Name of the Student:_____
Max. Marks : 22 Marks **Time : 22 Minutes**

Mark Schemes

Q1.

(a) **Method 1**

Allow working throughout to 2sf

M1 Moles of Mg = 0.396/24.3 = 0.0163

1

M2 Moles of CH_3COOH = 0.600 × 30.0/1000 = 0.018

1

M3 Mark for showing Mg is in excess: either
0.018 mol of CH_3COOH reacts with 0.009 mol of Mg OR
0.0163 mol of Mg reacts with 0.0326 mol of CH_3COOH OR
0.0073 mol of Mg is in excess

1

If candidate gets 16.3 mol (as not converted mg to g) in method 1 or 3 then can only score 1 mark maximum (M2)

Accept other valid calculations that show the Mg is in excess

Method 2

M1 Moles of CH_3COOH = 0.600 × 30.0/1000 = 0.018

M2 Moles of Mg that would react with this = 0.009

M3 Mass of Mg needed = 24.3 × 0.009 = 0.219 g which is less than 0.396 g OR
Moles of Mg = 0.0163 which is more than 0.009 required

Method 3

M1 Moles of Mg = 0.396/24.3 = 0.0163

M2 Moles of CH_3COOH that would react with this = 0.0326

M3 Volume of CH_3COOH needed = 0.0326 / 0.60 = 0.0543 dm^3 (54.3 cm^3) which is more than 0.030 dm^3 (30 cm^3)

(b) M1 Line starts at origin and is steeper

1

M2 (moles CH_3COOH = 0.800 × 20/1000 = 0.016) line levels out on 8^{th} line up (line below the original 9^{th} line)

M2 for line on 8^{th} line on grid (original on 9^{th} line) – allow some leniency so long as clear it ends at (or very close to) the 8^{th} line; and line does not significantly wobble

1

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Q2.

(a) (i) Curve drawn from origin with peak clearly lower and to right.

*New curve crosses original once only, finishes above original and does **not** clearly curve up*

***IGNORE** relative areas*

1

(ii) (Relative areas under curves indicate) <u>many</u> (owtte) more molecules with E greater than or equal to Ea (at higher T) or reverse argument

***ALLOW** 'particles'*

***IGNORE** 'atoms'*

1

(Large) increase in (number of) <u>successful</u> (owtte) <u>collisions per unit</u> time

OR <u>'frequency</u> of successful <u>collisions'</u>

1

(b) (i) Yield increases

Yield decreases/stays the same CE = 0

If not answered mark on

1

More moles/molecules (of gas) on left/fewer on right/3 on left 1 on right

1

<u>Equilibrium shifts/moves</u> (to right) to reduce pressure/oppose higher pressure

No M3 if 'more moles on right' in M2

***IGNORE** 'favours'*

***NOT** just 'oppose the change'*

QoL means that M3 is only awarded if these ideas are clearly linked in one statement

1

(ii) Higher T would increase rate but decrease yield/make less methanol

OR

Lower T decreases rate but increases yield;

*If no mention of both rate **AND** (idea of) yield max 1*

1

Chosen T is a compromise/balance (between rate and yield) owtte

1

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Q3.

(a) (i) **M1**

High (temperature) OR Increase (the temperature)

*If **M1** is incorrect **CE = 0** for the clip*

*If **M1** is blank, mark on and seek to **credit the correct information in the text***

M2

The (forward) reaction / to the right is endothermic or takes in / absorbs heat

OR

The reverse reaction / to the left is exothermic or gives out / releases heat

M3 depends on correct M2 and must refer to temperature / heat

M3** depends on a correct statement for **M2

At high temperature, the (position of) equilibrium shifts / moves left to right to oppose the increase in temperature

*For **M3**, the position of equilibrium shifts / moves*

to absorb heat OR

to lower the temperature OR

to cool down the reaction

3

(ii) **M1**

The reaction gets to equilibrium faster / in less time

OR

Produces a small yield faster / in less time

OR

Increases the rate (of reaction / of attainment of equilibrium)

Mark independently

M2

High pressure leads to **one** of the following

- more particles / molecules in a given volume
- particles / they are closer together
- higher concentration of particles / molecules

AND

- more collisions in a given time / increased collision frequency

*Penalise **M2** for reference to increased energy of the particles*

2

(iii) **M1** Increase in / more / large(r) / big(ger) surface area / surface sites

Mark independently

*For **M1** accept Éan increase in surface"*

M2 increase in / more successful / productive / effective collisions (in a given time) (on the surface of the catalyst / with the nickel)

*For **M2** not simply "more collisions"*

Ignore "the chance or likelihood" of collisions

2

(b) **M1**

No effect / None

*If **M1** is incorrect **CE = 0** for the clip*

*If **M1** is blank, mark on and seek to **credit the correct information in***

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the text

M2 requires a correct M1

Equal / same number / amount of moles / molecules / particles on either side of the equation

OR

2 moles / molecules / particles on the left and 2 moles / molecules / particles on the right

M2** depends on a correct statement for **M1

*In **M2 not** "atoms"*

2

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