CONTOUREDUCATION

VCE Chemistry ¾
Thermochemistry [1.1]
Test

20 Marks. 12 Minutes Writing

Results:

Test Questions	_____ / 15
Extension	_____ / 5

Section A: Test Questions (15 Marks)

Question 1 (4 marks)

Tick whether the following statements are **true** or **false**.

|	True	False
a. In an exothermic reaction, the environment's temperature increases.		
b. In an endothermic reaction, chemical energy is converted into thermal energy.		
c. The reason an endothermic reaction results in the system becoming cooler is because the system loses energy.		
d. Energy is released when new bonds are formed.		
e. The activation energy for a reaction can be negative.		
f. Complete combustion occurs whenever a larger - and therefore stronger - fuel is burnt.		
g. Given the equation, $C_4H_{10} + \frac{13}{2}O_2 \rightarrow 4CO_2 + 5H_2O \quad \Delta H = -2880\ kJ/mol$, the change in enthalpy for the equation when **doubled** will be $\Delta H = -5760\ kJ/mol$		
h. Thermochemical equations written using the databook assume complete combustion and liquid water as a product.		

Space for Personal Notes

Question 2 (2 marks)

A chemist reacts two different chemicals in a glass and notices frost forming on the outside of the beaker. In this reaction, is energy being released or absorbed? Is this an endothermic or exothermic reaction?

_____

_____

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Question 3 (4 marks)

Below is an energy profile diagram for a reaction that has taken place at SLC.

a.
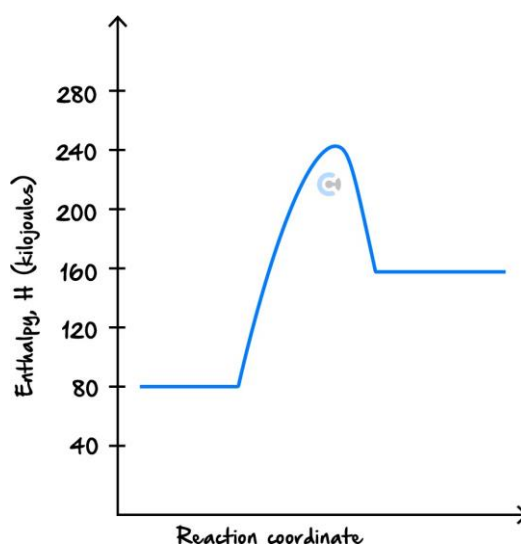
    i.   Calculate the ΔH for this reaction. (1 mark)

_____

    ii.   Hence, explain whether this reaction is endothermic or exothermic. (1 mark)

_____

_____

b. Find the activation energy for this reaction. (1 mark)

_____

c. What would be the activation energy required for the reverse reaction to occur? (1 mark)

_____

Question 4 (5 marks)

Butane is often used as the fuel to produce the flame in lighters. It is readily available and can be easily combusted.

a. Write the equation for the complete combustion of butane. (1 mark)

_____

b. What **three** products might form if the lighter filled with butane is lit at a high altitude that is low in oxygen? (1 mark)

_____

c. Is combustion an example of an exothermic or endothermic reaction? (1 mark)

_____

d. It is known that the activation energy for the combustion of butane is $+230 \ kJ/mol$. Draw an energy profile diagram for the combustion of butane, labelling the activation energy and the change in enthalpy value. (2 marks)
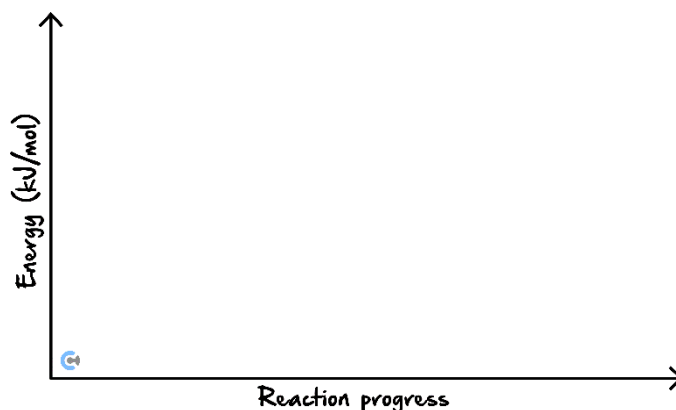
Section B: Extension (5 Marks)

Question 5 (2 marks)

Hydrochloric acid is a highly sought-after chemical due to its vast array of uses in both educational and professional labs. Below is the thermochemical equation for the breakdown of hydrogen chloride.

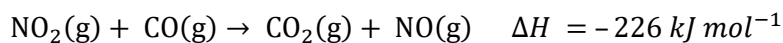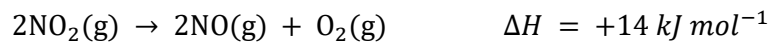$$HCl(g) \rightarrow H(g) + Cl(g) \qquad \Delta H = +431.9 \ kJ/mol$$

If a thermometer were placed within a vessel where this reaction was taking place, explain what one would expect to observe as the reaction progresses.
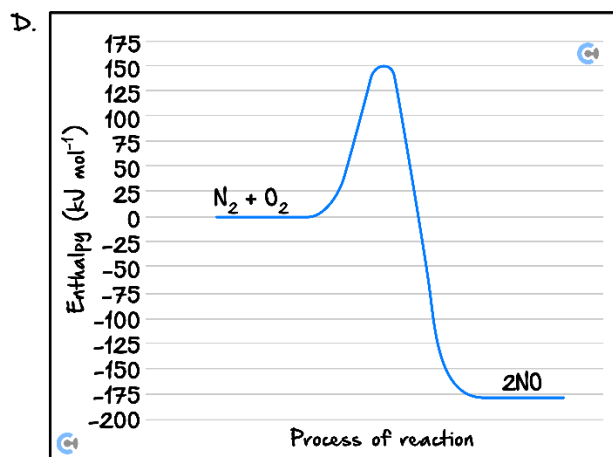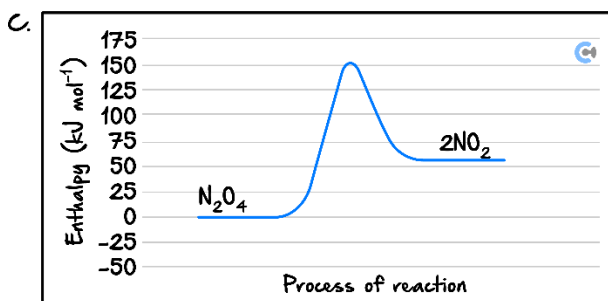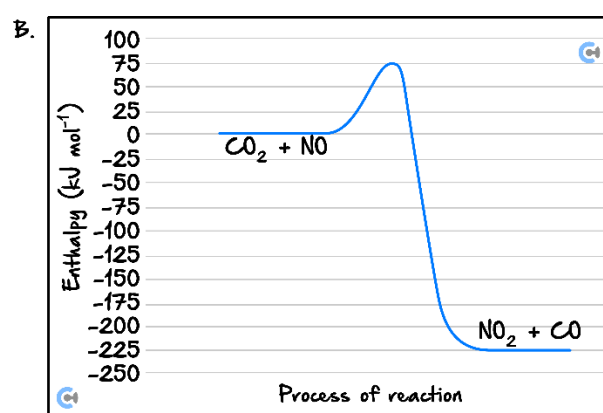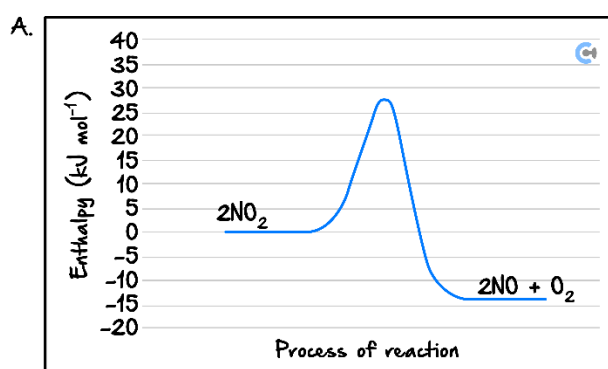
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Question 6 (1 mark)

Consider the following chemical equations.

$$2NO_2(g) \rightarrow 2NO(g) + O_2(g) \qquad \Delta H = +14 \; kJ \; mol^{-1}$$

$$NO_2(g) + CO(g) \rightarrow CO_2(g) + NO(g) \qquad \Delta H = -226 \; kJ \; mol^{-1}$$

$$2NO_2(g) \rightleftharpoons N_2O_4(g) \qquad \Delta H = -57 \; kJ \; mol^{-1}$$

$$N_2(g) + O_2(g) \rightleftharpoons 2NO(g) \qquad \Delta H = +181 \; kJ \; mol^{-1}$$

Which one of the following graphs is consistent with the chemical equations above?

A.

B.


C.

D.

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Question 7 (1 mark)

Which one of the following statements about enthalpy change is correct?

A. The sign of the enthalpy change for an endothermic reaction is negative.

B. The sign of the enthalpy change for the condensation of a gas to a liquid is negative.

C. The enthalpy change is the difference between the activation energy and the energy of the reactants.

D. The enthalpy change is the difference between the activation energy and the energy of the products.

Question 8 (1 mark)

Consider the following energy profile for a particular chemical reaction, where I, II and III represent enthalpy changes during the reaction.
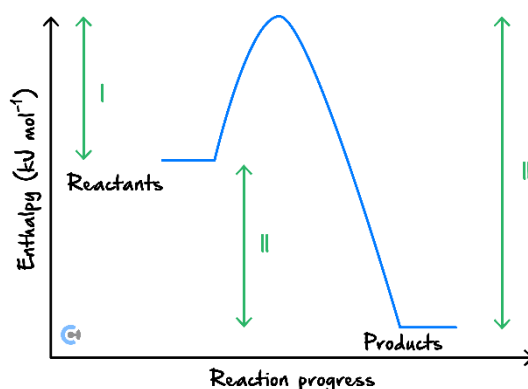
Which one of the following statements is correct?

A. The activation energy for the reverse reaction is (III-II).

B. The net energy released for the forward reaction is represented by II.

C. The energy required to break the reactant bonds is represented by II.

D. The energy released by the formation of new bonds is represented by I.

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