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Examiners' Report
June 2023

Int GCSE Chemistry 4CH1 2CR

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June 2023

Publications Code 4CH1_2CR_2306_ER

Introduction

The paper produced a good range of marks, with some candidates scoring very highly.

The topic of alloys has not been assessed frequently. Candidates answered the question about an alloy's properties, but were less sure about a definition for an alloy.

Questions on practical situations, as always, produced a variable response. There were some excellent answers to the question on the preparation of an insoluble salt. This was not surprising, as this topic has featured on previous question papers. However, the question on electrical conductivity was less well-known. This was a harder question, as it required application of knowledge of practical skills and some parts of theory.

Mathematical questions were well handled. Candidates just need to take care, in moles calculations, to consider the ratio only once. Some candidates incorporate the ratio in the calculation of Mr – which is an acceptable method – but then consider it again later in the calculation.

The other aspect that proved difficult was terminology. Here, the problem was distinguishing between halogens and halide ions, which affected two questions. This is an on-going issue, so would be one for candidates to try and master.

Question 1 (a)

Many candidates scored both marks here.

The most common error was missing the charge – or giving the wrong charge – for the electron. Some candidates simply gave a minus sign with no value: it did need to be – 1 in order to be equal (but opposite) the charge on a proton.

Candidates should also note that, at this level, it is sufficient to give the relative mass of proton and neutrons as 1.

Question 1 (b)(iii)

The multiple-choice questions were mostly correct, although C proved to be a good distractor in Question 1(b)(ii). This was because the first period – showing H and He – was not shown in the question, but was in the Periodic Table in the question paper.

A few candidates mistakenly chose Be, on the grounds that it was the smallest atom (so presumably had electrons closer to the nucleus, so less easily ionised). However, most candidates correctly chose Xe. The second mark was for an explanation – so simply stating "Xe is a noble gas" was not enough to score. There needed to be a reference to the full outer shell of electrons.

(iii) Explain which of the four elements in the diagram is least reactive.

(2)

Xe is a noble gas in group 0 which is the least reactive amoang them

ResultsPlus Examiner Comments

This scores 1 mark for correctly identifying Xe as the least reactive.

ResultsPlus Examiner Tip

An 'Explain' question needs to include "...because..." along with the reason. Here this would mean "... because xenon atoms have full outer shells".

Question 2 (a)

Most candidates knew that bromine is a liquid.

There was some variety in the colour given to fluorine, but candidates usually chose something paler than green eg yellow. A few went a little too pale with white or colourless, which did not score.

Question 2 (b)

The bromine water test is examined frequently, and so is well known by most candidates.

A few candidates failed to give bromine **water** or bromine **solution**. This is penalised, as pure bromine is not used for this test. The examiners tend to look at the final colour ie that bromine water decolourises or becomes colourless, but it is good to see most candidates who do give a starting colour of bromine giving it correctly as orange – which was given in the table!

A very small number of candidates seem to have been taught – or independently learned – other possible tests for the carbon-carbon double bond. Teachers should advise inquisitive candidates that it's better to stick with the bromine water test.

Bromine water test, where it turns from colorless to ~~green~~ orange if an alkene is present.

ResultsPlus Examiner Comments

Bromine water is the correct reagent, but the colour change is the wrong way round.

ResultsPlus Examiner Tip

Candidates need to revise correct directions for colour changes.

Question 2 (c)

This was the first challenging question on the paper, mostly because candidates don't always use accurate terminology.

In general, candidates appreciated that chlorine would react with potassium iodide, to produce iodine and potassium chloride. The final colour was frequently given as grey or purple – although the table at the start of the question gave the colour of iodine solution as brown.

The problem came with describing this reaction. Many candidates described chlorine as more reactive than iodide, rather than **iodine**; or said that iodide ions were displaced, rather than **iodine** being displaced. Some candidates gave an equation – this is a good idea, but only scored the mark if it was correctly balanced.

Colour ~~chan~~ of solution changes from brown ~~colourless~~ to colourless ~~brown~~. This is because sodium reacts with aqueous chlorine to form sodium chloride ~~as~~ chlorine ions displaces iodide ions as chlorine is more reactive.

ResultsPlus
Examiner Comments

This response is a little confused.

The colour change is the wrong way round, as the final solution is brown.

The description of the reaction is a little confused – as there is no sodium present, only sodium ions. However, the final mark was awarded for the idea of chlorine being more reactive.

ResultsPlus
Examiner Tip

Take care about using the name of the element and the name of the ions.

These reactions in Group always involve one halogen displacing another halogen from its ions.

Chlorine is more reactive than iodine.
chlorine displaces the iodine to form sodium chloride.
This changes the colour from ~~green~~ colourless to brown. aqueous iodine solution is formed which is brown.

ResultsPlus
Examiner Comments

An excellent response which scored all 3 marks.

Question 3 (a)(i)

The majority of candidates correctly chose magnesium.

Zinc was the most common incorrect answer.

Question 3 (a)(ii)

Question 3(a)(ii) proved to be slightly lower scoring than expected. The inclusion of silver in the list of elements was a distractor for some – although most candidates did correctly choose gold.

The second mark needed to say something about gold being unreactive, or low in the reactivity series. However, some candidates simply repeated the wording of the question and said that gold was not likely to be found in compounds. Candidates need to make sure that answers do not simply repeat the question wording.

Question 3 (b)(i)

This definition was not well known – and the use of steel as an example may have confused a few candidates.

Quite a lot of candidates implied that an alloy was a compound rather than a mixture by using words such as 'combined'. The other incorrect statement was that alloys could involve metals and any other element, whereas most elements are a mixture of metals. Steel is an exception in involving carbon.

(i) State what is meant by the term **alloy**.

(1)

~~mixture~~ combination of different metals and non-metals.

ResultsPlus
Examiner Comments

This scores 0 marks.

The first mistake is that it refers to an alloy as a 'combination' – this implies a compound, rather than a mixture.

The second is that alloys are usually mixtures of metals, or one metal with carbon.

Question 3 (b)(ii)

Despite the definition proving difficult for many, the explanation in Question 3(b)(ii) was done well by many candidates.

Most candidates described the different sizes of the atoms in the alloy – although some made reference to the lattice losing its regular arrangement. Candidates who scored the first mark almost inevitably also scored the second mark for stating that layers did not slide freely over each other, as in a pure metal.

A few candidates incorrectly referred to intermolecular forces, although metals are composed of atoms or ions, and not molecules. Candidates do need to be careful to use the phrase 'intermolecular forces' only when describing the forces between discreet covalent molecules.

(ii) Explain why an alloy is less malleable than a pure metal.

(2)

Malleability is how easy something can be bent or hammered into shape. Alloys are less malleable than pure metals because alloys are the product of ionic bonding, which strengthens intermolecular forces, making them tougher to break

ResultsPlus Examiner Comments

This answer scored 0 marks.

ResultsPlus Examiner Tip

Make sure that you know the difference between metallic bonding, ionic bonding, and covalent bonding (with intermolecular forces).

This answer mixes terminology from all of these very different forms of bonding.

(ii) Explain why an alloy is less malleable than a pure metal.

(2)

An alloy is less malleable than a pure metal because an alloy contains atoms consisting of different sizes which makes it ~~less~~ harder to be hammered into different shapes as the layers do not slide as smoothly over each other like they do in pure metals.

(Total for Question 3 = 6 marks)

ResultsPlus
Examiner Comments

An excellent answer which scored both marks.

Question 4 (a)(i)

The uses of different fractions are usually well known.

The examiners were quite generous, but candidates should note that giving "cooking oil" as a use for refinery gases is rather ambiguous, as it sounds like something used to cook the food in, rather than something used as a fuel for the cooking stove.

Similarly, with bitumen, it would be clearer if candidates stated that it is used to **surface** roads or roofs. Simply stating 'roads' is misleading, as roads are mostly made from stone or concrete.

Question 4 (a)(ii)

About two-thirds of candidates were able to score the mark here, usually by referring to the low boiling point of refinery gases.

Some candidates lost the mark by referring to melting points, which is not correct as a fractionating column only contains liquids and gases.

A few candidates gave an alternative correct property, such as high volatility.

Question 4 (a)(iii)

Most candidates knew that crude oil is heated or vaporised before being introduced into the fractionating column.

Some selected filtration, which may take place, but is not absolutely necessary.

Question 4 (b)(i)

Although there was sometimes confusion with the conditions used to hydrate ethene to form ethanol, the majority of candidates recalled the conditions here.

Some candidates narrowly missed out on the temperature, usually by giving a range that wasn't entirely within the acceptable range eg 650 – 750 ^{o}C. Others gave a catalyst that was not quite correct eg aluminium.

(b) There is a low demand for some of the hydrocarbons obtained from crude oil.

Catalytic cracking can be used to convert low-demand hydrocarbons into more useful products.

(i) Give the conditions needed for cracking.

(2)

300°C temperatures and ~~60~~ 60 atmospheres of pressure

ResultsPlus
Examiner Comments

These are the conditions for the hydration of ethene, so do not score here.

ResultsPlus
Examiner Tip

Make sure you're careful with giving silica or alumina as catalysts, not silicon or aluminium.

Question 4 (b)(ii)

This proved to be a tricky question for many candidates, with most candidates scoring 0 and full marks being very rarely seen.

There were two reasons for this. The first was that candidates didn't distinguish between the products in terms of one being an alkane and the other being an alkene. So, an answer that simply said "the products are used as a fuel" was common, but didn't score because only smaller alkanes are used as fuels, and not the alkenes from cracking. The second was that even candidates who gave a correct use for a shorter chain alkane and alkene very rarely answered the question. Candidates should note that an "Explain..." question needs some reasoning, in terms of why shorter alkanes make good fuels or why shorter alkenes can be used to make polymers.

(ii) The cracking of tetradecane is shown in the equation.

$$C_{14}H_{30} \rightarrow 2C_3H_6 + C_8H_{18}$$

Explain why there is a high demand for both of the products.

(3)

- Alkenes (Propene) is used for production of polymers.
- Short chained hydrocarbons are more profitable.
- Short chained hydrocarbon are mainly used for fuel in cars

ResultsPlus
Examiner Comments

This scores 1 mark for alkenes (in this case propene) being used to make polymers.

The comment about fuels does not specifically relate to short-chain **alkanes**, so does not score.

ResultsPlus
Examiner Tip

An "Explain..." question needs to include a reason – usually using the word **because**.

(ii) The cracking of tetradecane is shown in the equation.

$$C_{14}H_{30} \rightarrow 2C_3H_6 + C_8H_{18}$$

Explain why there is a high demand for both of the products.

(3)

C_3H_6, an alkene, is more useful as it can be used to make polymers (and plastics) due to its double C=C bond.

C_8H_{18}, is a shorter chain ~~ke~~ alkane, making it easier to ignite and therefore more useful to use as fuel for cars as an example.

ResultsPlus
Examiner Comments

An excellent answer.

The two uses given both clearly refer to alkanes and alkenes; and each use is justified with a reason.

All 4 marking points are present, and so the full 3 marks are scored.

Question 5 (a)

Question 5(a) was a salt preparation: and, on this occasion, the salt was an insoluble one. There should have been no doubt about this in candidates' minds, as this was in the stem of the question – and an equation showed the salt as a solid.

The most common mark was 4, so most candidates picked up on the information given and gave a very good answer. Of those who chose the correct method but did not score full marks, this was usually because the washing step was omitted.

Few candidates gave a complete description of the preparation of a soluble salt, but there were many answers which were ambiguous. This was either because they heated the reaction (candidates who have made an insoluble salt during the course would know that the reaction takes place at room temperature), or because they used words such as crystallisation in their answer. Ambiguous methods could still score the mark for mixing the reagents.

(a) Describe how solutions of lead nitrate and potassium bromide can be used to make a pure, dry sample of lead(II) bromide.

(4)

* Wash the conical flask with distill water.
* Take the test tube containing lead nitrate and potassium ~~sn~~ bromide.
* Mix both the solution in the conical flask.
* Filter the ~~mixture~~ solution to obtain the solids.
* Wash the solid with distill water.
* ~~d~~ Dry it using filter paper.

ResultsPlus
Examiner Comments

An excellent answer which clearly makes all 4 points in a clear and logical order.

Transfer the filtered solution of lead bromide and potassium bromide : to an evaporating dish and heat it till it reach saturation point (~~to~~ Dip a glass rod into the solution ~~and~~ if small crystales are ~~frome~~ fromed at the bottom it reached ~~a~~ saturation point). allow it of cool and filter it wash it distille pure water and dry it with filter paper or under the sun.

ResultsPlus
Examiner Comments

This is clearly the method for producing a soluble salt.

As there is no mention of mixing the two solutions at the start of the experiment, it scores 0.

ResultsPlus
Examiner Tip

It's very important to read the question carefully.

The question stems make it clear that lead(II) bromide is insoluble, so the method needed to match this.

Question 5 (b)

Most candidates gave a correct method here and scored both marks.

It was rare to see candidates score only 1 mark – those candidates who were unclear of the method scored 0.

Candidates who calculated the number of moles of lead(II) bromide formed almost always rounded this to 0.135 moles and therefore had a final answer of exactly 90% rather than 90.1%, as the question required. This was not penalised.

As always with a "Show that..." question, some candidates simply carried out random calculations until they hit the correct answer. In many cases, candidates were lucky enough to find a correct method and scored marks. However, one method was specifically rejected because, although it was mathematically correct, it made no chemical sense.

(b) A solution containing 0.150 mol of lead(II) nitrate is reacted with an excess of potassium bromide solution.

A mass of 49.6 g of pure, dry lead(II) bromide is produced.

Show, by calculation, that the percentage yield of lead(II) bromide is 90.1%.

[for $PbBr_2$, $M_r = 367$]

$$\cancel{\frac{49.6}{367}}$$

$$\frac{330.667}{367} \times 100 = 90.1$$

ResultsPlus
Examiner Comments

Although this method gives an answer of 90.1%, it does not score because it makes no chemical sense.

Maximum yield is calculated either from the moles of reactant and the Mr of the product; or by calculating the moles of product and comparing the moles of reactant.

ResultsPlus
Examiner Tip

In a "Show that..." question, there are no marks for the final answer: candidates are marked on the method used.

Question 5 (c)(iii)

Most candidates scored 1 mark here, but it was very rare for candidates to score both marks.

Examiners were generous when considering the description of this graph. Note that it doesn't show inverse proportion, which takes the form of an exponential curve. Here, the two variables are proportional to each other, but with negative correlation. Most candidates simply said that increasing the volume of lead(II) nitrate added decreased the conductivity.

The requirement to 'Explain...' was very rarely seen. Those that did attempt it didn't always understand that precipitation was removing ions from the solution.

(iii) Explain the shape of the graph.

(2)

Electrical conductivity reduces with increased amount of lead (II) nitrate. This is because the solution is an insulator

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Examiner Comments

This scores 1 mark for describing the shape of the graph.

ResultsPlus
Examiner Tip

Another "Explain..." question, so it was necessary to say why the electrical conductivity decreases when more lead(II) nitrate is added.

Question 5 (c)(i-ii)

The points plotted in Question 5(c)(i) mostly fell on major grid lines and so posed few difficulties, and most candidates scored both the plotting mark and the mark for the line of best fit.

Where there was a plotting error, it was nearly always the point at 20cm^3 of added lead(II) nitrate being plotted too low on the axes.

A small number of candidates did a "join the dots" rather than a straight line of best fit in Question 5(c)(ii).

Question 5 (c)(iv)

Question 5(c)(iv) asked candidates to account for the anomalous result.

In questions like this, it is important that the answer matches the direction of the error. For example, in this case, the anomalous result lies above the line of best fit and so the explanation had to take account of this. A number of answers simply said that part of the measurement was incorrect, but didn't specify what the error was.

Question 5 (c)(v)

Few candidates scored the mark here – mostly because they assumed that the trend in the graph would continue. This is partly because candidates did not consider the explanation in Question 5(c)(iii), so didn't appreciate the context here.

Most candidates assumed that conductivity would continue to decrease, although a few went for a no change. The idea that conductivity would increase once all the lead ions were precipitated was seen very infrequently.

Question 5 (d)

Around half of candidates scored the mark here.

The issue wasn't one of understanding – very large numbers of candidates evidently knew that oxidation was the loss of electrons. The problem was in identifying which species was losing electrons and therefore being oxidised. Many candidates chose bromine (or bromine ions) to lose electrons, which did not score.

This is the ionic half-equation for the formation of bromine at electrode A.

$$2Br^- \rightarrow Br_2 + 2e^-$$

Give a reason why this half-equation shows oxidation.

because Bromine has lost electrons

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Examiner Comments

This response scores 0 marks.

The species that is losing electrons is the bromide ion.

Bromine is the product of the reaction.

ResultsPlus
Examiner Tip

Be very careful in describing atoms and ions for non-metals.

Question 6 (a)

As with all definitions, the definition of metallic bonding was excellent from those who had learned the definition, but imprecise and did not score from those who did not recall it.

Some candidates lost one mark because they did not describe the electrons in the metal as being delocalised. However, examiners were happy to accept the attraction between the delocalised electrons and positive metal ions/cations or with the positive nuclei of metal atoms.

6 (a) Describe the forces of attraction in metallic bonding.

(2)

Strong electrostatic forces of attraction between atoms and the ~~(sea of)~~ delocalised electrons.

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Examiner Comments

This answer nearly scores both marks, but was worth 1 mark.

Electrostatic forces exist between the delocalised electrons and the particles in the metal – but these needed to be described as the positive nuclei of the atoms, or positive metal ions.

Strong electrostatic forces of attraction between the positive and the negative nuclei with ~~a~~ shared pair of electrons.

ResultsPlus
Examiner Comments

This was a confused answer which scored 0 marks.

It combines elements of ionic bonding (positive and negative nuclei) with covalent bonding (shared pair of electrons), but doesn't apply to metallic bonding.

Question 6 (b)(i)

Although this is a well-known test, a significant proportion of candidates did not score the mark.

There were two issues. The first was that many candidates used a glowing splint, rather than a burning splint. The other was that candidates only gave the result of the test ("it burns with a squeaky pop") and not the description of how the test was carried out ie the use of a burning splint.

Question 6 (b)(ii)

Some candidates misunderstood the question and gave two observations as the test for hydrogen is carried out, rather than two observations as potassium reacts with water.

The formation of bubbles of gas was in the question stem, so effervescence was not accepted as a possible answer.

However, many candidates were able to score both marks here.

(ii) Give two other observations that would be made.

1 lilac flame

2 fizzing / moving around the water

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Examiner Comments

Potassium will form a lilac flame, so this scores 1 mark.

The question stem refers to bubbles forming, so fizzing does not score; but a second mark is given for the potassium moving around.

Question 6 (c)

A number of excellent answers were seen to Question 6(c) which scored full marks.

For other candidates, terminology wasn't quite accurate to score all marks.

The first mark was given for the idea of the potassium atom being larger, or having more shells. Some candidates said that potassium had **'more outer shells'** which did not score, as atoms only have one outer shell.

The second mark was for the attraction between the nucleus and the **outer** shell of electrons being weaker in a larger atom. A number of candidates use the term 'valence electron' which is slightly old-fashioned, but is clear and is given credit.

For the third mark, it needed to be clear that one electron is lost as the atom forms an ion.

(c) Explain why lithium is less reactive than potassium.

Refer to atomic structure in your answer.

(3)

This is due to the atomic radius. As lithium has fewer shells than potassium, the outermost electron of lithium is less readily lost because it is more strongly attracted to the nucleus. Therefore, potassium's outermost electron is more easily lost, due to the weaker forces of attraction.

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Examiner Comments

This is a good answer which scores all 3 marks.

ResultsPlus
Examiner Tip

Although this scored all 3 marks, it is a little confusing because of the change of emphasis. The first part of the answer focuses on lithium having a smaller atomic radium and losing its outer electron less easily; but the second part shifts to potassium having weaker forces of attraction.

It is clearer if the explanation keeps the same focus throughout.

Question 6 (d)

The calculation in Question 6(d) was answered very well, with 4 marks being the most common score.

A reasonable number of candidates gave a fully correct method, but left the answer as 391.3 cm^3 and lost the final mark for giving the answer to 3 SF.

Candidates have different ways of attempting moles calculations like this. Some convert 0.75g to moles by dividing by 23 and then consider the 2:1 ratio between sodium and hydrogen. Others combined these steps, so give the calculation:

moles of hydrogen = 0.75 / 2 x 23 = 0.0163

The problem arises with candidates who do both, and end up considering the 2:1 ratio twice, so ended up with an answer of 196 cm^3. Teachers should be aware of this and stick with one method for teaching calculations.

Of course, some candidates didn't consider the ratio at all, and end up with 783 cm^3. As with any incorrect answer, marks were given for each correct step, as long as working out was shown.

A mass of 0.750 g of sodium is reacted with an excess of water.

Calculate the volume of hydrogen gas produced, in cm^3, at room temperature.

[molar volume of hydrogen at rtp = 24 000 cm^3]

[for Na, A_r = 23]

Give your answer to three significant figures.

(4)

~~0.75 ÷ 23 = 0.03 mol~~

~~0.03~~

~~2×23 + 2×18~~ = 82

0.75 ÷ 23 = 0.03 mol

0.03 × 24000 = 720

volume of hydrogen = 720 cm^3

ResultsPlus
Examiner Comments

This scores 2 marks.

The first step has the correct working, but the answer is given to only 1 SF.

The ratio is not considered – but the final step is correct and the final answer is to 3SF.

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Examiner Tip

Don't round early in calculations – always keep at least 3 SF in the early steps, and then round at the end.

Question 6 (e)

The titration calculation was less well answered than the gas volume calculation in Question 6(d).

Several candidates rely on a short-cut formula: $v_1c_1 = v_2c_2$ but this only works when the reactants are in a 1:1 ratio.

Otherwise, calculations were generally good. Candidates just need to take care when working with small numbers that they don't mis-copy the numbers of zeroes after the decimal point!

(e) This is the equation for the reaction between sodium hydroxide and sulfuric acid.

$$2NaOH + H_2SO_4 \rightarrow Na_2SO_4 + 2H_2O$$

A volume of 25.0 cm^3 of sodium hydroxide solution is completely neutralised by 16.3 cm^3 of 0.0500 mol/dm^3 sulfuric acid.

Calculate the concentration of the sodium hydroxide solution in mol/dm^3.

(3)

$n = CV$

$= \frac{16.3}{1000} \times 0.05$

$= 8.15 \times 10^{-4}$

$C = \frac{n}{V}$

$= \frac{8.15 \times 10^{-4}}{25/1000}$

$= 0.0326$

concentration = 0.0326 mol/dm^3

ResultsPlus
Examiner Comments

A good answer – and clearly laid out.

However, it's missing the 2:1 ratio so only scores 2 marks.

Question 7 (a)(i)

The majority of candidates knew that the rates of the forward and backward reactions are the same in a dynamic equilibrium – although some candidates missed out the key word 'rate' in their answer.

The second answer was less accurate. The problem was that candidates used the words **constant** and **equal** as the same, so implied that the concentrations of products were equal to those of the reactants, rather than all concentrations staying the same once equilibrium is reached.

7 Methanol is made by the reaction between hydrogen and carbon monoxide.

This is the equation for the reaction.

$$2H_2(g) + CO(g) \rightleftharpoons CH_3OH(g) \qquad \Delta H = -119\ kJ/mol$$

A mixture of hydrogen and carbon monoxide is left until dynamic equilibrium is reached.

(a) (i) Give two characteristics of a reaction at dynamic equilibrium.

1 Both forward reaction and backward reaction rate is equal

2 The amount of reactants and products are equal

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Examiner Comments

This scores 1 mark for the first answer.

The second answer was a common incorrect answer: the amounts of reactants and products stay constant, but are not equal to each other.

Question 7 (a)(ii)

Few candidates scored the mark here.

The most common answer was that a catalyst doesn't affect the yield, only the rate. However, this simply restated the question.

The idea that a catalyst affects the rates of forward and backward reactions **equally** was therefore seen infrequently.

Question 7 (a)(iii)

Centres can teach the topic of equilibrium in any way they wish, but the specification and all past papers are clear that reference to Le Chatelier's Principle does not score by itself. The answer needs to contain a clear statement about which direction is exothermic / endothermic; or which direction has the fewest/greatest number of gas molecules.

In the case of Question 7(a)(iii), therefore, there needed to be a clear statement that the forward reaction is exothermic, so decreasing temperature increases the yield of methanol.

(iii) The temperature of the reaction mixture is decreased at constant pressure.

Explain the effect of this change on the yield of methanol.

(2)

· A decrease in temperature would favour the ~~endothermic~~ exothermic side.
· Since the forward reaction is exothermic, the yield of methanol would increase.

ResultsPlus Examiner Comments

The first line does not score.

Both marks are scored for the statement "Since the forward reaction is exothermic, the yield of methanol would increase".

As the temperature is decreass the ~~equil~~ equilibrium will sfi more ~~forward~~ ~~backward~~ ~~increasing the yeild~~. forward increasing the yeild.

ResultsPlus Examiner Comments

This answer has the correct effect on the yield, but does not explain why this is the case.

1 mark scored.

Question 7 (a)(iv)

As with Question 7(a)(iii), the mark for explanation was scored for simply saying "there are fewer moles of gas on the right". References to a shift in the position of equilibrium are not penalised, but do not scored by themselves – it must be clear why this shift happens in terms of numbers of moles.

(iv) The pressure of the reaction mixture is increased at constant temperature.

Explain the effect of this change on the yield of methanol.

(2)

· An increase in pressure would favour the side with the less amount of moles.

· Therefore the yield of methanol will increase.

ResultsPlus
Examiner Comments

This was a common answer, but only scores 1 mark.

There needs to be a clear statement that the right-hand side (or the products side) has fewer moles.

Question 7 (b)(i)

Most candidates scored all 3 marks here, helped by the fact that the question was a "Show that...". It also helped that the diagram showed all the covalent bonds in the reactants and products clearly.

To score all 3 marks, candidates did need to show the correct signs for bonds broken (+) and bonds made (-). Some candidates didn't make this clear, or had the signs the wrong way round, so lost the final mark.

Oddly, several candidates had a fully correct method, but ended with the calculation 1944 – 2063 = – 199 kJ/mol. Although this was a mis-copy of the value in the question stem, it is not correct so also lost the final mark.

(i) Show that the molar enthalpy change, ΔH, for the reaction is -119 kJ/mol. (3)

2 H–H 2×436 = 872
1 C≡O 1072
} +1944 kJ/mol   break - endo

3 C–H 3×414 = 1242
1 C–O 358
1 O–H 463
} -2063 kJ/mol   make - exo

+1944 + -2063 = -199 kJ/mol

ResultsPlus
Examiner Comments

The calculation starts very well, with the correct values and signs for bonds broken and bonds made, but the subtraction gives an incorrect value, so only scores 2 marks.

ResultsPlus
Examiner Tip

Check that the final answer matches the value given in the question.

Question 7 (b)(ii)

Answers to this question were often confused and lacked accuracy. The most common score was 0/2.

Most candidates did not make a clear distinction between bond breaking being endothermic (or needing energy) and bond making being exothermic (or releasing energy). It was very common to see both processes as "needing energy". Once one error was made, it was difficult to score the 2nd mark, so answers that didn't score 2 marks mostly scored 0.

Many candidates simply said that the reaction had a negative sign, or released energy, and was therefore exothermic. Although this is true, it was not an explanation, so did not score.

(ii) Explain why this reaction is exothermic.

(2)

Because the heat is released to the surrounding. ~~Mo~~ less energy required ~~to bor~~ break the bond but more energy required to make the bond.

ResultsPlus
Examiner Comments

This answer scores 0 because of the reference to energy being required to make bonds.

ResultsPlus
Examiner Tip

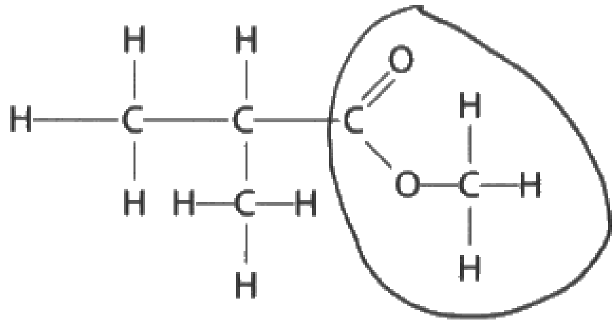
Remember that bond breaking is endothermic and bond making is exothermic.

Question 7 (c)(i)

About two-thirds of candidates successfully circled the ester group here.

Most incorrect answers circled more of the molecule than was necessary. The ester group is simply the – COO – group.

(c) The diagram shows the displayed formula of an ester that is made from methanol and a carboxylic acid.



(i) Draw a circle around the functional group of the ester.

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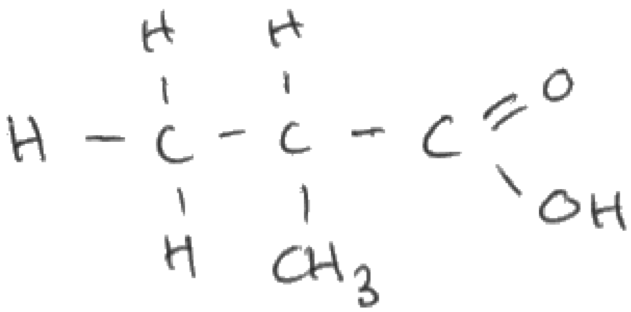
This scores 0 as the area circled is too large.

Question 7 (c)(ii)

The correct carboxylic acid was not often seen, with propanoic (or even ethanoic) acid being common wrong answers.

Those who did show a branched chain molecule usually gave a displayed formula, although a few candidates didn't display all the bonds in the molecule.

(ii) Give the displayed formula of the carboxylic acid used to make this ester.



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Examiner Comments

The correct molecule, but the – CH_3 group and the – OH group are not shown as displayed, so this does not score.

Paper Summary

Based on their performance on this paper, candidates should:

- Take care on the use of terminology around halogens and halide ions.
- Practise answering questions on equilibrium without reference to Le Chatelier's principle, which is not in the specification.
- Learn key definitions eg ionic bonding, metallic bonding, alloys.
- Be able explain patterns of reactivity in Group 1 and Group 7 in terms of the outer electron shell.

Grade boundaries

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