A. Purity and Formulations

1. A student carried out an experiment in which they measured the temperature of two substances whilst they were heated. During the experiment both substances melted.

Time in seconds	0	5	10	15	20	25	30	35	40	45	50
Temperature of substance A ^{o}C	30	35	39	40	40	40	40	44	49	54	59
Temperature of substance B ^{o}C	30	35	37	39	40	42	44	46	49	54	59

What can be concluded about each chemical from the results the student obtained? Explain your answer. (4)

Substance A – pure [1]; temperature remained constant between 15°C and 30°C [1]
Substance B – not pure [1]; temperature gradually increased throughout [1]

2. Why would a scientist not describe "pure milk" as pure? (2)

It is not a single element or compound [1] it is mixed with other substances [1]

3. There are a number of alloys of steel. They all contain slightly different components e.g. carbon steel is 99% iron and 1% carbon, whereas stainless steel is 88% iron and 12% chromium.
What is the scientific name given to these types of mixtures and why are they made? (3)

Formulations [1]
They have different properties to the starting materials [1]
By changing the materials a substance can be produced that has the required properties [1]

B. Chromatography

1. A student carries out chromatography on two chemicals X and Y. Explain how chromatography might split up the chemicals in the two substances. (3)

There is a stationary phase [1] and a mobile phase [1] separation depends on the distribution between the phases [1]

2. The student found that a spot had risen up 0.7cm from chemical X, whereas the solvent had risen 2cm, chemical Y had not moved.

Calculate the R_f value for chemical X. Describe what the student would have seen if X was a pure chemical and what might happen to chemical Y if a different solvent was used in the chromatography.(6)

0 marks	*Level 1 (1–2 marks)*	*Level 2 (3–4 marks)*	*Level 3 (5–6 marks)*
No relevant content	*R_f value calculated as 0.35* *OR* *Explanation that only one spot would be seen above X* *OR* *Explanation that Y might dissolve in another solvent therefore spots would be seen.*	*Two of the relevant pieces of information.*	*All three relevant pieces of information.*

C. Identification of Common Gases

1. A student has two test tubes of gas. He believes that one contains hydrogen and one contains oxygen. Describe how he could test for each gas and the positive result he would see for each gas. (4)

Hydrogen – use a burning splint [1] (squeaky) pop [1]
Oxygen – use a glowing splint [1] splint relights [1]

2. A student adds hydrochloric acid to a white solid in a test tube. She believes the solid is a carbonate. Describe in detail how she could test the gas given off to prove her prediction. You may draw a diagram to help you in your answer. (4)

Idea of delivery tube [1]
Gas then bubbled through lime water [1]
Lime water turns milky/cloudy [1]
This shows carbon dioxide released [1]

D. Identification of Ions By Chemical Means (Chemistry only)

1. A student has three different samples of chemicals, they know that one contains lithium, one contains potassium and one contains calcium. Describe the test she could do to determine which chemical contains which metal. (6)

Any three from: (a diagram is acceptable)
Heat metal wire [1] dip in chemical [1] put in roaring [1] Bunsen flame [1]
Lithium – crimson flame [1]
Potassium – lilac [1]
Calcium – orange-red [1]

2. The student has another sample that they know contains copper, however when they carry out the flame test they get a yellow colour rather than the expected green. Explain why this happens. (2)

Chemical is contaminated [1] with sodium [1]

3. In a further experiment two solutions contain aluminium and magnesium ions. They are tested with sodium hydroxide solution. Describe the similarities and differences in the results they would get. (3)

Both would give a white precipitate [1] aluminium precipitate would dissolve [1] with additional sodium hydroxide solution [1]

4. A chemist believed that a sample of water contained iodide and sulfate ions. When it was tested with silver nitrate a cream precipitate was produced; when tested with barium chloride a white precipitate was produced. What ions were present in the water? Write balanced symbol equations for the positive results, include state symbols. (6)

Ions identified bromide [1] sulfate [1]
$AgNO_3$ (aq) + NaBr (aq) → AgBr (s) + $NaNO_3$ (aq) [1] equation [1] state symbols
$BaCl_2$ (aq) + Na_2SO_4 (aq) → $BaSO_4$ (s) + 2NaCl (aq) [1] equation [1] state symbols

E. Identifications of Ions by Spectroscopic Means (Chemistry only)

1. Give three advantages of using instrumental methods compared to chemical methods to identify ions. (3)

Accuracy [1] sensitivity [1] rapid [1]

2. Describe how you would carry out flame emission spectroscopy and what you would use it to test for. (4)

Chemical put into flame [1] light given off passed through spectroscope [1] line spectrum [1] identifies metal ions [1]