DEPARTMENT OF CHEMISTRY
SCHOOL OF NATURAL AND APPLIED SCIENCES
FEDERAL UNIVERSITY OF TECHNOLOGY, MINNA
FIRSTSEMESTER EXAMINATION 2012/2013 SESSION

COURSE CODE: CHM211 **UNITS: 2**
COURSE TITLE: PHYSICAL CHEMISTRY II
TIME ALLOWED: 2 HOURS
INSTRUCTIONS: Answer any three questions

Q1(a) (i). Briefly explain the terms internal energy and enthalpy and show how they are related.

(ii). The work done when a gas is compressed in acylinder is 462J. During the process, there was heat transfer of 128J from the gas to the surrounding. Calculate ΔE.

(b). Nitroglycerinedecomposes resulting in an explosion and causing a change of $5.72x10^3$kJ of heat per mole. $C_3H_5(NO_3)_3 \rightarrow 3CO_2(g) + 5/2H_2O(g) + 1/4O_2(g) \backslash = 3/2N_2(g)$
State whether the decomposition is exothermic or endothermic and draw the enthalpy diagram for the process.

Q2(ai). State the laws of thermochemistry.

(ii). Define the following terms " standard heat of formation", " standard heat of vaporization" and "specific heat capacity."

(b).30g of a substance was heated in pure boiling water and transferred into a calorimeter containing 45g of water at 25°C. The temperature of the water increase by 12%.
What is the specific heat capacity of the substance?

Q3.(a) What is order of a reaction?

(b). A given first order reaction was 90% completed within a given period of time. Determine the ratio of this time to that of the reaction's half-life ($t_{1/2}$)

(c). Given the equation $aA + bB \rightarrow cC$. Assuming the concentration of A and B are **EQUAL**, $a = b = 1$, and the order of A and B are the same.
Derive the first order kinetics equation of the reaction.

Q4.(a) State Hess' law.

(b). Determine the enthalpy of the reaction; $C(graphite) + 2H_2(g) \rightarrow CH_4(g)$from the equations below using Hess' law

i. $C(graphite) + O_2(g) \rightarrow CO_2(g)$ $\Delta H_{rxn} = -393.5kJ$
ii. $2H_2(g) + O_2(g) \rightarrow 2H_2O(l)$ $\Delta H_{rxn} = -571.0kJ$
iii. $CH_4(g) + 2O_2(g) \rightarrow CO_2(g) + 2H_2O(l)$ $\Delta H_{rxn} = -890.0kJ$

(c.). Using a **diagram only**, describe the collision theory of gas molecules when temperature was raised from T_1 to T_2