cookie

Practice paper: mark scheme

GCSE Chemistry Higher, practice paper 2 (AQA style)

In the style of AQA GCSE Chemistry (8462) Paper 2 Higher

Practice paper written by cookie in the style of AQA GCSE Chemistry (8462) Paper 2 Higher. Not an AQA paper; not affiliated with or endorsed by AQA.

This mark scheme was written by cookie with its practice paper. Each row gives the answer, the marks and how they are given; where an answer is worded differently but means the same, give the mark.

Key

- Each line is one marking point, worth one mark unless it says otherwise.
- allow an answer that is also acceptable; do not accept an answer that gets no mark; ignore words that neither gain nor lose the mark
- Extended responses (6 marks) are marked by level: decide the level from the descriptors, then the mark within it.

Do it online, timed and marked:
cookie.education/past-papers/gcse/cookie/chemistry-aqa-style

Question	Answer and marking	Marks
01.1	**Answer: B** B (1)	**1**
01.2	**Answer: 0.70 cm^3/s** 42 ÷ 60 (1) 0.70 (cm^3/s) (1) *Allow 0.7. An answer of 0.70 with no working scores 2 marks. Do not accept 1.43 (60 ÷ 42).*	**2**
01.3	**Answer: The acid (and calcium carbonate) are used up, so the concentration of acid particles decreases and collisions become less frequent.** the concentration of hydrochloric acid decreases / the reactants are being used up (1) so the frequency of collisions decreases / there are fewer collisions per second (1) *'Fewer collisions' with no reference to time or frequency does not score the second mark. Ignore references to the particles slowing down.*	**2**
01.4	**Answer: Draw a tangent to the curve at 40 s and work out its gradient.** draw a tangent to the curve at 40 s (1) calculate the gradient of the tangent (change in volume ÷ change in time) (1) *Do not accept 32 ÷ 40 (this is the mean rate from 0 to 40 s, not the rate at 40 s) for either mark.*	**2**
01.5	**Answer: The rate increases: the powder has a larger surface area to volume ratio, so collisions are more frequent.** the rate increases / the reaction is faster (1) the powder has a larger surface area to volume ratio so there are more frequent collisions (1) *Allow 'larger surface area' for 'larger surface area to volume ratio'. Allow 'more collisions per second'. The second mark can be awarded on its own.*	**2**
02.1	**Answer: e.g. the volume of hydrochloric acid** any one from: volume of sodium thiosulfate solution / total volume of the mixture / volume of hydrochloric acid / concentration of hydrochloric acid / temperature / the same cross / the same size or type of flask (1) *Do not accept 'concentration of sodium thiosulfate' (this is the independent variable) or 'time' (this is the dependent variable). Ignore 'the amount of acid' unless volume or concentration is stated.*	**1**
02.2	**Answer: 0.031 /s** 1 ÷ 32 (1) 0.031 (/s) (1) *0.03125 (not rounded to 2 significant figures) scores 1 mark. A unit is not required. Allow 3.1×10^{-2} (/s).*	**2**
02.3	**Answer: Particles move faster, so they collide more frequently, and more of the collisions have at least the activation energy, so more collisions are successful.** the particles have more (kinetic) energy / move faster (1) so they collide more frequently / more collisions per second (1)	**3**

more particles have energy greater than or equal to the activation energy / a greater proportion of collisions are successful (1)
Allow 'more energetic collisions' for the third mark only if linked to the activation energy or to successful collisions. Do not accept 'the particles vibrate faster'.

02.4 **Answer: A catalyst provides a different reaction pathway with a lower activation energy.** **2**

a catalyst provides a different reaction pathway / route (1)
with a lower activation energy (1)
Allow 'so more collisions are successful' as an alternative to the first mark if lower activation energy is also given. Do not accept 'a catalyst gives the particles more energy'. Ignore 'the catalyst is not used up'.

03.1 **Answer: The forward and reverse reactions are both still happening, at the same rate.** **2**

the forward and reverse reactions are both still happening / the reaction has not stopped (1)
the forward reaction and the reverse reaction happen at the same rate (1)
Allow 'the amounts (or concentrations) of reactants and products stay the same' for the first mark. Do not accept 'the amounts of reactants and products are equal'.

03.2 **Answer: Extended response: see mark scheme.** **6**

Level 3 (5–6 marks): A detailed and coherent explanation of all three conditions. The effect of temperature and of pressure on both the yield (position of equilibrium) and the rate is explained, the idea of a compromise is clear, and cost or safety is linked to the choice of pressure.
Level 2 (3–4 marks): An explanation of at least two of the conditions, with some reference to yield or rate. The compromise may not be clearly explained, or the reasoning may lack detail.
Level 1 (1–2 marks): Simple statements about the effect of one or more of the conditions on the yield or the rate, with little or no explanation.
0 marks: No relevant content.
Indicative content:
• the forward reaction is exothermic, so a lower temperature would move the position of equilibrium to the right and give a higher yield of ammonia
• but at a lower temperature the rate of reaction would be too slow
• about 450 °C is a compromise: a reasonable yield produced at a fast enough rate
• there are 4 molecules (moles) of gas on the left and 2 molecules (moles) of gas on the right
• so a higher pressure moves the position of equilibrium to the right (the side with fewer molecules of gas), increasing the yield
• a higher pressure also increases the rate, because the gas particles are closer together and collide more frequently
• very high pressures are expensive (more energy is needed for compression and stronger equipment is needed) and more dangerous, so about 200 atmospheres is a compromise
• the iron catalyst increases the rate, so equilibrium is reached faster (or a lower temperature can be used than without it)
• the catalyst does not change the yield / the position of equilibrium
• unreacted nitrogen and hydrogen are recycled, so they are not wasted
Statements that the catalyst increases the yield are not credited and, if they are the only point about the catalyst, the answer cannot reach Level 3. A temperature explanation that says 'higher temperature gives a higher yield' is incorrect and limits

the answer to Level 2.

03.3 **Answer: 35%** **2**

Mr of NH_4NO_3 = 80 seen, or (2 × 14) ÷ 80 (× 100) (1)

35 (%) (1)

An answer of 35% with no working scores 2 marks. An answer of 17.5% (one nitrogen atom only) scores 1 mark.

04.1 **Answer: B** **1**

B (1)

04.2 **Answer: Crude oil is heated so it evaporates; the column is hotter at the bottom than the top; the hydrocarbons condense at different heights depending on their boiling points.** **3**

the crude oil is heated / evaporated / vaporised (1)

the column is hotter at the bottom and cooler at the top / there is a temperature gradient in the column (1)

the hydrocarbons condense at different heights / levels depending on their boiling points (1)

Allow 'hydrocarbons with smaller molecules / lower boiling points rise further up the column before condensing' for the third mark. Do not accept 'the fractions boil at different heights' for the third mark.

04.3 **Answer: $C_7H_{16} + 11O_2 \rightarrow 7CO_2 + 8H_2O$** **2**

CO_2 and H_2O as the only products (1)

$C_7H_{16} + 11O_2 \rightarrow 7CO_2 + 8H_2O$ (1)

Allow multiples. Allow formulae written without subscripts (C7H16, CO2, H2O). Ignore state symbols. The second mark depends on correct formulae.

04.4 **Answer: C_2H_4** **1**

C_2H_4 (1)

Allow $CH_2=CH_2$. Do not accept the name 'ethene' without the formula. Do not accept $2C_2H_4$ or C_4H_8.

04.5 **Answer: Add bromine water; it turns from orange to colourless.** **2**

(add / shake with) bromine water (1)

turns from orange to colourless (1)

Allow 'decolourised' for colourless. Allow brown or yellow for orange. Do not accept 'clear' for colourless. The second mark depends on bromine water (or bromine) being used.

05.1 **Answer: propene** **1**

propene (1)

Do not accept propane or propylene.

05.2 **Answer: propane; a catalyst (e.g. nickel)** **2**

propane (1)

a catalyst (1)

Allow a named catalyst, e.g. nickel. Ignore temperature or pressure if a catalyst is also given.

05.3 **Answer: Any two from: a warm temperature (about 30 °C); no air / anaerobic; an aqueous solution.** **2**

any two from:
• a warm temperature / any temperature from 25 °C to 40 °C (1)
• in the absence of air or oxygen / anaerobic (1)
• an aqueous solution / water present (1)
Ignore 'yeast' and 'sugar' (given in the question). Allow 'the sugar is dissolved in water' for the aqueous solution point. Do not accept 'a high temperature', 'hot' or 'boiling'.

05.4 **Answer: ethyl ethanoate; an acid (e.g. sulfuric acid)** **2**

ethyl ethanoate (1)
an acid / (concentrated) sulfuric acid (1)
Do not accept 'an ester' alone: the name is required. Do not accept 'ethanol ethanoate' or 'ethyl ethanoic acid'. Allow 'acid catalyst'.

05.5 **Answer: Ethanoic acid is a weak acid, so it is only partially ionised; the concentration of hydrogen ions is lower.** **2**

compound C / ethanoic acid is a weak acid and is only partially ionised (in solution) (1)
so the concentration of hydrogen ions / H^+ ions is lower (1)
Allow 'dissociated' for 'ionised'. Allow 'hydrochloric acid is fully ionised' for the first mark. References to the acid being more dilute score 0 (the concentrations are the same).

06.1 **Answer: Addition: monomers have a C=C double bond and the polymer is the only product. Condensation: monomers have two functional groups, usually two different monomers, and a small molecule such as water is also produced.** **2**

any two from:
• addition: the monomers contain a carbon–carbon double bond / C=C; condensation: each monomer has two functional groups (1)
• addition: the polymer is the only product; condensation: a small molecule such as water is also produced (1)
• addition: usually only one type of monomer; condensation: usually two different monomers (1)
Each difference must compare the two types, either explicitly or by clear implication. Do not accept 'addition joins monomers together' on its own.

06.2 **Answer: water** **1**

water / H_2O (1)

06.3 **Answer: an amine (amino) group and a carboxylic acid (carboxyl) group** **2**

amine / amino group / $–NH_2$ (1)
carboxylic acid / carboxyl group / –COOH (1)
Do not accept 'amide' for amine. Do not accept 'acid' alone or 'hydroxyl' for the carboxyl group.

06.4 **Answer: nucleotides** **1**

nucleotides (1)
Do not accept 'bases', 'nucleic acids' or 'amino acids'.

06.5 **Answer: 1500** **2**

Mr of C_2H_4 = 28 (1)

42 000 ÷ 28 = 1500 (1)

Allow ecf from an incorrect Mr of ethene for the second mark. An answer of 1500 with no working scores 2 marks.

07.1 **Answer: A single element or compound, not mixed with any other substance.** **1**

a single element or a single compound (not mixed with any other substance) (1)

Do not accept 'natural', 'nothing added' or 'contains only one ingredient'.

07.2 **Answer: P: it melts at a single, sharp temperature, the same as pure aspirin; Q melts over a range of temperatures.** **2**

P (1)

it melts at a specific / single temperature (that matches pure aspirin) / Q melts over a range (of lower) temperatures (1)

The reason mark depends on choosing P.

07.3 **Answer: A mixture designed as a useful product, made by mixing the components in carefully measured quantities.** **2**

a mixture that has been designed as a useful product (1)

made by mixing the components in carefully measured quantities / each component has a particular purpose (1)

Do not accept 'a mixture' alone for the first mark.

07.4 **Answer: So the dyes do not dissolve into the water in the beaker.** **1**

so that the dyes / spots do not dissolve into the water in the beaker (instead of moving up the paper) (1)

Do not accept 'so the pencil line does not run' or 'so the line does not wash away'.

07.5 **Answer: 0.65** **2**

5.2 ÷ 8.0 (1)

0.65 (1)

A unit is not required; an answer with a unit (e.g. 0.65 cm) scores 1 mark. Do not accept 1.54 (8.0 ÷ 5.2) for any marks.

07.6 **Answer: E is a mixture of at least three dyes; it contains F and H; it does not contain G, and the dye with Rf 0.20 is none of the known dyes.** **3**

E is a mixture / contains at least three dyes (1)

E contains F and H (1)

E does not contain G / the dye with an Rf value of 0.20 is not F, G or H (1)

Both F and H are needed for the second mark. Allow 'E contains an unknown dye' for the third mark.

08.1 **Answer: Damp litmus paper is bleached (turns white).** **2**

(hold) damp litmus paper (in the gas) (1)

the litmus paper is bleached / turns white (1)

Allow 'damp blue litmus turns red and then white'. The second mark depends on litmus paper being used. Do not accept 'dry litmus paper' for the first mark.

08.2 **Answer: lithium (Li^+)** **1**

lithium / Li^+ (1)

Do not accept 'lithium atom'. Ignore 'lithium ion' written without a charge.

08.3 **Answer: $Fe^{3+} + 3OH^- \rightarrow Fe(OH)_3$** **2**

$Fe(OH)_3$ as the only product (1)

$Fe^{3+} + 3OH^- \rightarrow Fe(OH)_3$ (1)

State symbols are not required; allow (aq), (aq) → (s). Allow charges written as Fe3+ and OH-. Ignore Na^+ ions shown on both sides. The second mark depends on $Fe(OH)_3$ being correct.

08.4 **Answer: Extended response: see mark scheme.** **6**

Level 3 (5–6 marks): A clear, logically ordered description of tests, with correct results, that would identify both the positive ion and the negative ion in all three solutions. The acid needed before adding silver nitrate or barium chloride is included.

Level 2 (3–4 marks): Tests with correct results that would identify at least three of the six ions, or that would identify all three positive ions or all three negative ions. Some detail may be missing (for example, the acid before silver nitrate or barium chloride).

Level 1 (1–2 marks): At least one relevant test with a correct result, but the description is incomplete or some results are incorrect.

0 marks: No relevant content.

Indicative content:

• add a few drops of sodium hydroxide solution to a sample of each solution

• aluminium ions (Al^{3+}) give a white precipitate that dissolves in excess sodium hydroxide solution

• calcium ions (Ca^{2+}) give a white precipitate that does not dissolve in excess sodium hydroxide solution

• iron(II) ions (Fe^{2+}) give a green precipitate

• a flame test: calcium ions give an orange-red flame

• for halide ions, add dilute nitric acid and then silver nitrate solution

• chloride ions (Cl^-) give a white precipitate

• bromide ions (Br^-) give a cream precipitate

• for sulfate ions, add dilute hydrochloric acid and then barium chloride solution

• sulfate ions (SO_4^{2-}) give a white precipitate

• use a fresh sample of each solution for each test

A test is credited only if its result is given. Using sulfuric acid before barium chloride, or hydrochloric acid before silver nitrate, is a method error: the answer cannot reach Level 3. Do not credit 'red-brown precipitate' for iron(II).

08.5 **Answer: e.g. it is more sensitive** **1**

any one from: more accurate / more sensitive (detects very small amounts) / quicker (rapid) / can measure concentration / can identify ions in a mixture (1)

Do not accept 'easier', 'cheaper' or 'more reliable' on their own.

09.1 **Answer: C** **1**

C (1)

09.2 **2**

Answer: Any two from: dissolved in the oceans; formed carbonate precipitates / sedimentary rocks; used by algae and plants for photosynthesis; locked up in fossil fuels.

any two from:
• dissolved in the oceans (1)
• (dissolved carbon dioxide) formed carbonate compounds that were precipitated / formed sediments / sedimentary rocks such as limestone (1)
• used by algae and plants for photosynthesis (1)
• locked up in fossil fuels (coal, crude oil, natural gas) (1)
Do not accept 'absorbed by trees' unless photosynthesis or plants using it is implied. Do not accept 'used in respiration'.

09.3 **3**

Answer: Short-wavelength radiation from the Sun reaches the Earth's surface; the Earth emits long-wavelength (infrared) radiation; greenhouse gases absorb this radiation, so less energy escapes into space.

(short-wavelength) radiation from the Sun passes through the atmosphere (and is absorbed by the Earth's surface) (1)
the Earth emits / radiates long-wavelength / infrared radiation (1)
greenhouse gases absorb (and re-emit) this long-wavelength radiation, so less energy escapes into space / the atmosphere is warmed (1)
Do not accept 'greenhouse gases trap the Sun's rays / heat' for the third mark. Any reference to the ozone layer or to greenhouse gases reflecting radiation is ignored.

09.4 **2**

Answer: 31%

(414 − 317) ÷ 317 (× 100) (1)
31 (%) (1)
An answer of 30.6 (not to 2 significant figures) scores 1 mark. An answer of 23% (97 ÷ 414 × 100) scores 0.

09.5 **2**

Answer: Nitrogen and oxygen from the air react at the high temperatures in the engine.

nitrogen and oxygen from the air (react) (1)
at the high temperatures in the engine (1)
Do not accept 'nitrogen in the fuel' or 'burning nitrogen' for the first mark.

10.1 **1**

Answer: water that is safe to drink

water that is safe to drink (1)
Do not accept 'pure water' or 'clean water'.

10.2 **2**

Answer: Its boiling point is exactly 100 °C; evaporating a sample to dryness leaves no solid residue.

measure the boiling point: it is (exactly) 100 °C (1)
evaporate a sample to dryness: no solid / residue is left (1)
Allow 'its freezing (or melting) point is exactly 0 °C' as one of the two ways. Each mark needs both the test and the result. Do not accept 'its pH is 7' (other solutions are also neutral).

10.3 **4**

Answer: The poly(ethene) bag needs more energy and produces more carbon dioxide per bag, but it is used many more times, so it uses less energy (0.16 MJ vs 0.9 MJ) and produces less carbon dioxide per use. The paper bag is made from a renewable resource and is biodegradable; poly(ethene) is made from crude oil (finite) and is not biodegradable. A justified conclusion.

any four from:

• the paper bag is made from a renewable resource / crude oil is a finite (non-renewable) resource (1)

• making one poly(ethene) bag uses more energy / produces more carbon dioxide than making one paper bag (1)

• but the poly(ethene) bag is used more times, so it uses less energy (or produces less carbon dioxide) per use, e.g. 0.16 MJ compared with 0.9 MJ per use (1)

• the paper bag is biodegradable / the poly(ethene) bag is not biodegradable, so it persists in landfill or the environment (1)

• a conclusion with a justification, e.g. the poly(ethene) bag is better if it is reused many times (1)

Per use: energy 0.9 MJ (paper) and 0.16 MJ (poly(ethene)); carbon dioxide 0.045 kg (paper) and 0.01 kg (poly(ethene)). A conclusion with no justification does not score. Simply copying values from the table without a comparison scores 0.

11.1 **2**

Answer: Plants are grown on land containing low-grade copper ore and absorb copper compounds; the plants are harvested and burned, and the ash contains copper compounds.

plants are grown on land containing (low-grade) copper ore and absorb copper compounds (1)

the plants are harvested and burned, and the ash contains copper compounds (1)

Do not accept 'the plants are burned to produce copper' for the second mark. Do not credit bacteria (that is bioleaching).

11.2 **2**

Answer: Both water and oxygen (air) are needed: tube 2 had no air (oxygen) and tube 3 had no water.

both water and oxygen / air are needed for iron to rust (1)

tube 2 had no air / oxygen and tube 3 had no water (and neither nail rusted) (1)

Allow 'boiling removes dissolved air and the oil stops air dissolving' for tube 2. Both tubes 2 and 3 must be correctly explained for the second mark.

11.3 **2**

Answer: Zinc is more reactive than iron, so the zinc reacts (corrodes) instead of the iron: sacrificial protection.

zinc is more reactive than iron (1)

so zinc reacts / corrodes / is oxidised instead of the iron / sacrificial protection (1)

Do not accept 'the zinc stops air and water reaching the iron' for the second mark (the coating is scratched).

11.4 **1**

Answer: 75%

75 (%) (1)

Do not accept 0.75 or 18/24 (the question asks for a percentage).

Total: 100 marks