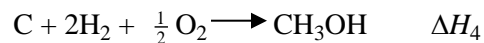
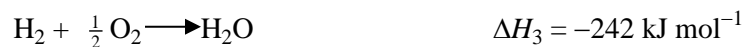
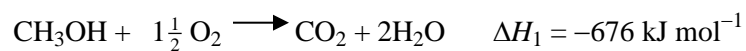


Total point \_\_\_/35

- 1, Calculate the enthalpy change,  $\Delta H_4$  for the reaction

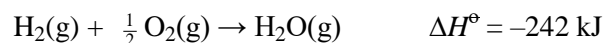


using Hess's Law and the following information.

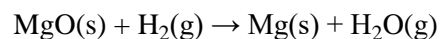


(Total 4 marks)

- 2, Consider the following equations.

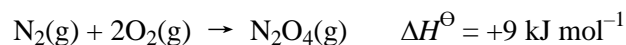
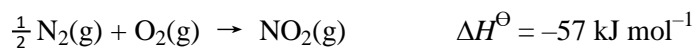


What is the  $\Delta H^\ominus$  value (in kJ) for the following reaction?

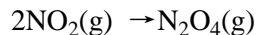


- A. -844      B. -360      C. +360      D. +844

3. The  $\Delta H^\ominus$  values for the formation of two oxides of nitrogen are given below.

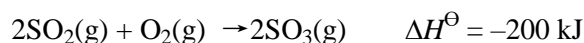
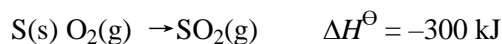


Use these values to calculate  $\Delta H^\ominus$  for the following reaction (in kJ):

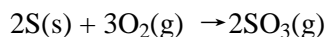


- A. -105    B. -48    C. +66    D. +123

4. The equations and enthalpy changes for two reactions used in the manufacture of sulfuric acid are:

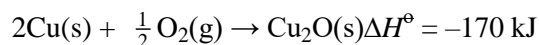
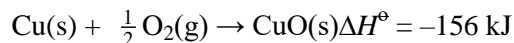


What is the enthalpy change, in kJ, for the reaction below?

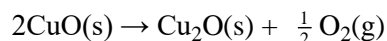


- A. -100    B. -400    C. -500    D. -800

5. Using the equations below

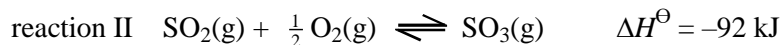
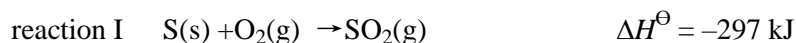


what is the value of  $\Delta H^\ominus$  (in kJ) for the following reaction?



- A. 142    B. 15    C. -15    D. -142

6. Two reactions occurring in the manufacture of sulfuric acid are shown below:



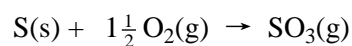
- (i) State the name of the term  $\Delta H^\ominus$ . State, with a reason, whether reaction I would be accompanied by a decrease or increase in temperature.

(3)

- (ii) At room temperature sulfur trioxide,  $\text{SO}_3$ , is a solid. Deduce, with a reason, whether the  $\Delta H^\ominus$  value would be more negative or less negative if  $\text{SO}_3(\text{s})$  instead of  $\text{SO}_3(\text{g})$  were formed in reaction II.

(2)

- (iii) Deduce the  $\Delta H^\ominus$  value of this reaction:



(1)

7. A sample of a metal is heated. Which of the following are needed to calculate the heat absorbed by the sample?

I. The mass of the sample  
the sample

II. The density of

III. The specific heat capacity of the sample

A. I and II only

B. I and III only

C. II and III only

D. I, II and III

8. The following equation shows the formation of magnesium oxide from magnesium metal.



Which statement is correct for this reaction?

- A. 1204 kJ of energy are released for every mol of magnesium reacted.
- B. 602 kJ of energy are absorbed for every mol of magnesium oxide formed.
- C. 602 kJ of energy are released for every mol of oxygen gas reacted.
- D. 1204 kJ of energy are released for every two mol of magnesium oxide formed.

9. Which statement is correct for an endothermic reaction?

- A. Bonds in the products are stronger than the bonds in the reactants.
- B. Bonds in the reactants are stronger than the bonds in the products.
- C. The enthalpy of the products is less than that of the reactants.
- D. The reaction is spontaneous at low temperatures but becomes non-spontaneous at high temperatures.

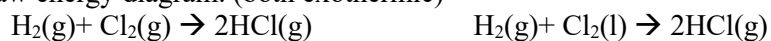
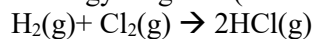
10. When  $100\text{ cm}^3$  of  $1.0\text{ mol dm}^{-3}$  HCl is mixed with  $100\text{ cm}^3$  of  $1.0\text{ mol dm}^{-3}$  NaOH, the temperature of the resulting solution increases by  $5.0^\circ\text{C}$ . What will be the temperature change, in  $^\circ\text{C}$ , when  $50\text{ cm}^3$  of these two solutions are mixed?

- A. 2.5
- B. 5.0
- C. 10
- D. 20

11. Use the bond enthalpy table to calculate the amount of enthalpy change when the following reactions take place. Identify each of the reaction if it is exothermic or endothermic. (6)

- a.  $\text{CH}_4\text{(g)} + \text{Br}_2\text{(g)} \rightarrow \text{CH}_3\text{Br(g)} + \text{HBr(g)}$
- b.  $\text{H}_2\text{(g)} + \text{Cl}_2\text{(g)} \rightarrow 2\text{HCl(g)}$
- c.  $\text{N}_2\text{(g)} + 3\text{H}_2\text{(g)} \rightarrow 2\text{NH}_3\text{(g)}$

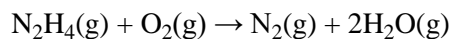
12. Describe and explain how the enthalpy change  $\Delta H$  would differ in the following two reactions. Draw energy diagram. (both exothermic) (3)



13. a. write an equation for the complete combustion reaction of ethanol. (2)

b. Determine the enthalpy of complete combustion of ethanol, in  $\text{kJ mol}^{-1}$ , using data from data booklet. (20)

14. One important property of a rocket fuel mixture is the large volume of gaseous products formed which provide thrust. Hydrazine,  $\text{N}_2\text{H}_4$ , is often used as a rocket fuel. The combustion of hydrazine is represented by the equation below.



a. Draw the Lewis structures for hydrazine and nitrogen. (2)

b. Use Data Booklet to determine the enthalpy change for the reaction in part (a) above.  
(2)