

LRN Chemistry Paper 2 2023 June
Mark scheme

MCQs

1. A
2. C – because at D the reaction has already stopped so there is no successful collisions.
3. C
4. B
5. D
6. A
7. D
8. D
9. B
10. C
11. A
12. C
13. A
14. C
15. D
16. D
17. A
18. B
19. B
20. C
21. D
22. B
23. C
24. A
25. D

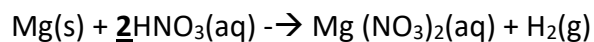
Extended theory MS:

Q1a)

MP1 – Less accurate

MP2 – additional loss of mass / faster than should be mass decrease.

b)



MP1 – 1 mark for correct reactants and products

MP2 – Balancing

MP3 – state symbols correct

ci)

MP1 – All data should be to 2 decimal places.

MP2 – Correct sum of mass decrease. (ignore differences of each row)

Time (s)	Mass reading (g)	Mass decrease (g)
0	111.30	0
10	111.00	0.30
20	110.80	0.50
30	110.70	0.60
40	110.65	0.65
50	110.65	0.65

cii)

MP1 Correct plotting

MP2 – Draw line of best fit as smooth curve. Ignore straight line

ciii)

MP1 – Possible that magnesium was a limiting reactant.

MP2 – Chemical reaction / neutralization forming soluble salt (accept all reacted with the acid)

civ)

- MP1 use Magnesium strips / cubes / ribbon instead

cv)

-MP1 Less area for collision between acid and magnesium

- MP2 Less successful collisions at any given time
- MP3 Less mass lost as less hydrogen gas produced / product produce

cvi.)

MP1 – add named indicator and state correct colour for neutral.

MP2 – add more magnesium to see if further reaction.

cvi.) $0.60\text{g} / 2 = 0.3$ moles of Hydrogen

cvi.)

$0.60\text{g} / 30 \text{ seconds} = 0.020 \text{ g/s}$

Or

$0.3 / 30\text{seconds} = 0.01 \text{ mols/s}$

MP1 – Calculation

(2 marks if answer with no working)

MP2 – appropriate unit g / s or mol / s

Q2a)

(a)(i)

MP1 – Haber process

(ii)

MP1 Lowers the activation energy.

MP2 Provides an alternate pathway for the reaction.

Bi)

Yield Max 3:

MP1 – Yield decreases

MP2.- Reverse reaction / endothermic favoured

MP3 – Equilibrium shifts to the left

Rate of reaction:

MP1 – Rate of reaction increases

MP2 – Particles have more kinetic energy

MP3 – Higher chance successful collisions

bii)

MP1 – Yield decreases

MP2 – Less concentration of N₂ and H₂

MP3 – Reverse reaction favoured

MP4 – Equilibrium shifts to the left

OR

MP2 – Less pressure

MP3 – Reverse reaction favoured / Equilibrium favours side with fewer moles

MP4- Equilibrium shifts to the left.

MAX 3 marks if MP2 not mentioned in either context.

Answers must be in the correct context.

c)

MP1) horizontal line with correct chemical formula of reactants

MP2) Horizontal line lower than MP1 line with correct chemical formula for products.

MP3) A line downwards with ARROW, and labelled with symbol and the value of -92.

d)

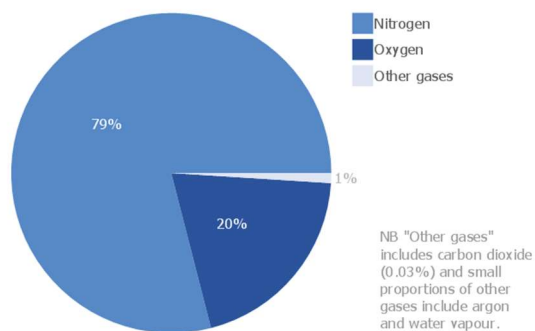
Mols of H = $168/24 = 7$ moles

$(7/3 * 2)$ to work out 4.7 or 4.66666 moles

4.7 moles of $\text{NH}_3 = 112$

$(24/112) * 100 = 21.4\%$

3a)



Example

MP1 – labelling correct Nitrogen largest section, followed by oxygen, followed by other gases (or labelled)

MP2 – Correct relative proportions to example image shown 77-79% Nitrogen, 20-22% Oxygen, 1 %

B)

MP1 Nitrogen oxides – car exhausts / power stations accept other AVP
Reject carbon dioxide.

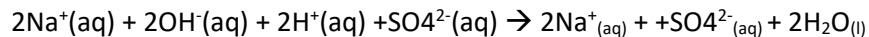
ci) It has 2 OH – ions per molecule / twice as much OH – ions

cii) Calcium Sulphate **and** CaSO₄

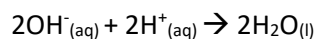
ciii)

MP1 Chemical ion equation unbalanced including symbols:

MP2: Balanced:



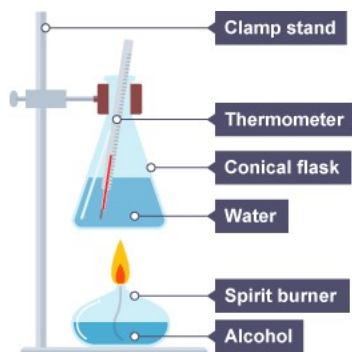
MP3 removal of spectator ions to create the following:



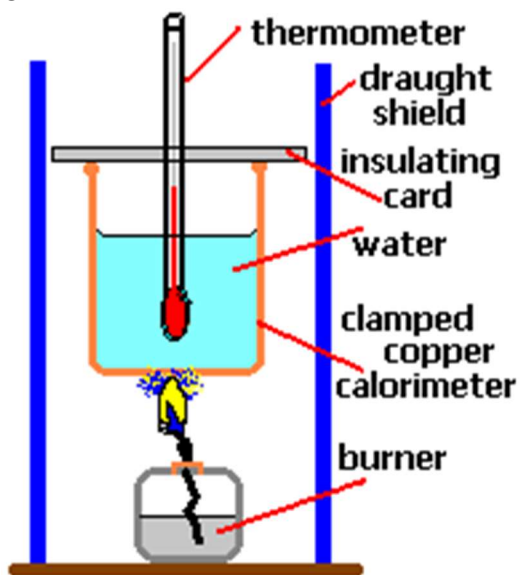
If answer is provided award full 3 marks without working.

Practical mark scheme:

Q1) Image as below, accept variations for full marks.



Or



(including tripod)

Or attempts of calorimetry drawing of device.

At least 3 pieces of name equipment in the general layout show in the pictures above.

Bi)

- MP1 Keep distance between flame and water the same
- MP2 Burn up until a specific final tem
- MP3 – Same starting temp
- AVP – same duration of time instead of MP2
- AVP other valid variables

ci)

Fuel type	Start mass of fuel (g)	Final mass (g)	Mass change (g)
Methanol	157.83	155.45	2.38
Ethanol	189.01	187.04	1.97
Propanol	179.95	178.21	1.74

cii) Methanol lost more mass because.....

MP1 Smaller molecule / less carbons to oxidise / lower activation energy

MP2 More combustion / reaction / bonds broken / more flammability. Accept easier to burn.

MP3 More carbon dioxide released / loss of carbon dioxide in a given time.

Accept ORA for propanol.

d)

Fuel type	Start temp (Degree C)	Final temp (Degree C)	Temp Change (Degree C)
Methanol	22.0	61.0	39.0
Ethanol	21.5	60.0	38.5
Propanol	21.0	60.0	39.0

e) MP1 To allow it to be comparable

f)

Fuel type	Energy released per gram kJ/g
Methanol	6.88
Ethanol	8.21
Propanol	9.41

g) $\text{C}_2\text{H}_5\text{OH} + 3\text{O}_2 \rightarrow 2\text{CO} + 3\text{H}_2\text{O}$

h)

MP1 – fermentation

MP2 – Reacting ethene and steam.

Q2a)

- Use of a locating agent
- To make the non-visible visible

b)

- Substances have a fixed R_f value / fixed solubility.
- Use chromatography for the unknown and compare it to the known values.
- If same R_f value mostly likely to be lysine.
- BOD 1 mark if method decreased for general chromatography.

c) Drawn at correct distance from Solvent front

2 correct 1 mark.

All correct 2 marks

d) $\pm 0.05\text{cm}$

3a) The volume of sodium thiosulphate

Bi) 1 mark per Science context and reason:

Max 2 for not valid:

Max 1 for valid:

No because

MP1 It is not reliable **BECAUSE** to not being repeated 3-5 times / average not calculated.

MP2 It is not resolute **BECAUSE** difficult to judge end point of reaction.

Or

Could have used colorimeter / absorbance to get a higher resolution of end point.

MP3 may not be fair due to no evidence of temperature mentioned in the method. / Temperature affects RoR

MP4 Without repeats the precision is unknown.

MP5 Used a measuring cylinder to measure volume when they could have used a burette which is more precise in measuring volume of reactants.

MP6: Possible delays / human error at starting stopwatch.

Accept other AVP

Yes

MP 1: It is fair because. The same volume of HCL was added each time.

MP 2: Yes, timer was started immediately, for experiment.

MP 3: A pattern / trend / correlation is consistent between the data, no anomalies observed.

Accept other AVP