

Name of the Student: _____

Max. Marks : 26 Marks

Time : 26 Minutes

Mark Schemes

Q1.

- (a) Aldehyde/propanal has dipole-dipole forces (between molecules)

If any 'covalent bonds broken' CE=0 for clip.

Ignore Van der Waal forces

M1

Alcohol/propan-1-ol AND Carboxylic acid/ propanoic acid have hydrogen bonding (between molecules).

Ignore reference to energy

M2

The forces between the molecules in aldehyde are weaker (than those in alcohol and acid so it will evaporate first.)

M3 only awarded following correct M1 OR M2

Allow converse for M3

M3

- (b) Keep the temperature of the reaction mixture below the boiling point of propan-1-ol/below 97 °C

Allow temperature in range 49-96 inclusive

Allow description of cooling the vessel

M1

Cool the distillate / collecting vessel

Ignore reference to oxidising agents

Penalise lid / sealed container

M2

- (c) Add named carbonate/hydrogencarbonate OR magnesium to a sample of the distillate.

Incorrect chemical CE=0

Allow formula (mark on for incorrect formula)

Allow blue litmus or correct named indicator

M1

Effervescence/fizz/bubbles would confirm presence of acid or converse

Blue litmus turns red confirms acid present or converse

Allow gas/CO₂ produced which turns lime water cloudy OR gas/H₂ produced which burns with a squeaky pop

M2

- (d) (Temperature difference = 15.1 °C)

If ΔT wrong – AE mark on otherwise can only award M2

If use 457 in M1, can only score M2

$$q = 150 \times 4.18 \times 15.1 \text{ or } 9467.7 \text{ J or } 9.4677 \text{ kJ}$$

M1

$$\text{amount ethanol burned} = 0.457/46.0 = 9.93 \times 10^{-3} \text{ mol}$$

If use 457 in M2 can score 2 for - 0.953 kJ mol⁻¹

M2

$$\text{Heat change per mole} = (M1/1000)/M2 = 952.99 \text{ kJ mol}^{-1}$$

$\Delta H = -953 \text{ kJ mol}^{-1}$ must be 3sfs and must be negative

(allow range -953 to -954)

BEWARE if they miss conversion to kJ and also miss conversion to g, they get answer = - 953 which scores 1 +953 can score M1 and M2

Allow -950 or -960 for rounding to 2sf

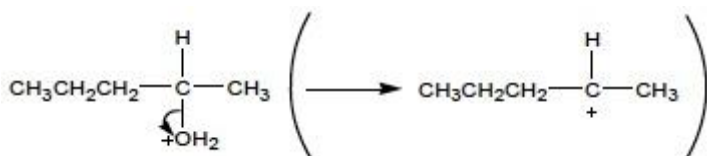
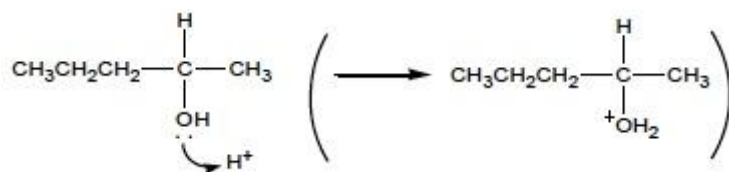
M3

(e) Elimination

Penalise base elimination

M1

Mechanism : Either (E1)



M2 for protonation of alcohol, i.e. lp plus arrow to H^+ or to H of $\text{H}-\text{O}-$ in H_2SO_4 and from $\text{H}-\text{O}$ bond to O
M3 for protonated alcohol plus arrow showing loss of water

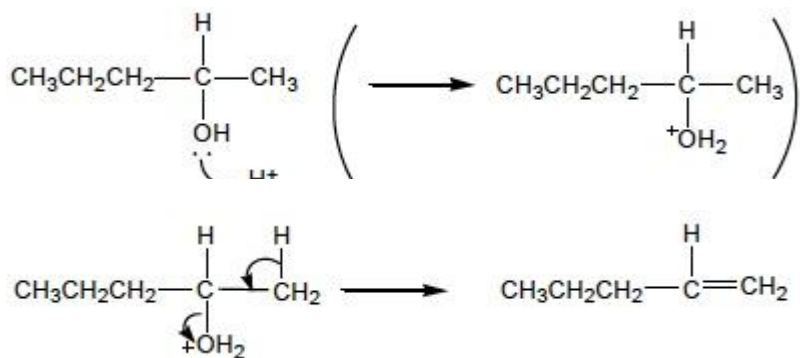
M4 for arrow showing loss of H^+

From correct carbocation (E1)

wrong alcohol used / alkene formed loses M4

3

OR (E2)



M2 for protonation of alcohol, i.e. lp plus arrow to H^+
 or to H of $\text{H}-\text{O}-$ in H_2SO_4 and from $\text{H}-\text{O}$ bond to O
 M3 for protonated alcohol plus arrow showing loss of water

M4 for arrow showing simultaneous loss of H^+
 wrong alcohol used / alkene formed loses M4

3

(f) E-pent-2-ene

Allow trans

M1

$\text{C}=\text{C}$ bond cannot rotate and

Each carbon in the double bond has (2) different groups attached.

Allow (two) different groups on each/either side of the double bond.

M2

[16]

Q2.

(a) Decrease

1

Increasing pressure moves equilibrium to the side of least moles i.e. backward reaction

1

To oppose the increase in pressure or to decrease the pressure

1

(b) A catalyst speeds up the rate of the forward and backward reaction

1

By the same amount

1

(c) $\Delta H = -111 - (-75 - 242)$

1

206 (kJ mol⁻¹)

1

(d) $\Delta S = 3 \times 131 + 198 - (186 + 189) = 216 \text{ J K}^{-1} \text{ mol}^{-1}$

1

$\Delta G = \Delta H - T\Delta S$

1

$$0 = 206 - T \frac{216}{1000}$$

1

T = 953.7 or 954 K

1

T = 681 (°C)

If the value given in the question is used then the answer is 283 (°C)

1

[12]