Thermochemistry revision quiz

Name ----------

40

1) Consider the following equation

$2A(g) + C(g) \rightarrow 2D(l)$ $\Delta H = -121.5$ kJ mol^{-1}

$D(l) + C(g) \rightarrow 2G(l)$ $\Delta H = -141.5$ kJ mol^{-1}

a) Give the ΔH for the following reactions. (*3 marks*)

i. $A(g) + \frac{1}{2} C(g) \rightarrow D(l)$ ΔH =

ii. $4D(l) \rightarrow 4A(g) + 2C(g)$ ΔH =

iii. $2A(g) + 2G(g) \rightarrow 3D(l)$ ΔH =

b) Consider the equation given below.

$2A(g) + C(g) \rightarrow 2D(g)$

Will the ΔH for this equation most likely be : (*1 mark*)

i. -111.5 kJ mol^{-}

ii. +121.5 kJ mol^{-}

iii. -131.0 kJ mol^{-}

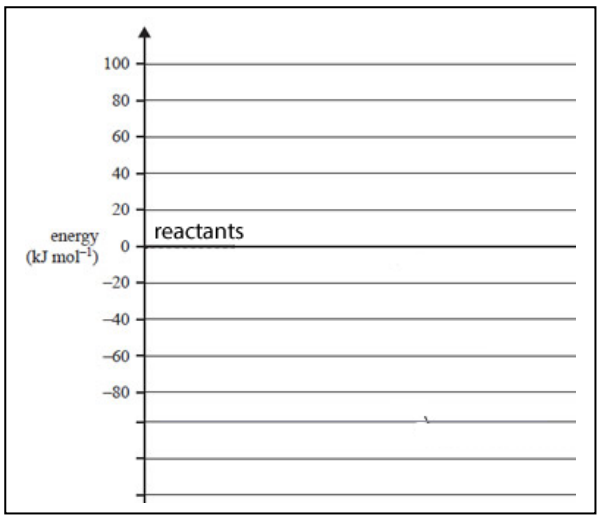
iv. +131.0 kJ mol^{-}

c) Explain your answer to b) above. (*1 mark*)

2) Consider the thermochemical equation given below.

$2A(g) + C(g) \rightarrow 2D(l)$ $\Delta H = +80.0$ kJ mol^{-1}

Draw the energy profile of this reaction given that 130 kJ/mol of energy is needed to break bonds.
Label: (*4 marks*)



i. The energy content of the products

ii. The ΔH of the reaction

iii. The activation energy

iv. The amount of energy released during bond formation

9

.

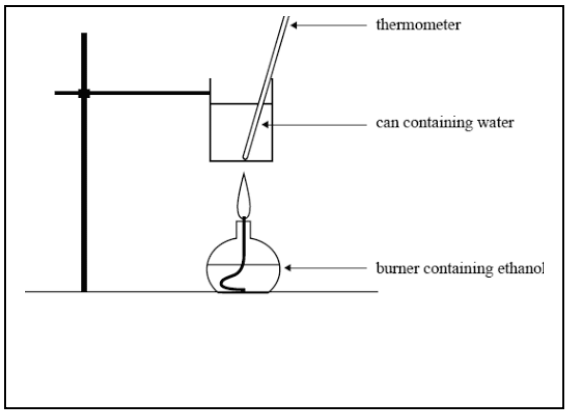
3) Consider the thermochemical equation below
$A(g) + C(g) \rightarrow 2D(l)$ $\Delta H = -121.5$ kJ mol^{-1}
What mass, in grams of reactant "C" is required to produce 364.5 kJ of energy given the molar mass of "C" is given as 100.00 g mol^{-}? Give the answer to the right number of significant figures. (*3 marks*)

4) Consider the liquid fuel octane.
i. Write a balanced thermochemical equation for the complete combustion of liquid octane, at SLC. (*2 marks*)

ii. Using the equation derived in i. above calculate the amount, in kilograms, of gas produced if 3.56 Megajoules of energy are required to be released. Give the answer to the right number of significant figures. (*3 marks*)

iii. Using the ideal gas equation (PV = nRT) calculate the volume, in litres, of gas <u>produced</u> if a limited amount of octane burns in excess oxygen to produce 3.489×10^4 kJ of energy at 25°C and 101.3 kpa pressure. Give the answer to the right number of significant figures. (*3 marks*)

5) A student was set the task of determining the molar heat of combustion of ethanol using the setup shown on the right.
An amount of 100 mL of water was placed in the can at 25.0° C and heated using an ethanol burner.
The ethanol burner was weighed before and after burning and a mass loss of 0.46 grams was recorded. The final temperature of the water was recorded at 49.2 °C.



a) Calculate the molar heat of combustion given the experimental results above. Give the answer to the right amount of significant figures.

(*3 marks*)

b) Compare your result to the molar heat of combustion given for ethanol in the data sheet and discuss the reason for any discrepancy. (*2 marks*)

c) Suggest one possible way of how can the validity of the results be improved?

(*1 mark*)

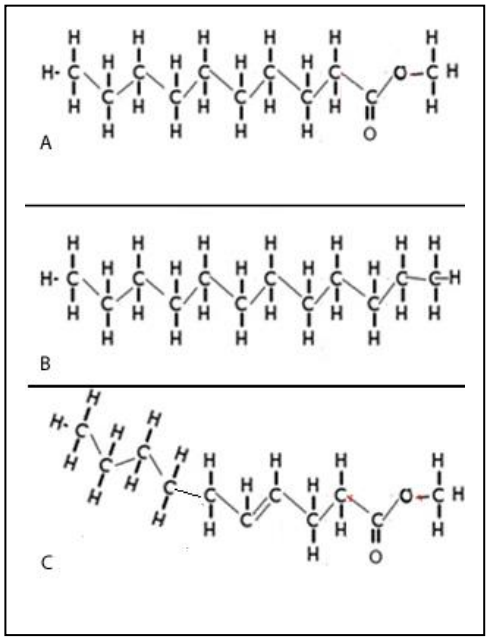
d) Give one example of a random error and discuss how it may have impacted on the result.

(*2 marks*)

e) Give one example of a systematic error and discuss how it may have impacted on the result. (*2 marks*)

10

6) Consider the molecules shown on the right of three different impure types of fuels. The molecule pictured is the common molecule present but no the only type. Other molecules exist with similar chemical structures but longer carbon chains. Give a reason for each of your answers. Which of the molecules pictured belong to a fuel that: (*10 marks*)



i. needs to be stored in air tight containers from fear of being contaminated by atmospheric water ,

ii. are renewable sources of energy,

iii. has the lowest viscosity,

iv. can be used as an effective fuel in very low temperature climates,

v. has a very low flash point,

vi. is least likely to be bio-degraded,

vii. is most likely to be bio-degraded,

viii. is more likely to undergo incomplete combustion in low oxygen environments,

ix. has energy density measured in kJ/gram and not in kJ/mol,

x. has the most impact on anthropogenic Climate Change.