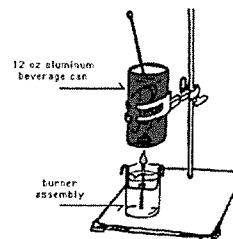# Enthalpy Worksheet

Name: _____ **Date:** _____

2. The temperature of a 2.0 g sample of aluminium increases from 25°C to 30°C. How many joules of heat energy were added? (Specific heat of Al = 0.90 J $g^{-1}K^{-1}$)

 A. 0.36
 B. 2.3
 C. 9.0
 D. 11

8. Which statements about exothermic reactions are correct?

 I.   They have negative ΔH values.
 II. The products have a lower enthalpy than the reactants.
 III. The products are more energetically stable than the reactants.

 A. I and II only
 B. I and III only
 C. II and III only
 D. I, II and III
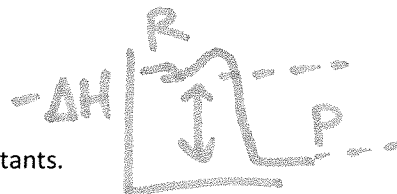
9. A sample of a metal is heated. Which of the following are needed to calculate the heat absorbed by the sample?

 I.   The mass of the sample
 II. The density of the sample
 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

11. How much energy (in kJ) is released when 100.0g of CH_4 combust according to the following reaction?

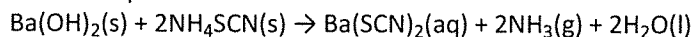$$CH_4(g) + 2O_2(g) \rightarrow CO_2(g) + 2H_2O(g) \quad \Delta H = -891 \text{ kJ mol}^{-1}$$
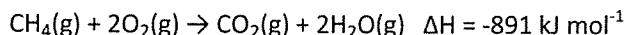
 A. 891 kJ
 B. 2777 kJ
 C. 5555 kJ
 D. 89100 kJ

14. What is the energy change (in kJ) when the temperature of 20 g of water increases by 10°C?

 A. 20×10×4.18
 B. 20×283×4.18
 C. $\dfrac{20 \times 10 \times 4.18}{1000}$
 D. $\dfrac{20 \times 283 \times 4.18}{1000}$

16. When the solids $Ba(OH)_2$ and NH_4SCN are mixed, a solution is produced and the temperature drops.

$$Ba(OH)_2(s) + 2NH_4SCN(s) \rightarrow Ba(SCN)_2(aq) + 2NH_3(g) + 2H_2O(l)$$

Which statement about the energetics of this reaction is correct?

 A. The reaction is endothermic and ΔH is negative.
 B. The reaction is endothermic and ΔH is positive.
 C. The reaction is exothermic and ΔH is negative.
 D. The reaction is exothermic and ΔH is positive.

32. The equation for the decomposition of calcium carbonate is given below.

$$CaCO_3(s) \rightarrow CaO(s) + CO_2(g)$$
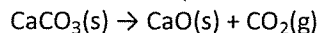
At 500 K, ΔH for this reaction is +177 kJ mol^{-1} and ΔS is 161 J K^{-1} mol^{-1}.

(a) Explain why ΔH for the reaction above cannot be described as $\Delta H_f^{\ominus}$ (standard enthalpy of formation).

conditions are not standard (500 K) and not a f (formation), but a decomposition

(2)

33. Which statements are correct for an endothermic reaction?
    I. The system absorbs heat.
    II. The enthalpy change is positive.
    III. The bond enthalpy total for the reactants is greater than for the products.

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

34. The mass m (in g) of a substance of specific heat capacity c (in J g^{-1} K^{-1}) increases by t°C. What is the heat change in J?
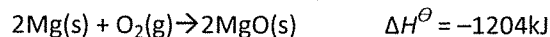
    A. mct
    B. $mc(t + 273)$
    C. $\dfrac{mct}{1000}$
    D. $\dfrac{mc(t + 273)}{1000}$

39. The standard enthalpy change for the combustion of phenol, $C_6H_5OH(s)$, is −3050 kJ mol^{-1} at 298 K.
    (a) Write an equation for the complete combustion of phenol.

    $C_6H_5OH + 7O_2 \rightarrow 6CO_2 + 3H_2O$

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

    $$2Mg(s) + O_2(g) \rightarrow 2MgO(s) \qquad \Delta H^{\ominus} = -1204 kJ$$

    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.

42. A simple calorimeter was used to determine the enthalpy of combustion of ethanol. The experimental value obtained was −920 kJ mol^{-1}. The Data Booklet value is −1371 kJ mol^{-1}. Which of the following best explains the difference between the two values?
    A. incomplete combustion of the fuel
    B. heat loss to the surroundings
    C. poor ventilation in the laboratory
    D. inaccurate temperature measurements

MARK SCHEME

2.   C

8.   D

9.   B

11.   C

14.   C

16.   B

32.   (a)   (cannot be $^{\ominus}$ as) conditions are not standard/at 500 K/*OWTTE*;
                (cannot be f as) not formation from elements/is decomposition/*OWTTE*;   2

33.   A

34.   A

39.   (a) $C_6H_5OH + 7O_2 \rightarrow 6CO_2 + 3H_2O$;   1
                 Ignore state symbols.

40.   D

42.   B