Knowledge/ Understanding	Thinking/Inquiry	Communication	Application	Total
15	7	12	10	44

Knowledge: **[……………/15]**

1-An increase in temperature:

a) Lowers the activation energy

b) Increases the number of collisions

c) Increases the population of molecules that can overcome the activation barrier

d) b and c

e) a and c

2- Consider the following experimental results, which of the following factors would account for the lower rate in Experiment 1?

	Experiment 1	Experiment 2
Reactants	powdered Cu and HCl	chunk of Cu and HNO_3
Temperature	20°C	10°C
Concentration of acid	0.6M HCl	0.4M HNO_3
Rate	low	high

A. Temperature   B. nature of reactants   C. surface area of Cu   D. concentration of acid

3- Which of the following actions would not change the rate of a reaction?

a) increasing the concentration of the reactants

b) increasing the available surface area of a reactant

c) using different reactants

d) removing heat from the reaction

e) none of the above

4- Consider the following potential energy diagram:

The energy interval that represents the activation energy for this reaction is:
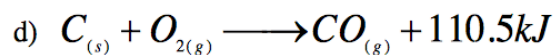
A. I   B. II   C. III   D. IV
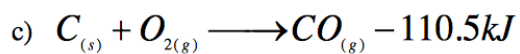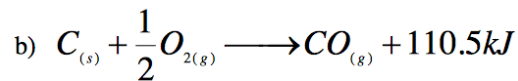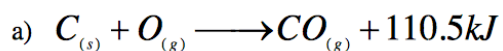
5- Which of the following equations shows the correct thermochemical equation for the heat of formation of CO (g) ?

a) $C_{(s)} + O_{(g)} \longrightarrow CO_{(g)} + 110.5kJ$

b) $C_{(s)} + \dfrac{1}{2}O_{2(g)} \longrightarrow CO_{(g)} + 110.5kJ$

c) $C_{(s)} + O_{2(g)} \longrightarrow CO_{(g)} - 110.5kJ$

d) $C_{(s)} + O_{2(g)} \longrightarrow CO_{(g)} + 110.5kJ$

e) $2C_{(s)} + O_{2(g)} \longrightarrow 2CO_{(g)} + 110.5kJ$
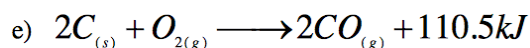
6- Which of the following are necessary for successful collisions to occur?

I :Favorable geometry   II :Sufficient energy   III :Large ΔH

A. I only   B. I and II only   C. II and III only   D.I, II, and III

7- For each of the following situations, determine the effect on the rate of reaction (Circle the correct choice) and state which of the 5 factors affecting rate of reaction are being changed. [4]

A block of wood is cut into smaller pieces before being burned in a fire. (1.5)

a) Circle the correct choice:

| Rate Increases | Rate Decreases | Rate stays the Same | Impossible to Determine |

b) Which factor(s) is/are being changed? _____

In the reaction of baking soda and vinegar, 5 ml of vinegar at 15°C is replaced with 3 ml of vinegar at 20°C.

a) Circle the correct choice:
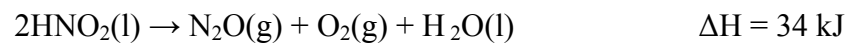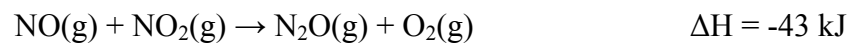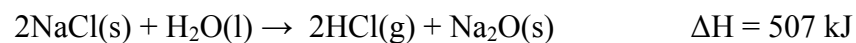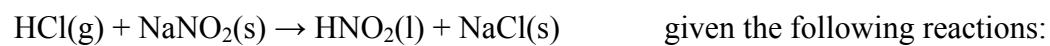
| Rate Increases | Rate Decreases | Rate stays the Same | Impossible to Determine |

b) Which factor(s) is/are being changed? _____

(2.5)

8. Use the thermo chemical equations shown below to determine the enthalpy for the reaction: (5)

$$HCl(g) + NaNO_2(s) \rightarrow HNO_2(l) + NaCl(s)$$ given the following reactions:

$2NaCl(s) + H_2O(l) \rightarrow 2HCl(g) + Na_2O(s)$ $\Delta H = 507$ kJ

$NO(g) + NO_2(g) + Na_2O(s) \rightarrow 2NaNO_2(s)$ $\Delta H = -427$ kJ

$NO(g) + NO_2(g) \rightarrow N_2O(g) + O_2(g)$ $\Delta H = -43$ kJ

$2HNO_2(l) \rightarrow N_2O(g) + O_2(g) + H_2O(l)$ $\Delta H = 34$ kJ

1-The complete combustion of 1.00 mol of sucrose, $C_{12}H_{22}O_{11}$, releases 5641 kJ of energy. How many grams of sucrose is needed to change the temperature of 750 g water from 11 to 33 C?

$C_{12}H_{22}O_{11}(s) + 24O_2(g) \rightarrow CO_2(g) + 11H_2O(l)$ (………./4)
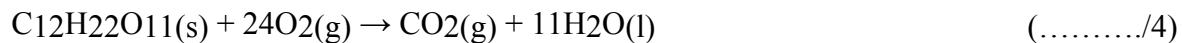
2-The complete combustion of 1.00 mol of an unknown compound, XYZ, releases −5641 kJ of energy

   $XYZ(s) + 12O_2(g) \rightarrow 12CO_2(g) + 11H_2O(l)$ (………./3)
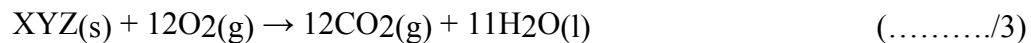
Use the enthalpy change of this reaction, and enthalpies of formation from the table, to determine the enthalpy of formation of the unknown compound.

Communication:

1- For the following pair of substances state which would have a <u>higher rate</u> of reaction **and explain**

why (refer to the 5 factors that affect rate, and explain **why** that factor affects the rate of reaction) (....../3)

*3g of salt dissolved in a solution of 1M (1 mole/L) hydrochloric acid **versus** 3g of salt dissolved in a solution of 0.1M (0.1 moles/L) hydrochloric acid.*

2- What is a catalyst? What is the effect of adding a catalyst on the rate of reaction? Explain what happens in the reaction to cause this effect. (.........../2)
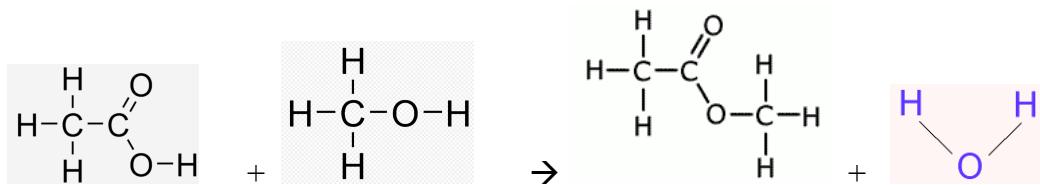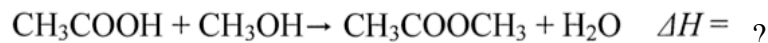
3- State two reasons why some collisions may not result in a chemical reaction. (............/2)

Reason I:

Reason II:

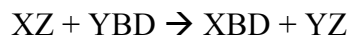4- What is the meaning of "enthalpy of formation"? (......../2)

5-Calculate the enthalpy change from bond energies for the following reaction: (3)

$CH_3COOH + CH_3OH \rightarrow CH_3COOCH_3 + H_2O \quad \Delta H = $?

1-An endothermic reaction is given as below: (…………/2)

XZ + YBD → XBD + YZ

a) Draw the structure of the activated complex for this reaction. (1)
b) Within the activated complex, show/name the bonds which are stronger than other bonds in the compound. (1)

2-Calculate the value of ΔH^o for the following reactions using the table of standard enthalpy of formation. Assume all reactants and products are in the *gaseous state*. (Show all your work) (…………/2)
     $CH_3CH_2CH_3$ + 5 O_2 →   3 CO_2 +   4 H_2O
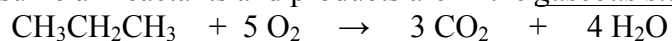
3-Use the following data to : (…………/6)

a) calculate the **rate law equation ,including all exponents, rate constant and its unit** for the system.

(4 marks)

$$NO_{(g)} + H_{2(g)} \longrightarrow HNO_{2(g)}$$
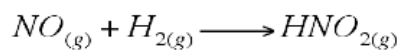
Experiment	NO (mol/L)	H2 (mol/L)	Initial Rate of Reaction (mol/(L·s))
1	0.001	0.004	0.002
2	0.002	0.004	0.008
3	0.003	0.004	0.018
4	0.004	0.001	0.008
5	0.004	0.002	0.016
6	0.004	0.003	0.024

b) Calculate **reaction rate** when [NO]=[H2]=0.20 mol/L. (1 mark)

c) What is the over all order? (1 mark)

Good Luck   ☺