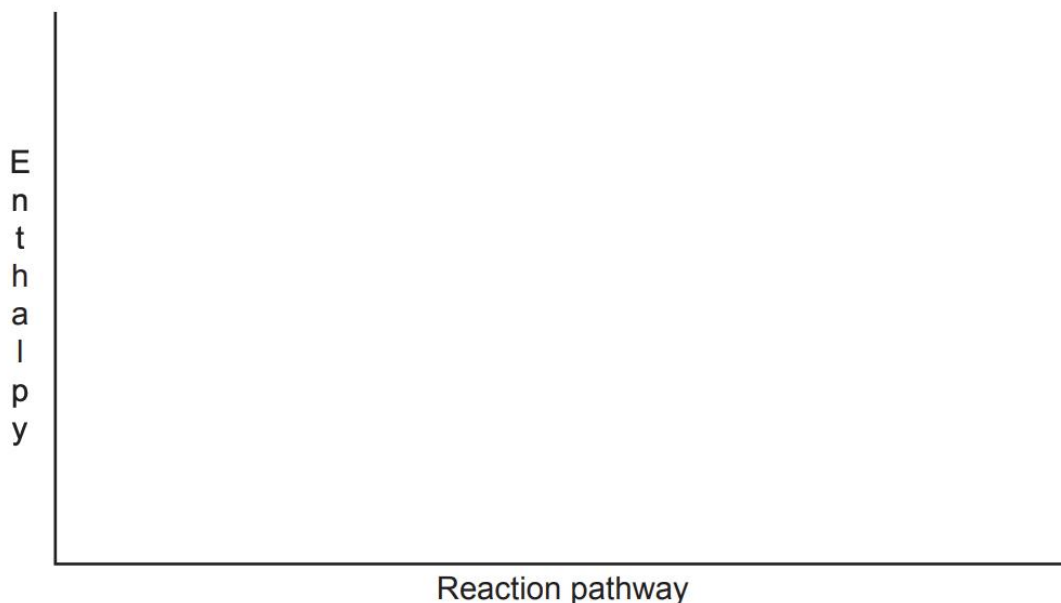


Question 33

(9 marks)

Both dynamite and TNT are explosive substances that are sometimes confused with each other. The active ingredient in dynamite is a stabilised form of nitroglycerine, $\text{C}_3\text{H}_5\text{N}_3\text{O}_9$, while TNT is the common name for the explosive compound 2,4,6-trinitrotoluene, $\text{C}_6\text{H}_2(\text{NO}_2)_3\text{CH}_3$.

- (a) An explosion is a 'very fast and very exothermic reaction'. Use a solid line (—) to draw, and then label, an energy profile diagram reflecting an explosive reaction. (3 marks)



Nitroglycerin is extremely shock-sensitive and readily becomes unstable. In dynamite the nitroglycerin is combined with inhibitors and stabilisers, making it safer to use. Typically, dynamite is between 25% to 50% nitroglycerine.

- (b) An inhibitor is a substance that decreases the rate of, or prevents, a chemical reaction. On the diagram in part (a) above, indicate by way of a dashed line (- -) any change/s that would be evident if an inhibitor were to be introduced. (2 marks)
- (c) The energy density of dynamite is 5.0 MJ kg^{-1} and the energy density of TNT is 4.0 MJ kg^{-1} . Show by calculation and by reasoning which of these two explosives produces more energy per mole of the **active** ingredient. (4 marks)

$$M(\text{C}_3\text{H}_5\text{N}_3\text{O}_9) = 227.10 \text{ g mol}^{-1}$$

$$M(\text{C}_6\text{H}_2(\text{NO}_2)_3\text{CH}_3) = 227.14 \text{ g mol}^{-1}$$
