

Name KEY  
 Date \_\_\_\_\_  
 Due Date \_\_\_\_\_

Mark 22 / 22

Correct and Hand in Again by \_\_\_\_\_

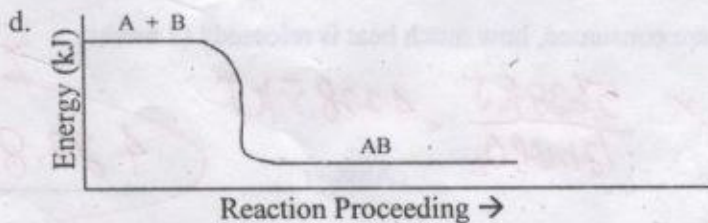
**Chemistry 11**

**Hand In Assignment # 9 – Energy in Chemical Reactions**

This Assignment will be marked and you are allowed to do one set of corrections.

1. State whether each of the following are *exothermic* or *endothermic*. (7 marks)

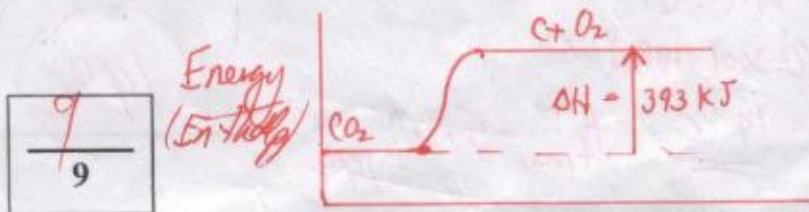
- a.  $H + Cl \rightarrow HCl + 432 \text{ kJ}$  Answer exo
- b.  $12CO_2 + 11H_2O \rightarrow C_{12}H_{22}O_{11} + 12 O_2 \quad \Delta H = 5638 \text{ kJ}$  Answer endo
- c.  $H_2O(s) \rightarrow H_2O(l)$  Answer endo



Answer exo

- e.  $C + D \rightarrow CD \quad \Delta H = -65.7 \text{ kJ}$  Answer exo
- f.  $E + F + 437 \text{ kJ} \rightarrow G + H$  Answer endo
- g.  $H_2O(g) \rightarrow H_2O(l)$  Answer exo

2. Draw an "Energy" vs. "Reaction Proceeding" graph for the reaction:  
 $CO_2 \rightarrow C + O_2 \quad \Delta H = 393 \text{ kJ/mol}$ . Label  $\Delta H$  on your graph. (2 marks)



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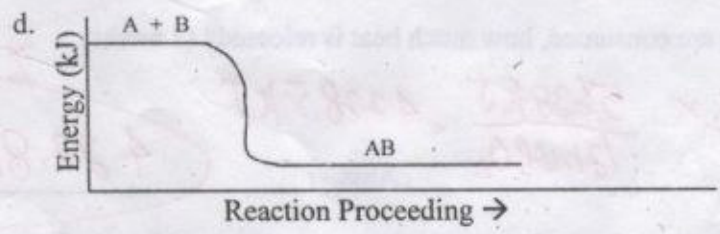
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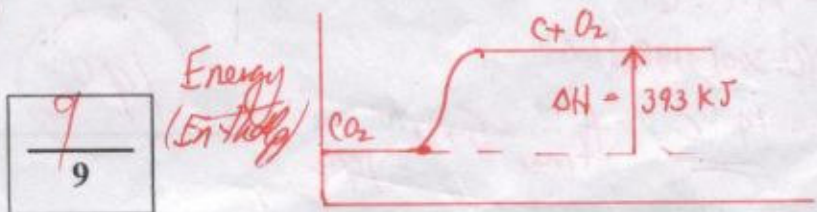
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KEY!

3. In an *endothermic* reaction, the surroundings get (*warmer/cooler*) (1 mark) cooler

4. Define *enthalpy* (1 mark)

total energy contained in a substance (chem pot. en.)

5. Given the equation:  $\text{HCl} + 432 \text{ kJ} \rightarrow \text{H} + \text{Cl}$

How much heat is absorbed when 5.5 moles of HCl is decomposed into its atoms? (1 mark)

$$5.5 \text{ mol} \times \frac{432 \text{ kJ}}{1 \text{ mol}} = 2376 \text{ kJ}$$

Answer

2376 kJ

6. Given the equation:  $\text{C}_{12}\text{H}_{22}\text{O}_{11} + 12\text{O}_2 \rightarrow 12\text{CO}_2 + 11\text{H}_2\text{O} + 5638 \text{ kJ}$

a. How much heat is released during the formation of one mole of  $\text{CO}_2$ ? (1 mark)

$$1 \text{ mol CO}_2 \times \frac{5638 \text{ kJ}}{12 \text{ mol CO}_2} = 469.8 \text{ kJ}$$

Answer

469.8 kJ

b. How much heat is released during the formation of 2.2 moles of  $\text{H}_2\text{O}$ ? (2 marks)

$$2.2 \text{ mol H}_2\text{O} \times \frac{5638 \text{ kJ}}{11 \text{ mol H}_2\text{O}} = 1127.6 \text{ kJ}$$

Answer

1127.6 kJ

c. If 9.0 moles of  $\text{O}_2$  are consumed, how much heat is released? (2 marks)

$$9.0 \text{ mol O}_2 \times \frac{5638 \text{ kJ}}{12 \text{ mol O}_2} = 4228.5 \text{ kJ}$$

Answer

4228.5 kJ

7. Calculate the amount of heat (in Joules) required to warm 400.0 g of water from  $10^\circ\text{C}$  to  $35^\circ\text{C}$ . (Heat Capacity (C) for  $\text{H}_2\text{O}$  is  $4180 \text{ J/kg} \cdot ^\circ\text{C}$ ) (2 marks)

$$H = m \cdot C \cdot \Delta t$$

$$= 0.400 \text{ kg} \times \frac{4180 \text{ J}}{\text{kg} \cdot ^\circ\text{C}} \times 25^\circ\text{C} = 41800 \text{ J}$$

Answer

41800 J (41.8 kJ)

8. 17.556 kJ of heat are added to a 300.0 gram sample of water initially at  $5^\circ\text{C}$ . Calculate the final temperature of the water sample. Be careful with units! (3 marks)

$$H = m \cdot C \cdot \Delta t$$

$$17556 = (0.300)(4180 \text{ J}) \Delta t$$

$$\Delta t = 14^\circ\text{C}$$

$$t_{\text{final}} = 5 + 14 = 19^\circ\text{C}$$

Answer

19°C

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