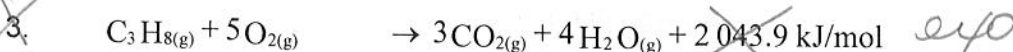
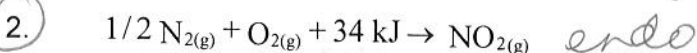
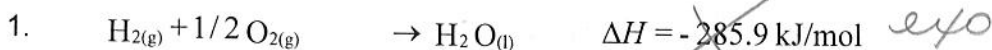
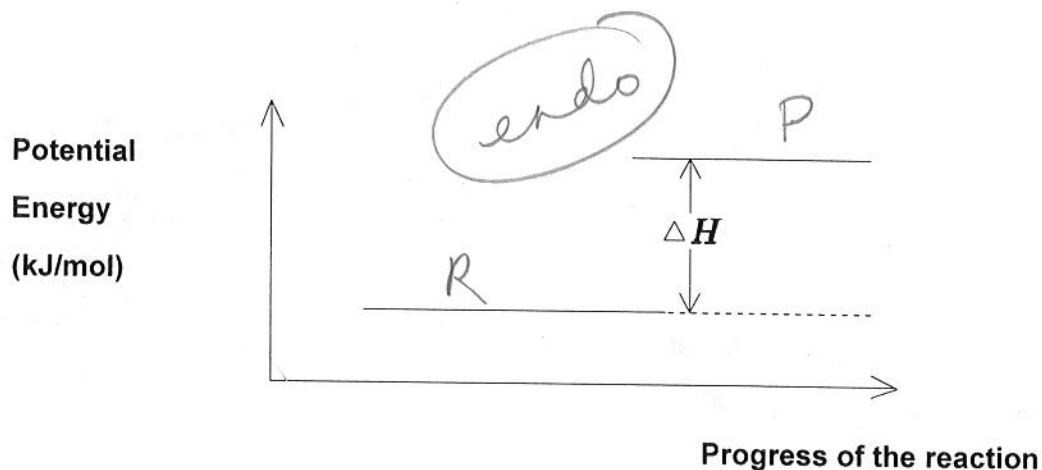


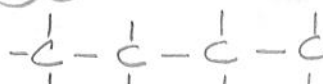
Which of the equations below could be represented by the potential energy diagram?



*4c single draw it!*

2 Using bond energies, what is the molar heat of butane combustion

Show all your work.



*T<sub>c</sub>      -m<sub>c</sub>*

$$C_H = \frac{4.19 \text{ J}}{g \cdot ^\circ C}$$

3 The temperature of water running from a tap is 10°C. 250 g of this water is poured into an aluminum saucepan which is at room temperature, 20°C. The mass of the saucepan is 520g and the specific heat of aluminum is 0.92 J/g°C.

*-m<sub>c</sub>      T<sub>H</sub>*

*m<sub>c</sub>*

Disregarding any heat loss to the surroundings i.e. the heat transfer is 100% efficient, what will be the final temperature of the water and the saucepan?

A) 17°C

B) 15°C

C) 14°C

D) 13°C

$$-Q = +Q$$

*exo = endo*

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

$$T_f = \frac{m_H C_H T_H + m_C C_C T_C}{m_H C_H + m_C C_C}$$

*Al(H) | W(C)*

*m<sub>H</sub> = 520g      m<sub>C</sub> = 250g*

*C<sub>H</sub> = 0.92 J/g°C      C<sub>C</sub> = 4.19 J/g°C*

*T<sub>H</sub> = 20°C      T<sub>C</sub> = 10°C*

*T<sub>f</sub> = ?*

4 A beaker contains 600 cm<sup>3</sup> of water at 50°C. If 200 cm<sup>3</sup> of water at 10°C is added, what will be the final temperature of the water after mixing?

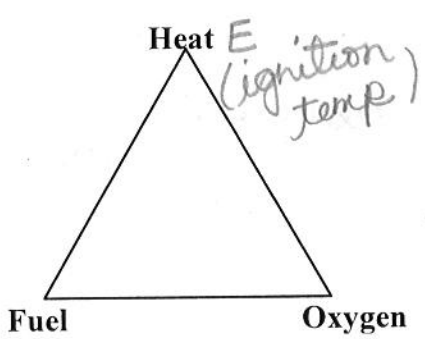
- A) 30°C  
 B) 35°C  
 C) 40°C  
 D) 45°C
- |  | W(H)                                    | W(C)                                    |
|--|---|---|
|  | $m_H = 600g$                            | $m_C = 200g$                            |
|  | $c_H = \frac{4.19 J}{g \cdot ^\circ C}$ | $c_C = \frac{4.19 J}{g \cdot ^\circ C}$ |
|  | $T_H = 50^\circ C$                      | $T_C = 10^\circ C$                      |
|  | $T_f = ?$                               |   |

water  $d = \frac{1g}{1mL}$

$$T_f = \frac{m_H T_H + m_C T_C}{m_H + m_C}$$

$$= \frac{(600g)(50^\circ C) + (200g)(10^\circ C)}{(600g + 200g)}$$

5



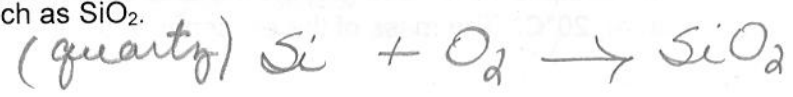
Any measure used to extinguish a fire usually tries to reduce or eliminate one or more of the three components of the fire triangle.

Two of the most common substances used to extinguish fires are water and carbon dioxide.

- A) Which component of the fire triangle does water reduce or eliminate? HE *specific heat capacity = absorb a lot of HE*
- B) Which component of the fire triangle does carbon dioxide reduce or eliminate? *CO<sub>2</sub> doesn't burn = Not a fuel + "blankets" fire = cuts off O<sub>2</sub>*

6

Oxygen and silicon are the most abundant elements present in the Earth's crust. However, the two elements are very rarely found in the atomic state (Si, O). Generally they tend to exist in the form of compounds, such as SiO<sub>2</sub>.



Which statement best explains the tendency of oxygen atoms and silicon atoms to combine, forming SiO<sub>2</sub>?

*formation of bonds = exo*

- A) The total amount of energy contained in one atom of silicon and two atoms of oxygen is **greater** than the energy contained in one molecule of SiO<sub>2</sub>.
- B) The total amount of energy contained in one atom of silicon and two atoms of oxygen is **less** than the energy contained in one molecule of SiO<sub>2</sub>.
- ~~C) The total amount of energy contained in one atom of silicon and two atoms of oxygen is **equal** to the energy contained in one molecule of SiO<sub>2</sub>.~~
- ~~D) Atoms of oxygen and silicon are radioactive.~~

3x the Energy needed for Zn to change its T!

7 The specific heat capacity of Pb(s) is 0.13 J/g°C and that of Zn(s) is 0.39 J/g°C. Given the same mass of solid lead (Pb) and zinc (Zn), which of the following statements is true?

- A) The amount of energy required to raise the temperature of Pb one degree Celsius is three times that of Zn.
- B) The amount of energy required to raise the temperature of Zn one degree Celsius is three times that of Pb.**
- C) The amount of energy removed from Pb that has cooled one degree Celsius is three times that of Zn.
- D) The same amount of energy is required to raise the temperature of Pb and Zn one degree Celsius.

8 Which of the following defines enthalpy? the energy contained in

- A) The energy absorbed or released during a chemical reaction = Q
- B) The change in potential energy that results from a chemical or physical change =  $\Delta H$
- C) The energy required to start a chemical reaction = activation energy
- D) The internal energy stored in a substance during its formation = H**

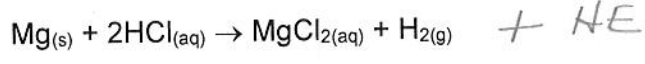
9 Which of the following changes are exothermic?

- 1. Logs burning on a camp-fire** = gives off HE = release of HE  $S \leftarrow L$
- 2. The action of an ice-salt mixture used to freeze ice cream** = exo  $S \rightarrow L = \text{melting} = \text{absorbing HE}$
- ~~3. Laundry that dries on a clothesline~~ =  $L \rightarrow G$  endo
- ~~4. A chicken roasting~~ = endo = absorbing HE from oven
- 5. A bolt of lightning** = release of light E + heat E

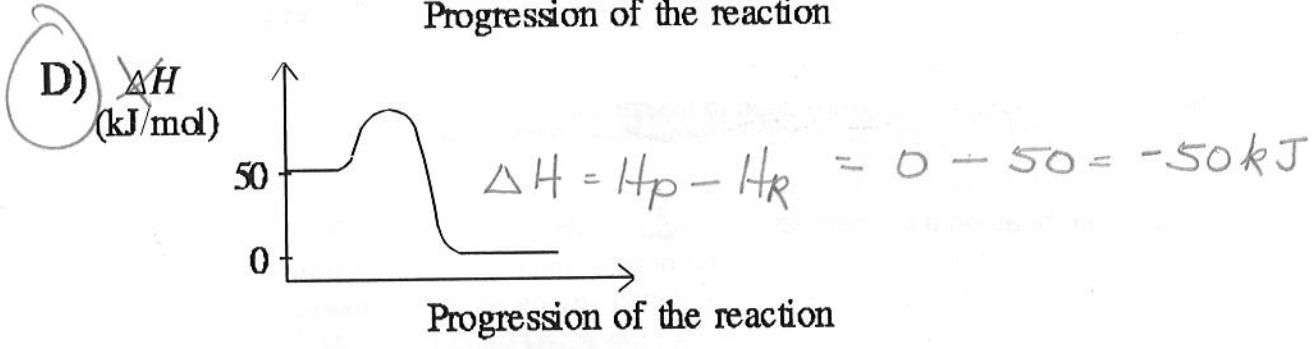
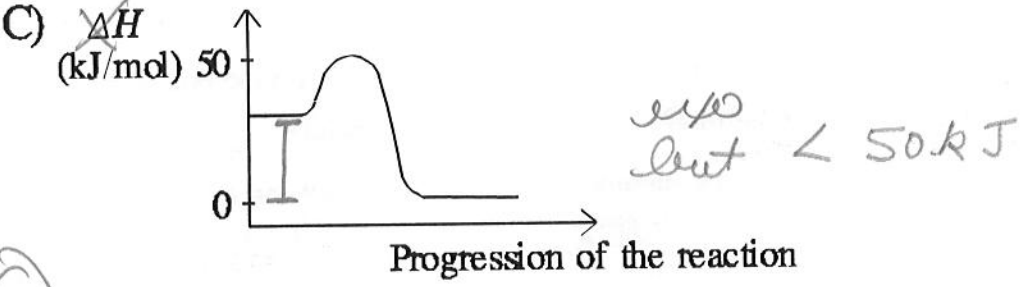
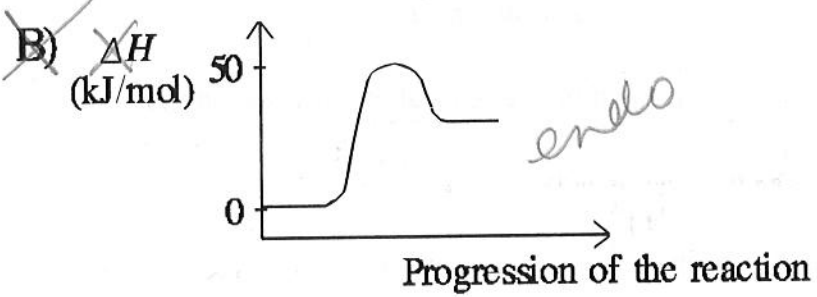
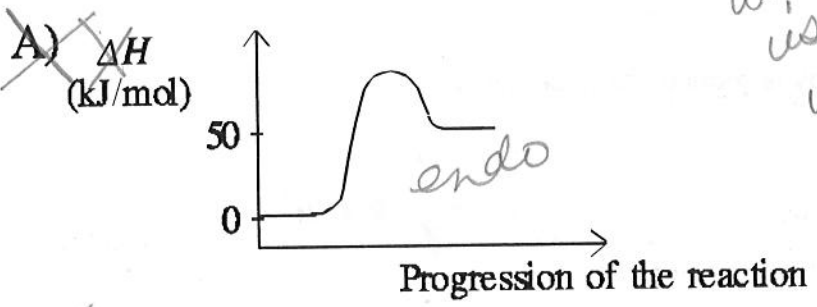
10 While performing an experiment, you observed that energy was released as a result of the chemical reaction between solid magnesium and hydrochloric acid. After a fixed amount of magnesium decomposed, 50 kJ of energy was released.

$\Delta H = -50 \text{ kJ}$        $\Delta H = H_p - H_r$

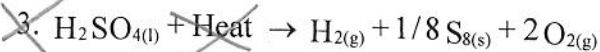
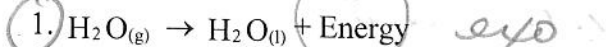
Which graph best represents the change in enthalpy?



what is wrong with the y-axis ???



11 Identify the exothermic reactions from the following.

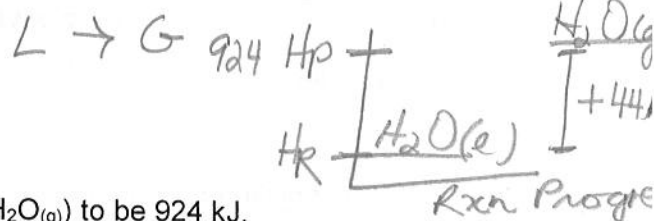


12 Following the evaporation of water, a student derives the following thermochemical equation.



*endo*

$\Delta H = H_p - H_r$



During his research, he finds the enthalpy for the products ( $\text{H}_2\text{O}_{(g)}$ ) to be 924 kJ.

Based on this information, calculate the enthalpy for the reactants ( $\text{H}_2\text{O}_{(l)}$ ).

$H_p$

$H_r = ?$

$\Delta H = H_p - H_r$   
 $H_r = H_p - \Delta H$   
 $= 924 - 44$

$H_r = 880 \text{ kJ}$

Sketch the graph and label every part!!!!

13 The following statements concern the enthalpy of substances :

1. When a chemical bond forms, the enthalpy decreases. *exo* ✓ releases  $E = \text{bond formation}$

2. When a chemical bond is broken, the enthalpy decreases. ✗

3. When a chemical bond is broken, the enthalpy increases. ✓

4. When a chemical bond forms, the enthalpy increases. ✗

Which of the statements are true?

A) 1 and 3

B) 1 and 4

C) 2 and 3

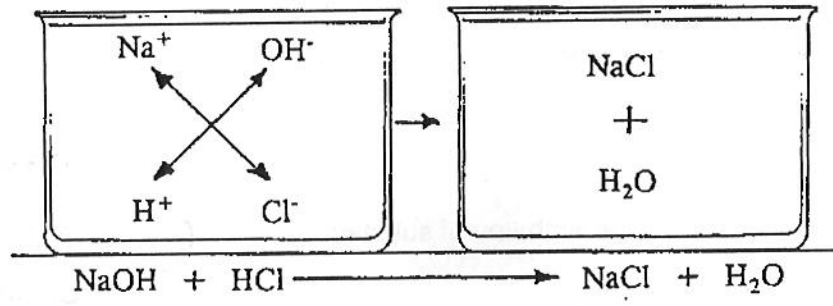
D) 2 and 4

14 Classify each of the following changes as exothermic or endothermic.

*electrolysis*

1. The condensation of water on a window  $L \leftarrow G$  *exo*
2. The decomposition of water into hydrogen and oxygen = + elec E = *endo*
3. The digestion of food in the stomach *exo*
4. The combustion of propane in a B.B.Q. = *exo*
5. The evaporation of maple-syrup sap  $L \rightarrow G$  = *endo*
6. The production of aluminum by the electrolysis of bauxite *endo*
7. Peeling a potato ?
8. The sublimation of a solid air-freshener  $S \rightarrow G$  *endo*
9. The production of food by a plant through photosynthesis + sunlight = *endo*
10. A lit candle = burning = *exo*

15 When an acidic solution comes in contact with a basic solution, the hydrogen ions combine with the hydroxide ions, producing water. Also, the metallic ions combine with the non-metallic ions, producing a salt, as in the diagram below :



*exo*  $\Delta H = -ve$

Given that the neutralizing reaction described above releases heat, which of the following statements is **correct**?

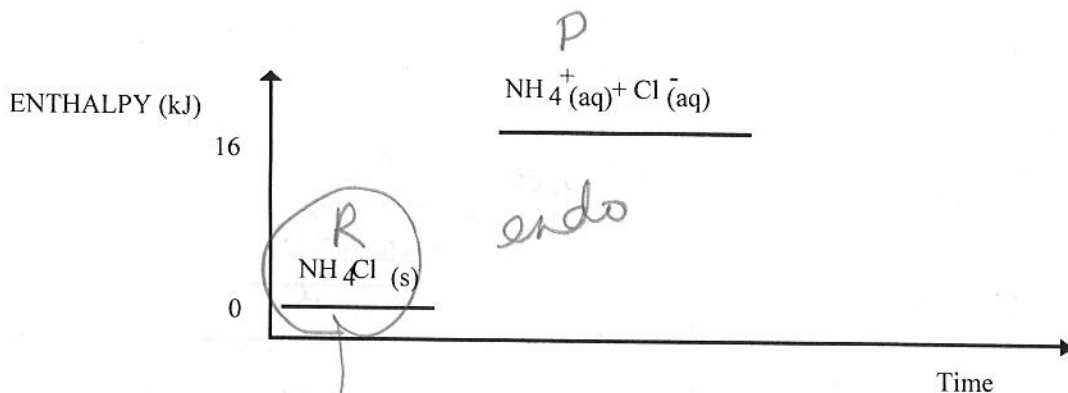
- (A) The enthalpy of the reactants is greater than the enthalpy of the products.
- B) The enthalpy of the reactants is less than the enthalpy of the products.
- C) The change in enthalpy ( $\Delta H$ ) is ~~positive~~.
- D) The reaction is endothermic.

*as soon as you see*

*enthalpy of R or P SKETCH!*



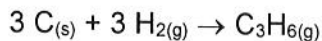
16 The graph below illustrates a variation in enthalpy ( $\Delta H$ ):



Which of the following equations best represents the graph?

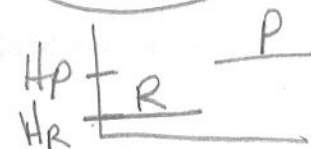
- A)  $\text{NH}_4^+(\text{aq}) + \text{Cl}^-(\text{aq}) \rightarrow \text{NH}_4\text{Cl}(\text{s}) + 16.2 \text{ kJ}$
- B)  $\text{NH}_4\text{Cl}(\text{s}) \rightarrow \text{NH}_4^+(\text{aq}) + \text{Cl}^-(\text{aq}) + 16.2 \text{ kJ}$  *exo*
- C)  $\text{NH}_4\text{Cl}(\text{s}) + 16.2 \text{ kJ} \rightarrow \text{NH}_4^+(\text{aq}) + \text{Cl}^-(\text{aq})$
- D)  $\text{NH}_4^+(\text{aq}) + \text{Cl}^-(\text{aq}) + 16.2 \text{ kJ} \rightarrow \text{NH}_4\text{Cl}(\text{s})$

17 Given the following reaction:



$\Delta H = 53.3 \text{ kJ}$  *endo*

Which of the following statements are correct?



- 1. The enthalpy of the reactants is greater than the enthalpy of the product.
- 2. This is an exothermic reaction.
- 3. This is an endothermic reaction.
- 4. The enthalpy of the reactants is less than the enthalpy of the product.

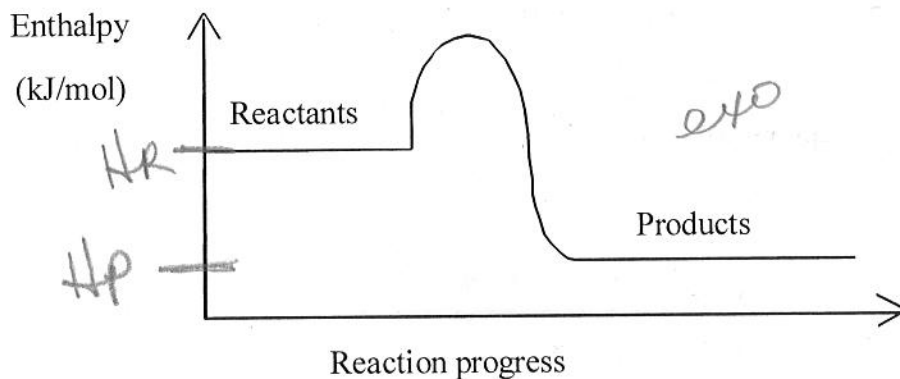
A) 1 and 2

C) 2 and 4

B) 1 and 3

D) 3 and 4

18 The following diagram shows the change in enthalpy of the substance involved in a chemical reaction.



Given this diagram, which of the following statements is TRUE?

- A) This is an endothermic reaction.
  - B) The enthalpy of the products is greater than that of the reactants.
  - C) The  $\Delta H$  for this reaction is negative.
  - D) This is a spontaneous reaction.
- ? you don't know this yet

19 A block of ice (pure  $H_2O$ ) is heated from  $-25^\circ C$  to  $-5^\circ C$  ( $P = 101 \text{ kPa}$ ).

Which type of energy changes the most as you heat the block of ice?

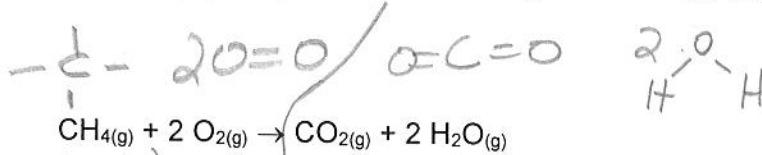
- 1- Translation kinetic energy
  - 2- Vibrational kinetic energy
  - 3- Rotational kinetic energy
- solids only vibrate  
liquids all 3  
gases all 3 but mainly translational



Using the table below, determine which graph represents the change in enthalpy for the following reaction.

*exo! combustion.*

$4(414) = 1656$



$2(498) = 996$

$2 \times 2 \times 464 = 1856$

$2 \times 2 \times 464 = 1856$

BER

Average enthalpy associated with breaking of certain bonds in kJ/mol

H - H	435	C = C	611	C ≡ C	837
C - H	414	C = O	741	C ≡ O	1070
C - O	351	O = O	498		
C - C	347				
O - O	138				
H - O	464				

2652

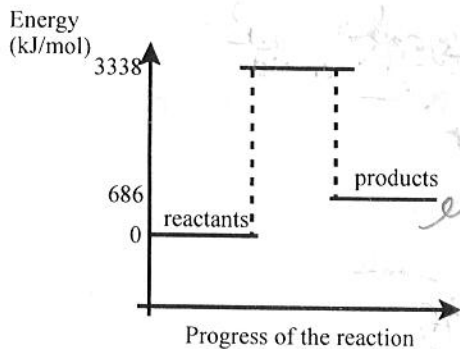
3338

BEP

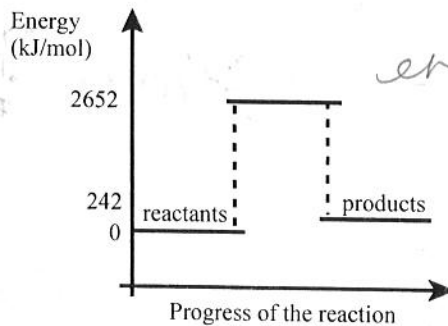
$\Delta H = \text{BER} - \text{BEP} = 2652 \text{ kJ} - 3338 \text{ kJ}$

$\Delta H = -686 \text{ kJ} = \text{exo}$

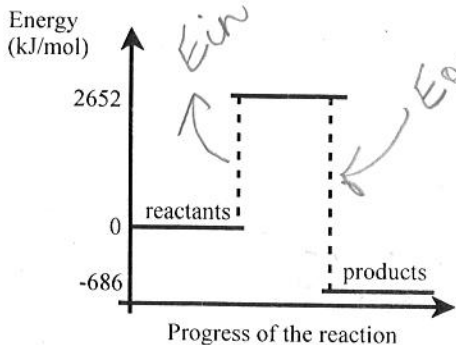
~~A)~~



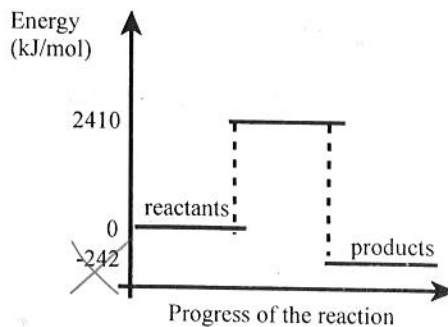
~~C)~~



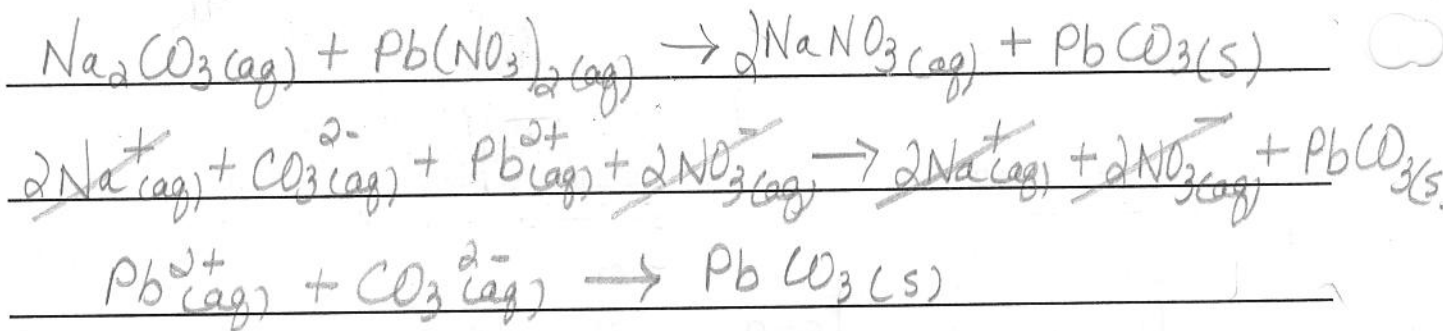
B)



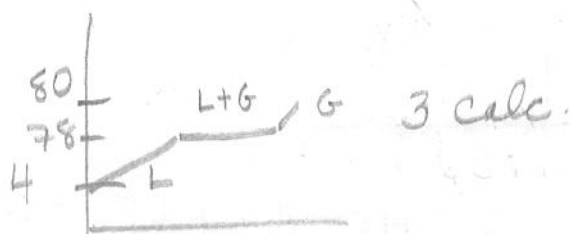
D)



- A) Write the net ionic equation for the reaction between a solution of sodium carbonate and a solution of lead nitrate. Make sure your 2 compounds are properly constructed!



- B) <sup>10.00g</sup> Ethyl alcohol is warmed from 4.0 °C to 80.0 °C. How much heat energy is involved? Sketch!!



$$1) Q = mc\Delta T = (10.00\text{g}) \left( \frac{2.46\text{J}}{\text{g}\cdot\text{C}} \right) (78.0^\circ\text{C} - 4.0^\circ\text{C}) = 1820\text{J}$$

$$2) Q = n\Delta H = 10.00\text{g} \times \frac{1\text{mol}}{46\text{g}} \times \frac{+38.5\text{kJ}}{1\text{mol}} = 8.382\text{kJ}$$

$$3) Q = mc\Delta T = (10.00\text{g}) \left( \frac{1.42\text{J}}{\text{g}\cdot\text{C}} \right) (80.0^\circ\text{C} - 78.0^\circ\text{C}) = 28.4\text{J}$$

$$4) Q_T = 10230.4\text{J} = \boxed{10230\text{J}}$$

- C) Dissociate the following electrolytes:

