1) equation or −1 3) units or −1
2) rearrange or −1 4) s/l or −1

Thermochemistry November 9th 2017

Name: _____

All Questions 4 Marks Each

Do Not give Roman Numerals for "triangle elements"! or −1

1 Name the following compounds:

a) MgF_2 (2+ 1−) magnesium fluoride

b) CuO (2+ 2−) copper (II) oxide

c) N_2S_5 dinitrogen pentasulfide

d) $Ni_2(CO_3)_3$ (3+ 2−) nickel (III) carbonate

2 Write the formulae for the following compounds:

a) ammonium phosphate $(NH_4)_3PO_4$

b) iron (2) nitride Fe_3N_2

c) phosphorus trifluoride PF_3

d) calcium acetate $Ca(CH_3COO)_2$

3 Write the net ionic equation for the following precipitation reaction:

$$CdSO_4(aq) + K_2S(aq) \rightarrow CdS(s) + K_2SO_4(aq)$$

not on the test

I.E. $Cd^{2+}_{(aq)} + SO_4^{2-}{}_{(aq)} + 2K^{+}_{(aq)} + S^{2-}_{(aq)} \rightarrow CdSO_4(s) + 2K^{+}_{(aq)} + SO_4^{2-}{}_{(aq)}$

N.I.E. $Cd^{2+}_{(aq)} + S^{2-}_{(aq)} \rightarrow CdS(s)$

tricky tricky

4 Which of the following is an example of a physical exothermic reaction?

+HE endo
S → L → G

A) Burning a candle — chem exo
B) Clothes drying on a line — L → G endo + phys
C) The electrolysis of water — + elec E = endo + chem
D) Condensation on a window — L ← G exo + phys

5 When 4.0 g of potassium hydroxide, KOH, is dissolved in 200.0 mL of water in a calorimeter, the temperature increases from 25.0°C to 31.5°C.

Calculate the molar heat of solution of the potassium hydroxide.

-2 sb

1) $Q_{water} = mc\Delta T = \left(200.0\,g\left(\frac{4.19\,J}{g\cdot°C}\right)\right)(31.5°C - 25.0°C)$

$= 5450\,J$ carry the 3rd to the next step

2) $Q_{sub} = -5450\,J$

3) $n_{sub} = 4.0\,g\,KOH \times \frac{1\,mol\,KOH}{56\,g} = 0.0714\,mol$

4) $\Delta H_{sub} = \frac{-5450\,kJ}{0.0714\,mol} = 76\,\frac{kJ}{mol}$

Answer: $-76\,\frac{kJ}{mol}$

6 Magnesium burns in oxygen according to the following equation: → exo

$$Mg_{(s)} + \frac{1}{2}O_{2(g)} \rightarrow MgO_{(s)} \qquad \Delta H = -6.00 \times 10^2\,\frac{kJ}{mol}$$

If 3.00 g of magnesium metal is burned in an excess of oxygen, what energy will be released during this reaction?

$3.00\,g\,Mg \times \frac{1\,mol\,Mg}{24.3\,g} \times \frac{-6.00 \times 10^2\,kJ}{1\,mol\,Mg} = -741.00\,J$

Answer: $-741.00\,J$

7 Julie pours 37.5 litres of water at a temperature of 75.0 °C into a tub.

She realizes that this water is too hot.

What volume of water at 22.0 °C must she add to lower the temperature to 60.0 °C?

give me this list or −1

$-Q_H = +Q_C$ ← rearrange equation or −1

$-m_H C_H \Delta T_H = m_C C_C \Delta T_C$

$+ C_C \Delta T_C + C_C \Delta T_C$

H	C
$T_H = 75.0°C$	$T_C = 22.0°C$
$V_H = 37.5\ L$	$m_C = ?$
$C_H = 4.19\ \frac{J}{g \cdot C}$	$C_C = 4.19\ \frac{J}{g \cdot C}$
	$T_f = 60.0°C$

show me mL → g or −1

$$m_C = \left(-37.5\ L \times \frac{10^3\ mL}{1\ L} \times \frac{1\ g}{1\ mL}\right)(60.0°C - 75.0°C) \over (60.0°C - 22.0°C)$$

$= 14.8 \times 10^3\ g \times \frac{1\ mL}{1\ g} =$

$14.8 \times 10^3\ mL$

Answer: 14.8×10^3 mL of cold water

8 Given the equation representing a reaction:

$$H_2(g) + I_2(g) \rightarrow 2HI(g)$$

Which statement describes the energy changes that occur in this reaction?

(1) Energy is absorbed as bonds are formed, only.

(2) Energy is released as bonds are broken, only.

(3) Energy is absorbed as bonds are formed, and energy is released as bonds are broken.

(4) Energy is absorbed as bonds are broken, and energy is released as bonds are formed.

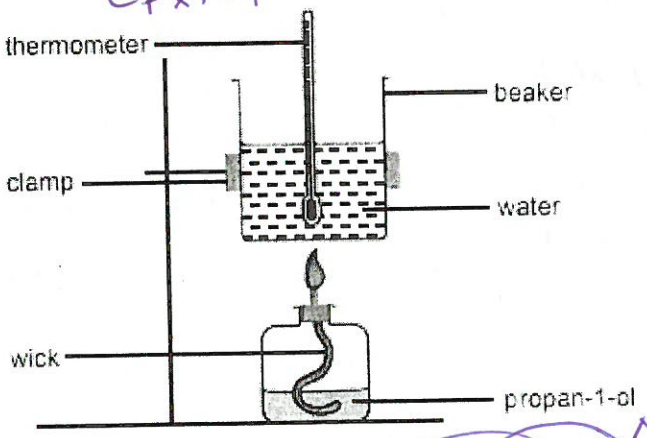
bonds breaking = endo

bonds forming = exo

$3 \times 12 = 36$ $16 \times 1 = 16$ $1 = 60\ g/mol$

9 In an experiment to determine the standard enthalpy change of combustion of propan-1-ol, C_3H_7OH, a student used the apparatus shown below.

$7 \times 1 = 7$



4 step reverse

3 sf

$\Delta H = -2120\ \frac{kJ}{mol}$

ΔH

The student determined the molar enthalpy of combustion to be – 2120 kJ/mol.

T_i T_f

The student had measured 50.0 mL of water at 25.0 °C into the beaker and lit the burner. When the temperature of the water had gone up to 37.8 °C, she re-massed the alcohol burner and found out the mass had gone down.

$\left(50.0\ mL \times \frac{1\ g}{1\ mL}\right) = 50.0\ g$

How many grams of propanol had been burned?

4) $\Delta H = -2120\ \frac{kJ}{mol}$

3) ?

1) $Q_{water} = mc\Delta T$

$= (50.0\ g)\left(4.19\ \frac{J}{g \cdot °C}\right)(37.8°C - 25.0°C)$

$= +2682\ J$

∴ 2) $Q_{sub} = -2682\ J$

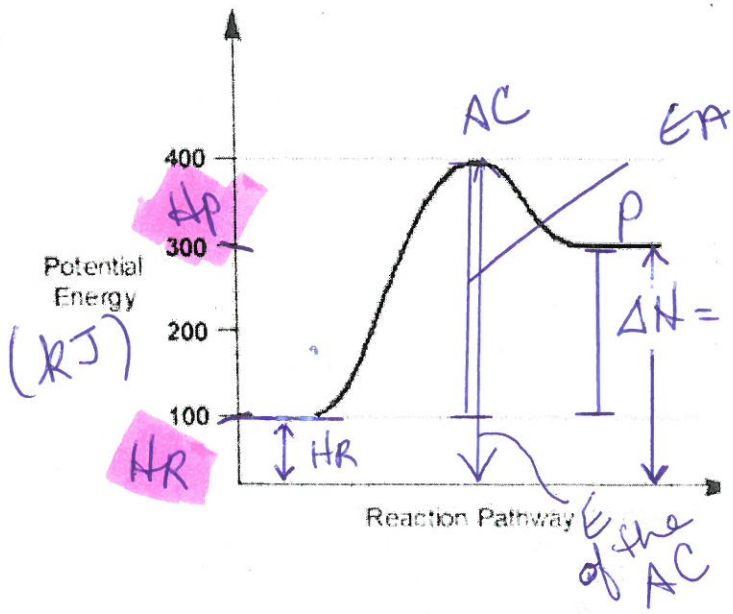
3) $n \cdot \Delta H = Q \cdot n$

$n = \frac{Q}{\Delta H} = \frac{-2682\ J \cdot \frac{1\ kJ}{10^3\ J}}{-2120\ \frac{kJ}{mol}}$

$1.265 \times 10^{-3}\ mol \times \frac{60\ g}{1\ mol} = 0.0759\ g$

Answer: 0.0759 g C_3H_7OH

10



i) Calculate the ΔH for the above reaction:

$\Delta H = +200 \frac{kJ}{mol}$

Answer: _____

ii) What does this answer indicate about the above reaction?

endo

because $H_R < H_P$