Mark schemes

Q1.

(a) **M1** Misty / white / steamy fumes

   M1 (immediate) White precipitate forms

   M2 No visible change

   M2 White precipitate forms <u>slowly</u>

   2

(b) **M1** Propanal AND (blue solution gives a brick) red precipitate

   If **M1** incorrect, allow ECF for suitable tests on remaining liquids

M1	(Warm with) acidified potassium dichromate (VI)	add Na	warm with a named carboxylic acid with conc H_2SO_4	(Warm with) acidified potassium manganate (VII)
M2	Propan-1-ol/alcohol AND (orange solution) goes green	Propan-1-ol/alcohol AND effervescence	Propan-1-ol/alcohol AND fruity smell	Propan-1-ol/alcohol AND (purple solution) goes colourless

   3

   [5]

Q2.
(a)
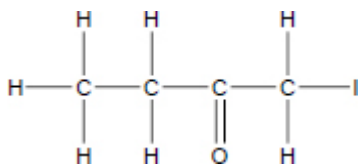
Apply list principle for more than one structure given

M1

1-iodobutan-2-one

Allow 1-iodo-2-butanone

M2

(b) $\dfrac{\text{Rate}}{[CH_3CH_2COCH_3][H^+]} = k$

Rearranged expression Or with numbers

M1

k = 4.(04) × 10^{-5} or 0.00004(04)

If upside down = 24752 mol dm^{-3} s

If multiply = 5.20 × 10^{-4} mol^3 dm^{-9} s^{-}

M2

mol^{-1} dm^3 s^{-1}

M3

(c) 3.6(25) × 10^{-5} (mol dm^{-3} s^{-1})

Allow 3.59 × 10^{-5} to 3.63 × 10^{-5}

1

(d) Brown colour removed

Goes colourless

Allow (orange) brown to colourless

Allow purple to colourless

1

(e)   As T increases rate (1/t) increases OR time for completion decreases

M1

Exponentially
OR
By a greater/ increasing factor

Or rate increases more and more as temp increases ie description of exponential increase

M2

<u>Many</u> more particles have $E \geq E_a$

NOT just higher collision frequency
NOT just more successful collisions

M3

(f)   Time = $\dfrac{1}{0.03}$ = 33 s

1

(g) $\ln(1.55 \times 10^{-5}/1.70 \times 10^{-4}) = \dfrac{E_a}{R}\left(\dfrac{1}{333} - \dfrac{1}{303}\right)$

Insertion of correct values

M1

$-2.39 = \dfrac{E_a}{R}(-2.97 \times 10^{-4})$

Evaluate LHS and fraction on RHS

M2

$\dfrac{2.39 \times 8.31}{2.97 \times 10^{-4}} = E_a$

Re-arrange for E_a

M3

66937

Evaluate

M4

66.9 kJ mol^{-1}

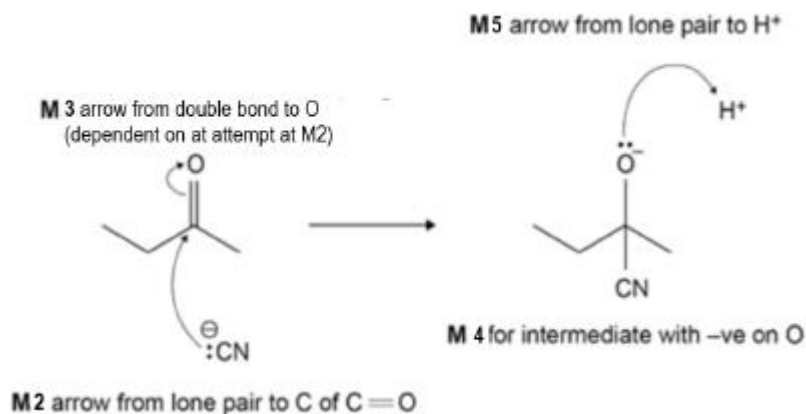*convert to kJ mol^{-1}*

M5

If only k_1 and k_2 reversed this gives a negative answer for E_a Lose M1 and M5
If AE in M2 allow ECF
Allow ECF from M4 to M5 for a correct unit conversion
Allow range 66.3 − 67.1

(h) Nucleophilic Addition

M5 arrow from lone pair to H⁺

M 3 arrow from double bond to O (dependent on at attempt at M2)

M2 arrow from lone pair to C of C=O

M 4 for intermediate with –ve on O

M1M2M3M4M5

ALLOW negative charge anywhere on cyanide

But attacking lone pair must be on C

Do not award M3 without attempt of M2

Allow M2 for attack to a positive carbon following breaking of C=O

Penalise covalent KCN in M2

M3 ignore partial charges unless wrong

Penalise M3 for incorrect connection between CN and C

NB Allow fully displayed or other structural formulae

[21]