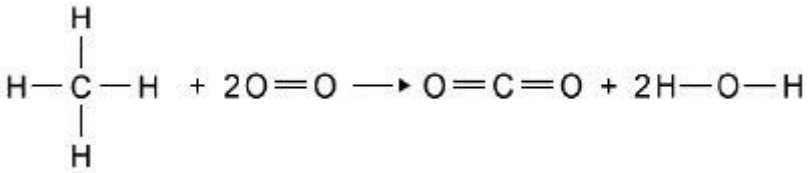
Chemistry unit 5/6 homework – Energy changes & Rates of reaction

For each of the questions below: -

Highlight the command word if there is one & annotate what the command word means. - Answer the question!

Q1. The equation shows the reaction of methane with oxygen.



The table shows the bond energies.

Bond	**C–H**	**O=O**	**C=O**	**O–H**
Bond dissociation energy in kJ per mole	412	496	803	463

Calculate the overall energy change for the combustion of one mole of methane.

Energy change = _____ kJ mol^{-1}

(3)

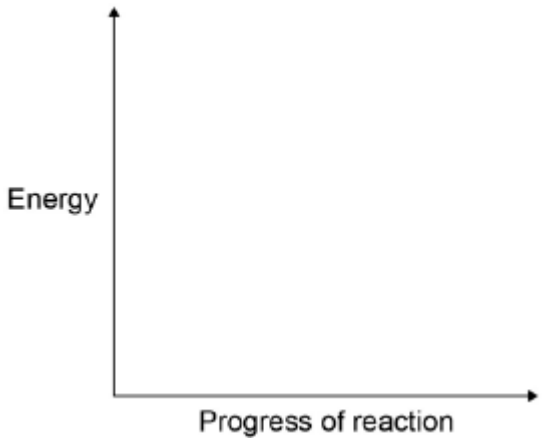
Q2 Exothermic reactions transfer energy to the surroundings.

(a) Draw a reaction profile for an exothermic reaction using the axes in **Figure 1**.

Show the:

- relative energies of the reactants and products
- activation energy and overall energy change.

Figure 1

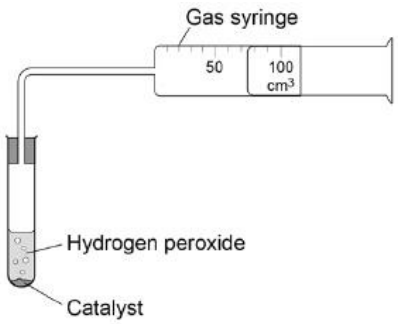


(2)

Q3 A student investigated the effect of different catalysts on the decomposition of hydrogen peroxide.

Figure 1 shows the apparatus the student used.

Figure 1



(a) Oxygen gas is produced.

Table 1 shows the student's observations.

Table 1

Catalyst	**Observation**
Manganese dioxide	A lot of gas and hydrogen peroxide bubbles up into gas syringe
Potato	Steady bubbles of gas
Copper oxide	Few bubbles of gas
Sodium chloride	Very few bubbles of gas

Which is the most useful catalyst?

Explain your answer.

_____

_____

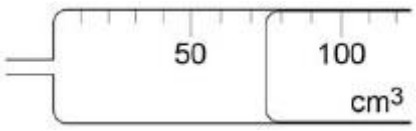
_____

_____

(2)

(b) **Figure 2** shows the gas syringe during the investigation.

Figure 2



What is the volume of gas?

Tick **one** box.

52 cm^3 ☐ 55 cm^3 ☐ 70 cm^3 ☐ 75 cm^3 ☐

(1)

(c) For one of the catalysts the student measures the volume of gas given off every 20 seconds for 2 minutes.

The volume of gas was zero at the start of the experiment.

The measured volumes of gas are:

23 cm^3 42 cm^3 59 cm^3 72 cm^3 80 cm^3 88 cm^3

Complete **Table 2** to show these results.

Table 2

(4)

(d) Suggest why the readings might be lower than expected.

_____

(1)

(e) The student did the experiment with four different catalysts.

Give **two** variables the student should keep constant.

1. _____

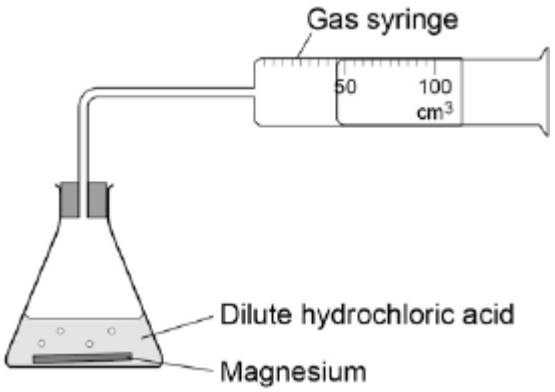
2. _____

(2)

(Total 10 marks)

Q4 A student investigated the rate of the reaction between magnesium and dilute hydrochloric acid. The student used the apparatus shown in **Figure 1** to collect the gas produced.

Figure 1



(a) Outline a plan to investigate how the rate of this reaction changed when the concentration of the hydrochloric acid was changed.

- Describe how you would do the investigation and the measurements you would make.
- Describe how you would make it a fair test.

You do **not** need to write about safety precautions.

(6)