Q1.

This question is about simple test-tube reactions to identify organic liquids.

(a) Silver nitrate solution can be used to distinguish between propanoyl chloride and 1-chloropropane.

Give the observations you would expect when a few drops of silver nitrate solution are added to separate samples of propanoyl chloride and 1-chloropropane.

Observation with propanoyl chloride _____

_____

Observation with 1-chloropropane _____

_____

(2)

(b) Three unlabelled bottles are known to contain either propan-1-ol, propanal, or propanone.

A sample of each liquid is warmed with a few drops of Fehling's solution.

Identify the liquid that reacts with Fehling's solution and give the expected observation.

Suggest a further simple test-tube reaction that can be used to distinguish between the remaining two liquids.

Give the expected observation with the liquid that reacts.

Liquid that reacts with Fehling's solution _____

Observation _____

_____

Further test _____

_____

Observation _____

_____

(3)

(Total 5 marks)

Q2.

An acidified solution of butanone reacts with iodine as shown.

$$CH_3CH_2COCH_3 + I_2 \rightarrow CH_3CH_2COCH_2I + HI$$

(a) Draw the displayed formula for $CH_3CH_2COCH_2I$

Give the name of $CH_3CH_2COCH_2I$

Displayed formula

Name _____

(2)

(b) The rate equation for the reaction is

$$rate = k[CH_3CH_2COCH_3][H^+]$$

Table 1 shows the initial concentrations used in an experiment.

Table 1

	$CH_3CH_2COCH_3$	**I_2**	**H^+**
Initial concentration / mol dm^{-3}	4.35	0.00500	0.825

The initial rate of reaction in this experiment is 1.45×10^{-4} mol dm^{-3} s^{-1}

Calculate the value of the rate constant, *k*, for the reaction and give its units.

k _____

Units _____

(3)

(c) Calculate the initial rate of reaction when all of the initial concentrations are halved.

Initial rate of reaction _____ mol dm^{-3} s^{-1}

(1)

(d) An experiment was done to measure the time, *t*, taken for a solution of iodine to react completely when added to an excess of an acidified solution of butanone.

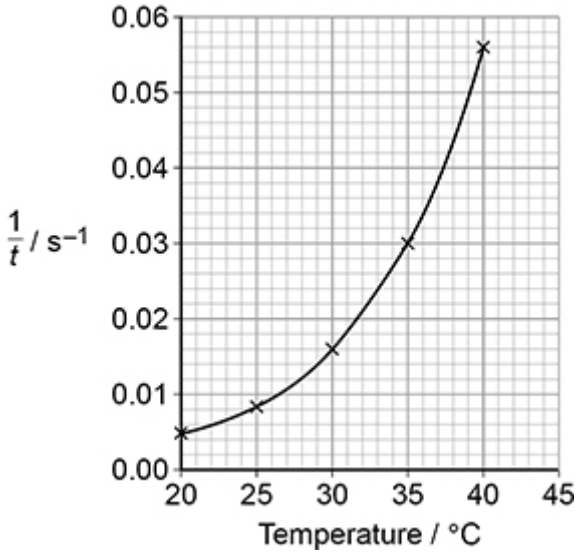
Suggest an observation used to judge when all the iodine had reacted.

_____

_____

The experiment was repeated at different temperatures.

The graph below shows how $\frac{1}{t}$ varied with temperature for these experiments.



(1)

(e) Describe and explain the shape of the graph above.

_____

_____

_____

_____

_____

_____

_____

(3)

(f) Deduce the time taken for the reaction at 35 °C

Time _____ s

(1)

(g) For a different reaction, **Table 2** shows the value of the rate constant at different temperatures.

Table 2

Experiment	Temperature / K	Rate constant / s^{-1}
1	$T_1 = 303$	$k_1 = 1.55 \times 10^{-5}$
2	$T_2 = 333$	$k_2 = 1.70 \times 10^{-4}$

This equation can be used to calculate the activation energy, E_a

$$\ln\left(\frac{k_1}{k_2}\right) = \frac{E_a}{R}\left(\frac{1}{T_2} - \frac{1}{T_1}\right)$$

Calculate the value, in kJ mol^{-1}, of the activation energy, E_a

The gas constant, $R = 8.31$ J K^{-1} mol^{-1}

E_a _____ kJ mol^{-1}

(5)

(h) Name and outline the mechanism for the reaction of butanone with KCN followed by dilute acid.

Name of mechanism _____

Outline of mechanism

(5)

(Total 21 marks)