

1. Two alcohols were ignited, and the heat given out by the flame measured by the change in temperature of a known amount of water heated by each flame. The results recorded were:

Alcohol	Mass of alcohol consumed (g)	Heat given out (kJ)
Methanol, CH <sub>3</sub> OH	6.2	142
Ethanol, C <sub>2</sub> H <sub>5</sub> OH	9.2	268

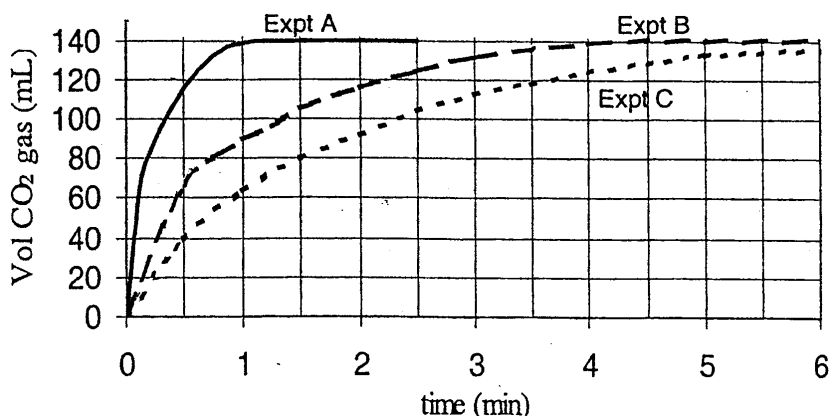
Calculate:

- (a) the number of moles of methanol /2  
 (b) the enthalpy of combustion for methanol (kJ mol<sup>-1</sup>) /1  
 (c) the energy density of ethanol (kJ g<sup>-1</sup>). /1
2. Examine the following data.

Alcohol	$\Delta H$ combustion (kJ mol <sup>-1</sup> )	Density (g mL <sup>-1</sup> )
1-propanol, C <sub>3</sub> H <sub>7</sub> OH	2016	0.799
1-butanol, C <sub>4</sub> H <sub>9</sub> OH	2630	0.813

Calculate, for each alcohol:

- (a) the energy density (kJ g<sup>-1</sup>) /2  
 (b) the energy volume (kJ L<sup>-1</sup>) /2
3. State and explain the effect of modifying each of the following on the rate of reaction:
- a) concentration of reactants /2  
 b) temperature of the reaction mixture /2  
 c) pressure of the reaction mixture /2  
 d) state of subdivision of the reactants /2  
 e) presence of catalysts /2  
 f) intensity of light (for photochemical reactions) /2
- 4.
- a) Draw a labelled energy profile diagram for an exothermic reaction with and without a catalyst. /3  
 b) State and explain the effect increasing the temperature would have on this diagram. /2
5. Describe the function of enzymes. /2
6. The graph below shows the results of a series of experiments at room temperature.



Experiment A: 0.5g powdered zinc carbonate, 25 mL of 0.5 mol L<sup>-1</sup> HCl, room temperature.

Experiment B: 0.5g granules zinc carbonate, 25 mL of 0.5 mol L<sup>-1</sup> HCl, room temperature.

Experiment C: 0.5g lump of zinc carbonate, 25 mL of 0.5 mol L<sup>-1</sup> HCl, room temperature.

- (a) Write the equation for the reaction /2  
 (b) State an hypothesis that could be tested using the above series of experiments /2  
 (c) State, for Experiment B, whether the rate of reaction is faster at 1 minute or 2 minutes, and state how the graph shows this. /2  
 (d) If Experiment D were conducted as in Experiment B except with 3.0 mol L<sup>-1</sup> HCl:  
 (i) State the effect on the total CO<sub>2</sub> produced /1  
 (ii) State the effect on the rate at which CO<sub>2</sub> is produced /1