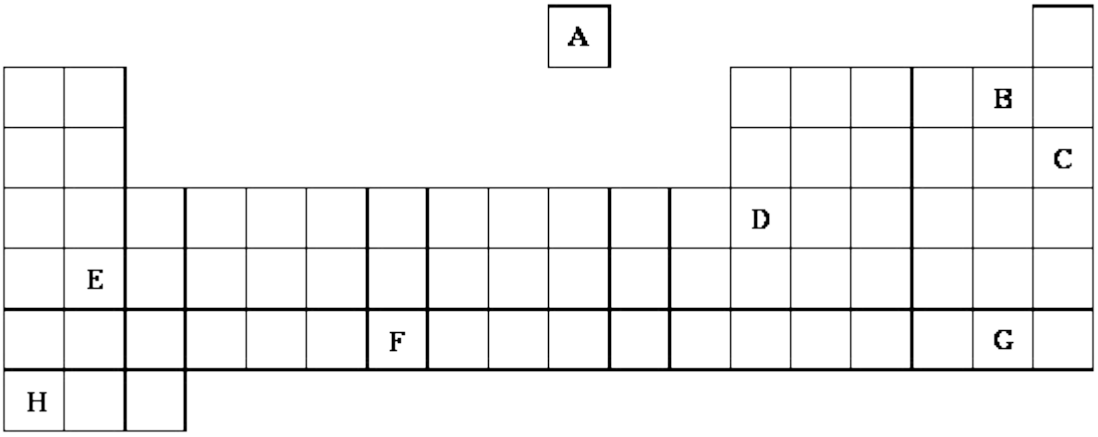
(2)

(Total 4 marks)

Q30.

The periodic table on the Data Sheet may help you to answer this question.

The diagram shows an outline of the periodic table.



Choose your answers **only** from the letters shown on this outline table.

Which letter, **A** to **H**, represents an element which:

(a) is in Group 3,

Letter _____

(1)

(b) is in Period 2,

Letter _____

(1)

(c) is a transition element,

Letter _____

(1)

(d) is the least reactive element in Group 7,

Letter _____

(1)

(e) is the most reactive metal?

Letter _____

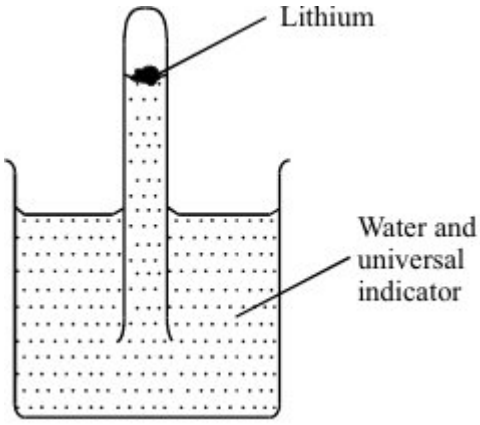
(1)

(Total 5 marks)

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Q31.

The diagram shows an experiment to study the reaction of lithium with water.



(a) Describe, as fully as you can, what you would see as the lithium reacts with the water in this experiment.

To gain full marks in this question you should write your ideas in good English. Put them into a sensible order and use the correct scientific words.

_____

_____

_____

_____

_____

(3)

(b) The reaction has two products. Complete the word equation for this reaction by choosing the correct substances from the box.

hydrogen	**lithium hydride**	**lithium hydroxide**
lithium oxide		**oxygen**

lithium + water → _____ + _____

(2)

(c) Caesium is lower down in Group 1 of the periodic table than lithium.
Suggest how the reaction of caesium with water might be different from lithium's reaction.

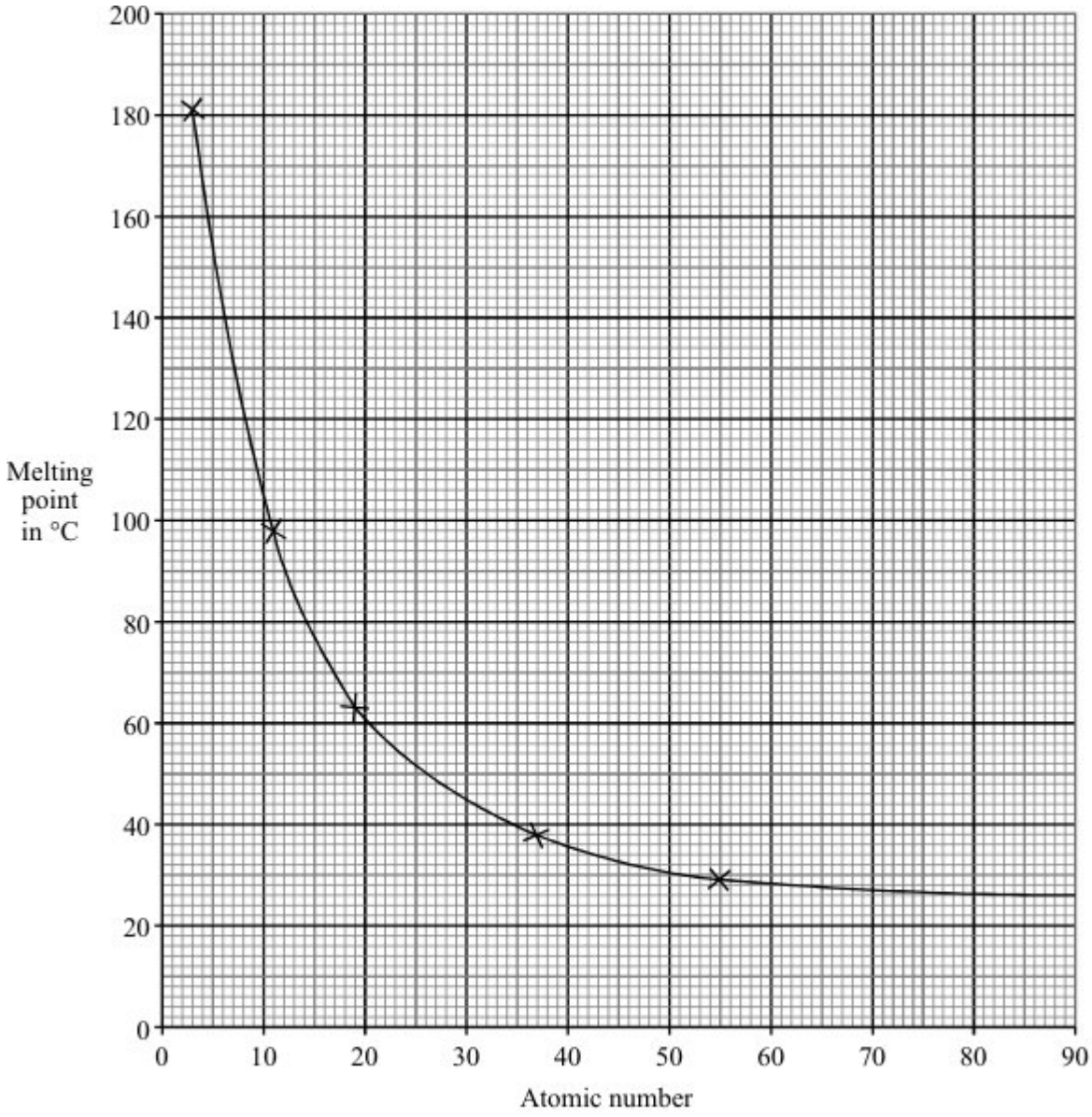
_____

_____

(1)

(d) The graph shows the melting points of the Group 1 metals plotted against their atomic numbers.

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(i) Describe fully how the melting points change as the atomic number increases.

_____

_____

_____

(2)

(ii) Francium has an atomic number of 87.
Use the graph to estimate the melting point of francium.

Estimate of melting point _____ °C

(1)

(Total 9 marks)

Q32.

The table shown below was devised by John Newlands in 1864. He arranged the elements in order of their relative atomic masses. He found a repeating pattern, with elements having similar properties in the vertical columns (Groups). He called this pattern

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the ‘Law of Octaves’, because elements with similar properties seemed to be repeated every eighth element.

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
I	Cs	Ba/V	Ta	W	Nb	Au
Pt/Ir	Tl	Pb	Th	Hg	Bi	Os

(a) Many scientists were critical of Newlands’ Law of Octaves.
Suggest why other scientists were critical of the Law of Octaves.
You should give examples from the table and use your knowledge of the chemistry of the elements.

_____

_____

_____

_____

_____

_____

(3)

(b) The diagram below shows a version of Mendeleev’s Periodic Table of 1871.
Mendeleev placed most of the elements in order of relative atomic mass.

	Group 1	Group 2	Group 3	Group 4	Group 5	Group 6	Group 7	Group 8
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	Fe Co Ni
Period 5	Rb Ag	Sr Cd	Y In	Zr Sn	Nb Sb	Mo Te	? I	Ru Rh Pd

This table became accepted by other scientists.

Give **two** ways in which Mendeleev’s table improved on Newlands’ table.

1 _____

_____

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2 _____

_____

(2)

(Total 5 marks)

Q33.

The periodic table on the Data Sheet may help you to answer this question.

(a) Newlands and Mendeleev both designed periodic tables in which the elements were put in the order of their relative atomic masses.

When the elements are put in this order a few of them are placed incorrectly when compared with a modern periodic table.

(i) Give **one** example of a pair of elements that would be placed incorrectly if they were in the order of their relative atomic masses.

_____ and _____

(1)

(ii) Explain why placing these two elements in the order of their relative atomic masses would **not** be correct.

_____

_____

(1)

(b) In the modern periodic table the elements are put in order of their atomic (proton) numbers.

Explain how the positions of the elements in the periodic table are linked to the electronic structure of their atoms.

_____

_____

_____

_____

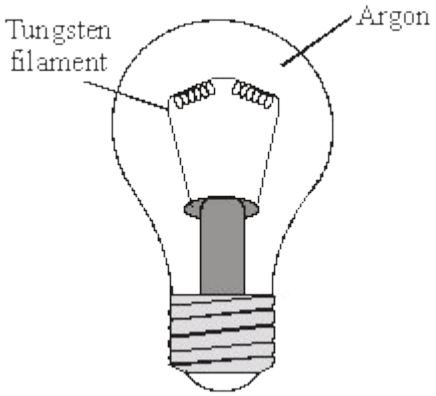
(2)

(Total 4 marks)

Q34.

The diagram shows an electric light bulb.

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When electricity is passed through the tungsten filament it gets very hot and gives out light.

(a) What reaction would take place if the hot tungsten was surrounded by air?

_____

_____

_____

(1)

(b) State why argon is used in the light bulb. Explain your answer in terms of the electronic structure of an argon atom.

_____

_____

_____

_____

_____

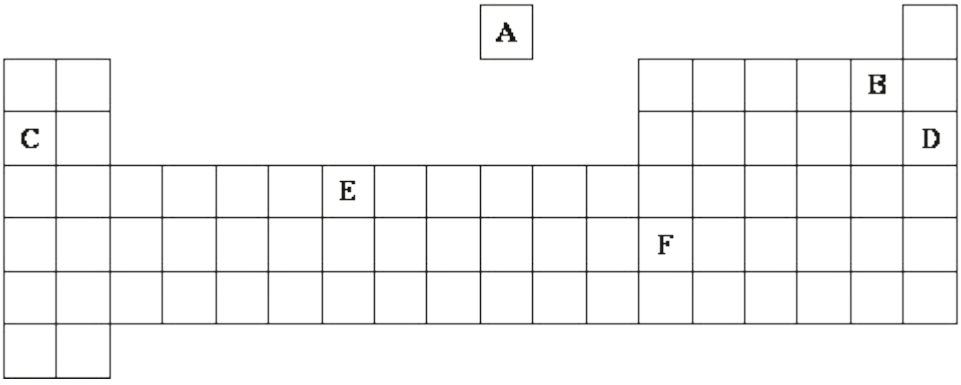
_____

(3)

(Total 4 marks)

Q35.

The diagram shows an outline of the periodic table.



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Choose your answers **only** from the letters shown on the table above.

The periodic table on the Data Sheet may help you to answer this question.

Which element, **A** to **F**:

(a) is in Group 3;

_____

(1)

(b) is a metal which floats on water and reacts violently to make an alkaline solution and hydrogen gas;

_____

(1)

(c) is a gas which burns with a squeaky pop?

_____

(1)

(Total 3 marks)

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