Q1.
A student used paper chromatography to identify the pigments in spinach leaves.
She used propanone as a solvent.

**Figure 1** shows the student’s results.

(a) Name the mobile phase and the stationary phase in the student’s experiment.

Mobile phase ________________________________________________________

Stationary phase _____________________________________________________
___________________________________________________________________

(b) What does **Figure 1** tell you about the green pigment from spinach?

___________________________________________________________________
___________________________________________________________________
___________________________________________________________________
___________________________________________________________________
___________________________________________________________________
___________________________________________________________________
___________________________________________________________________
___________________________________________________________________
___________________________________________________________________
(c) Write the equation that links distance moved by solvent, distance moved by solute and R<sub>f</sub> value.

(1)

(d) Use Figure 1 to calculate the R<sub>f</sub> value for pigment B.

R<sub>f</sub> value = ________________

(3)

(e) Another student set up the apparatus shown in Figure 2.

This student did not set up the apparatus correctly.

Identify the errors the student made.

Explain how the errors she made would affect her results.
Q2.

This question is about atomic structure and elements.

(a) Complete the sentences.

(i) The atomic number of an atom is the number of ____________________________

(ii) The mass number of an atom is the number of ____________________________

(b) Explain why an atom has no overall charge.

Use the relative electrical charges of sub-atomic particles in your explanation.

(c) Explain why fluorine and chlorine are in the same group of the periodic table.

Give the electronic structures of fluorine and chlorine in your explanation.

(d) The diagram shows the electronic structure of an atom of a non-metal.
What is the chemical symbol of this non-metal?

Tick (✓) one box.

Ar
O
S
Si

(e) When elements react, their atoms join with other atoms to form compounds.
Complete the sentences.

(i) Compounds formed when non-metals react with metals consist of particles called ________________________ .

(ii) Compounds formed from only non-metals consist of particles called ____________________ .

(Q3. In 1866 John Newlands produced an early version of the periodic table.

Part of Newlands’ periodic table is shown below.)
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)

Q4.

This question is about the halogens (Group 7).

(a) How do the boiling points of the halogens change down the group from fluorine to iodine?
(b) Sodium bromide is produced by reacting sodium with bromine.
Sodium bromide is an ionic compound.

(i) Write down the symbols of the two ions in sodium bromide.

_______________________________

(ii) Chlorine reacts with sodium bromide solution to produce bromine and one other product.
Complete the word equation for the reaction.
chlorine + sodium bromide → bromine + ________________

(iii) Why does chlorine displace bromine from sodium bromide?

_______________________________

_______________________________

(iv) Use the Chemistry Data Sheet to help you to answer this question.
Suggest which halogen could react with sodium chloride solution to produce chlorine.

_______________________________

(Total 5 marks)
Choose the correct symbol from Figure 1 to answer each question.

You may use each symbol once, more than once or not at all.

Write the symbol that represents:

(i) a Group 1 element

(ii) a transition metal

(iii) an element with electrons in the same number of energy levels as an atom of argon (Ar)

(iv) an element which forms an oxide that dissolves in water to form an acidic solution

(v) an element that forms a chloride with the formula XCl

(b) A teacher put a cube of sodium metal into water containing universal indicator, as shown in Figure 2.

The equation for the reaction is:

\[ 2\text{Na(s)} + 2\text{H}_2\text{O(l)} \rightarrow 2\text{NaOH (aq)} + \text{H}_2(g) \]

(i) The sodium floated on the surface of the water. The universal indicator turned purple.

Give three other observations that would be seen during the reaction.
(ii) Name the ion that made the universal indicator turn purple.

Figure 3 represents the electronic structure of a sodium atom.

In the space below, draw the electronic structure of a sodium ion. Include the charge on the ion.

(Total 11 marks)
Q1.
(a) mobile phase propanone
    stationary phase paper
(b) any three from:
    • contains chlorophyll a, b and carotene
    • contains Pigment B
    • does not contain pheophytin
    • contains (at least) one unknown substance
    • contains five substances
    • contains a substance that does not dissolve in the solvent
(c) \[ R_f = \frac{\text{distance moved by substance}}{\text{distance moved by solvent}} \]
(d) both measurements correct
    solvent front = 9.0 cm and pigment B distance = 5.0 cm
    \[ R_i = \frac{5.0}{9.0} \]
    \[ = 0.56 \]
    allow ecf from incorrect measurements
(e) origin line drawn in ink
    so it will run or dissolve in the solvent or split up
    spots under solvent or solvent above spots / origin line
    so they will mix with solvent or wash off paper or colour the solvent or dissolve in the solvent

Q2.
(a) (i) protons
    allow “protons or electrons”, but do not allow “protons and electrons”
(ii) protons plus / and neutrons
(b) (because the relative electrical charges are) −(1) for an electron and +(1) for a
proton

*allow electrons are negative and protons are positive*

and the number of electrons is equal to the number of protons

*if no other mark awarded, allow 1 mark for the charges cancel out*

(c) (the electronic structure of) fluorine is 2,7 and chlorine is 2,8,7

*allow diagrams for the first marking point*

(so fluorine and chlorine are in the same group) because they have the same number of or 7 electrons in their highest energy level or outer shell

*if no other mark awarded, allow 1 mark for have the same / similar properties*

(d) S

(e) (i) ions

(ii) molecules

Q3.

(a) (iron) is a metal

*accept transition element*

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

*ignore electrons*

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

*allow to make the pattern fit*

*ignore undiscovered elements*

(c) atomic number(s)

*allow proton number(s)*

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

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

(so they) have similar properties

*or*

react in the same way

*allow specific reactions e.g. with water*

[9]
Q4.
(a) increase

(b) (i) Na\textsuperscript{+} and Br\textsuperscript{-} \\
both required

(ii) sodium chloride \\
allow NaCl \\
do not allow sodium chloride

(iii) chlorine is more reactive than bromine \\
allow converse argument \\
allow symbols Cl, Cl\textsubscript{2}, Br and Br\textsubscript{2} \\
allow chlorine / it is more reactive \\
do not allow chloride or bromide

(iv) fluorine \\
allow F / F\textsubscript{2}. \\
do not allow fluoride.

Q5.
(a) (i) Na \\
allow sodium / phonetic spelling \\
if more than one answer is given apply list principle

(ii) Fe \\
allow iron / phonetic spelling \\
if more than one answer is given apply list principle

(iii) Na or S \\
allow sodium or sulfur / sulphur / phonetic spelling \\
if more than one answer is given apply list principle

(iv) S \\
allow sulfur / sulphur / phonetic spelling \\
if more than one answer is given apply list principle

(v) Na \\
allow sodium / phonetic spelling \\
if more than one answer is given apply list principle

(b) (i) any three from:

- effervescence / fizzing or bubbles or gas produced
do not allow incorrectly named gas
• sodium melts or turns into a ball
• sodium moves (on the surface)
• steam / mist / vapour is produced
  ignore heat / temperature / flame / spark
• sodium gets smaller / disappears
  allow dissolves
• colour of indicator is darker / more intense near the sodium
  Must be linked to near the sodium.

(ii) hydroxide or OH-
  allow OH without a charge
  do not allow OH+

(c) [2,8]^+

  diagram showing electron configuration of ion is 2,8

  charge on ion is +
  Bracket not necessary
  [2,8]^+ is worth 1 mark as there is no diagram

[11]