

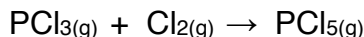
## Enthalpy Change

### Apprentice Difficulty Level

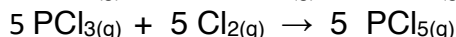
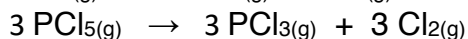
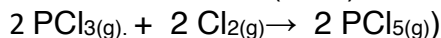
#### Question Group 1

##### Question 1

The  $\Delta H$  for the following reaction is -88 kJ.

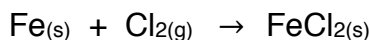


Determine the  $\Delta H$  (in kJ) for the related reactions below. (Give attention to the +/- sign).

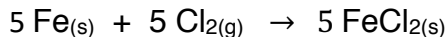
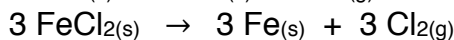
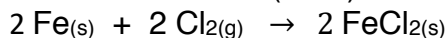


##### Question 2

The  $\Delta H$  for the following reaction is -342 kJ.

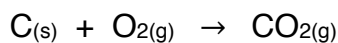


Determine the  $\Delta H$  (in kJ) for the related reactions below. (Give attention to the +/- sign).

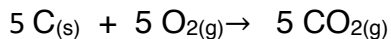
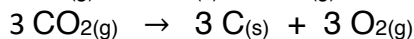
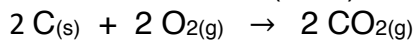


##### Question 3

The  $\Delta H$  for the following reaction is -394 kJ.



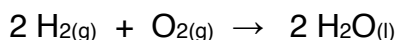
Determine the  $\Delta H$  (in kJ) for the related reactions below. (Give attention to the +/- sign).



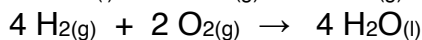
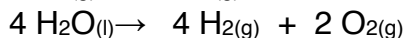
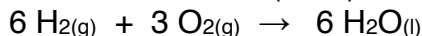
#### Question Group 2

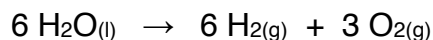
##### Question 4

The  $\Delta H$  for the following reaction is -570 kJ.



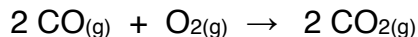
Determine the  $\Delta H$  (in kJ) for the related reactions below. (Give attention to the +/- sign).



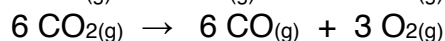
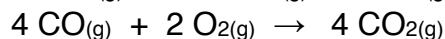
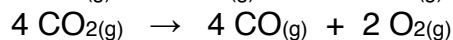
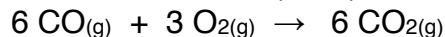


### Question 5

The  $\Delta H$  for the following reaction is -565 kJ.

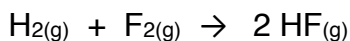


Determine the  $\Delta H$  (in kJ) for the related reactions below. (Give attention to the +/- sign).

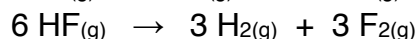
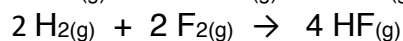
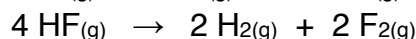
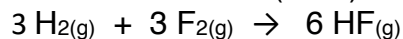


### Question 6

The  $\Delta H$  for the following reaction is -537 kJ.



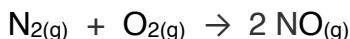
Determine the  $\Delta H$  (in kJ) for the related reactions below. (Give attention to the +/- sign).



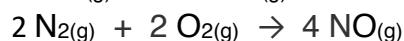
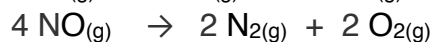
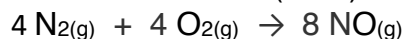
### Question Group 3

#### Question 7

The  $\Delta H$  for the following reaction is 180 kJ.

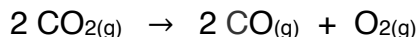


Determine the  $\Delta H$  (in kJ) for the related reactions below. (Give attention to the +/- sign).

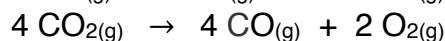
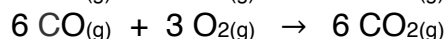
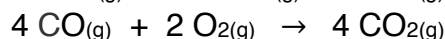


#### Question 8

The  $\Delta H$  for the following reaction is 566 kJ.

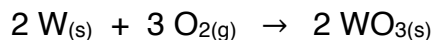


Determine the  $\Delta H$  (in kJ) for the related reactions below. (Give attention to the +/- sign).

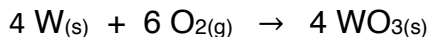
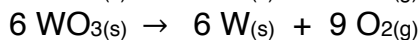
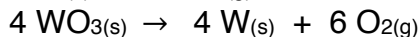
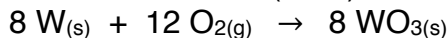


**Question 9**

The  $\Delta H$  for the following reaction is -1686 kJ.



Determine the  $\Delta H$  (in kJ) for the related reactions below. (Give attention to the +/- sign).

**Question Group 4****Question 10**

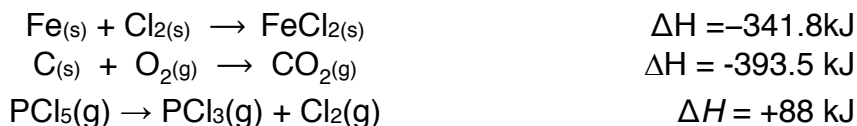
The  $\Delta H$  values for three chemical equations is shown. Adjust the equation so that the energy term (kJ) is located in the equation. Locate it on either the reactant or the product side.

**Question 11**

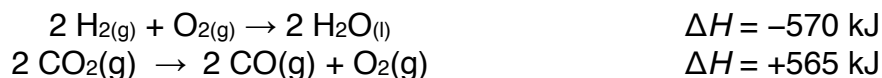
The  $\Delta H$  values for three chemical equations is shown. Adjust the equation so that the energy term (kJ) is located in the equation. Locate it on either the reactant or the product side.

**Question 12**

The  $\Delta H$  values for three chemical equations is shown. Adjust the equation so that the energy term (kJ) is located in the equation. Locate it on either the reactant or the product side.

**Question Group 5****Question 13**

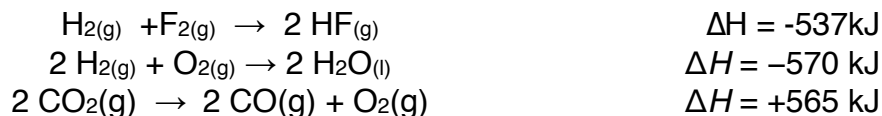
The  $\Delta H$  values for three chemical equations is shown. Adjust the equation so that the energy term (kJ) is located in the equation. Locate it on either the reactant or the product side.





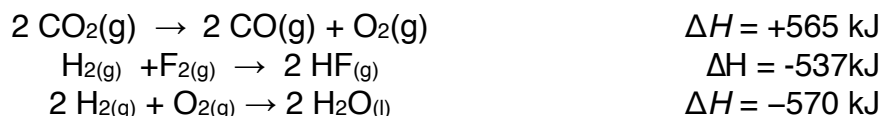
#### Question 14

The  $\Delta H$  values for three chemical equations is shown. Adjust the equation so that the energy term (kJ) is located in the equation. Locate it on either the reactant or the product side.



#### Question 15

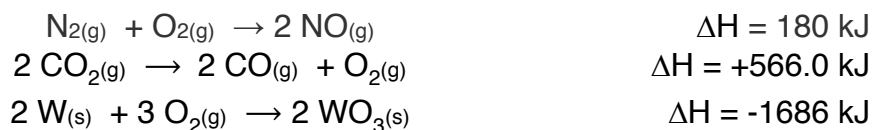
The  $\Delta H$  values for three chemical equations is shown. Adjust the equation so that the energy term (kJ) is located in the equation. Locate it on either the reactant or the product side.



#### Question Group 6

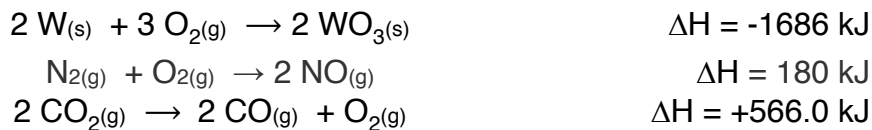
##### Question 16

The  $\Delta H$  values for three chemical equations is shown. Adjust the equation so that the energy term (kJ) is located in the equation. Locate it on either the reactant or the product side.



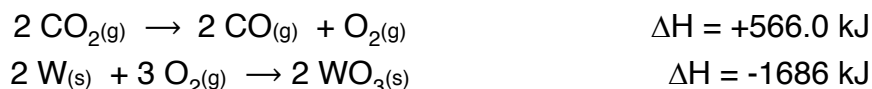
##### Question 17

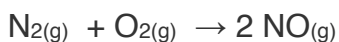
The  $\Delta H$  values for three chemical equations is shown. Adjust the equation so that the energy term (kJ) is located in the equation. Locate it on either the reactant or the product side.



##### Question 18

The  $\Delta H$  values for three chemical equations is shown. Adjust the equation so that the energy term (kJ) is located in the equation. Locate it on either the reactant or the product side.





$$\Delta H = 180 \text{ kJ}$$

## Master Difficulty Level

### Question Group 7

#### Question 19

Students are studying the reaction:  $2 \text{H}_{2(\text{g})} + \text{O}_{2(\text{g})} \rightarrow 2 \text{H}_2\text{O}_{(\text{l})}$

Their calorimetry methods indicate that 61 kJ of heat is released to the surroundings when 0.250 mol of  $\text{H}_2$  reacts. Use their data to determine the enthalpy change of the three given reactions.



#### Question 20

Students are studying the reaction:  $2 \text{H}_{2(\text{g})} + \text{O}_{2(\text{g})} \rightarrow 2 \text{H}_2\text{O}_{(\text{l})}$

Their calorimetry methods indicate that 121 kJ of heat is released to the surroundings when 0.500 mol of  $\text{H}_2$  reacts. Use their data to determine the enthalpy change of the three given reactions.



#### Question 21

Students are studying the reaction:  $2 \text{H}_{2(\text{g})} + \text{O}_{2(\text{g})} \rightarrow 2 \text{H}_2\text{O}_{(\text{l})}$

Their calorimetry methods indicate that 968 kJ of heat is released to the surroundings when 2.00 mol of  $\text{O}_2$  reacts. Use their data to determine the enthalpy change of the three given reactions.

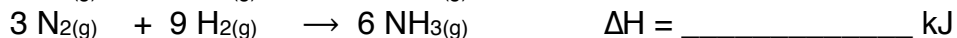
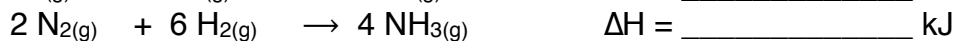


### Question Group 8

#### Question 22

Students are studying the reaction:  $\text{N}_{2(\text{g})} + 3 \text{H}_{2(\text{g})} \rightarrow 2 \text{NH}_{3(\text{g})}$

Their calorimetry methods indicate that 23 kJ of heat is released to the surroundings when 0.250 mol of  $\text{N}_2$  reacts. Use their data to determine the enthalpy change of the three given reactions.

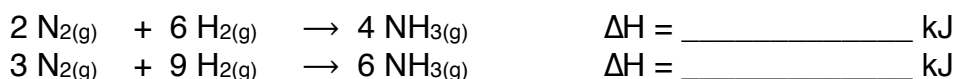


#### Question 23

Students are studying the reaction:  $\text{N}_{2(\text{g})} + 3 \text{H}_{2(\text{g})} \rightarrow 2 \text{NH}_{3(\text{g})}$

Their calorimetry methods indicate that 46 kJ of heat is released to the surroundings when 0.500 mol of  $\text{N}_2$  reacts. Use their data to determine the enthalpy change of the three given reactions.

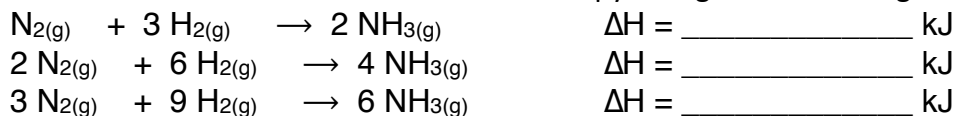




### Question 24

Students are studying the reaction:  $\text{N}_{2(\text{g})} + 3 \text{ H}_{2(\text{g})} \rightarrow 2 \text{ NH}_{3(\text{g})}$

Their calorimetry methods indicate that 46 kJ of heat is released to the surroundings when 1.50 mol of  $\text{H}_2$  reacts. Use their data to determine the enthalpy change of the three given reactions.

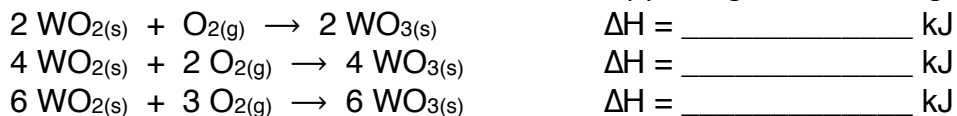


### Question Group 9

#### Question 25

Students are studying the reaction:  $2 \text{ WO}_{2(\text{s})} + \text{O}_{2(\text{g})} \rightarrow 2 \text{ WO}_{3(\text{s})}$

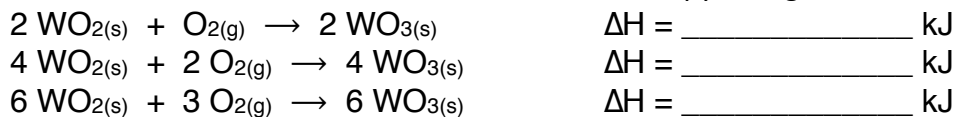
Their calorimetry methods indicate that 63 kJ of heat is released to the surroundings when 0.250 mol of  $\text{WO}_2$  reacts. Use their data to determine the enthalpy change of the three given reactions.



#### Question 26

Students are studying the reaction:  $2 \text{ WO}_{2(\text{s})} + \text{O}_{2(\text{g})} \rightarrow 2 \text{ WO}_{3(\text{s})}$

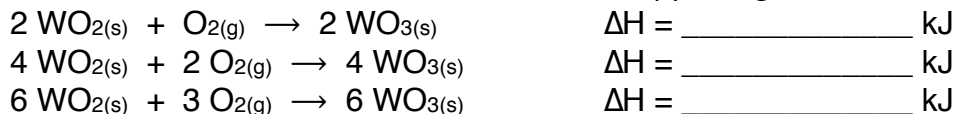
Their calorimetry methods indicate that 126 kJ of heat is released to the surroundings when 0.500 mol of  $\text{WO}_2$  reacts. Use their data to determine the enthalpy change of the three given reactions.



#### Question 27

Students are studying the reaction:  $2 \text{ WO}_{2(\text{s})} + \text{O}_{2(\text{g})} \rightarrow 2 \text{ WO}_{3(\text{s})}$

Their calorimetry methods indicate that 1010 kJ of heat is released to the surroundings when 2.00 mol of  $\text{O}_2$  reacts. Use their data to determine the enthalpy change of the three given reactions.

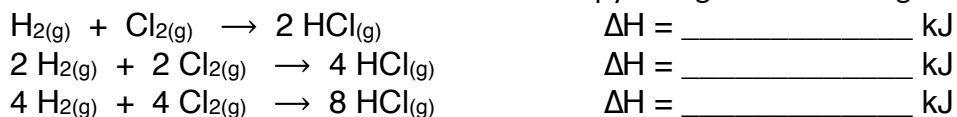


### Question Group 10

#### Question 28

Students are studying the reaction:  $\text{H}_{2(\text{g})} + \text{Cl}_{2(\text{g})} \rightarrow 2 \text{ HCl}_{(\text{g})}$

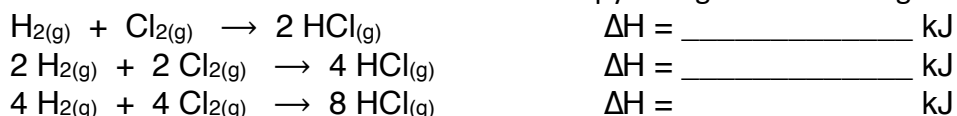
Their calorimetry methods indicate that 92 kJ of heat is released to the surroundings when 0.50 mol of  $\text{H}_2$  reacts. Use their data to determine the enthalpy change of the three given reactions.



### Question 29

Students are studying the reaction:  $\text{H}_{2(g)} + \text{Cl}_{2(g)} \rightarrow 2 \text{HCl}_{(g)}$

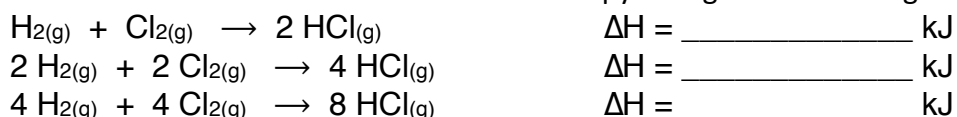
Their calorimetry methods indicate that 46 kJ of heat is released to the surroundings when 0.250 mol of  $\text{H}_2$  reacts. Use their data to determine the enthalpy change of the three given reactions.



### Question 30

Students are studying the reaction:  $\text{H}_{2(g)} + \text{Cl}_{2(g)} \rightarrow 2 \text{HCl}_{(g)}$

Their calorimetry methods indicate that 368 kJ of heat is released to the surroundings when 2.00 mol of  $\text{Cl}_2$  reacts. Use their data to determine the enthalpy change of the three given reactions.

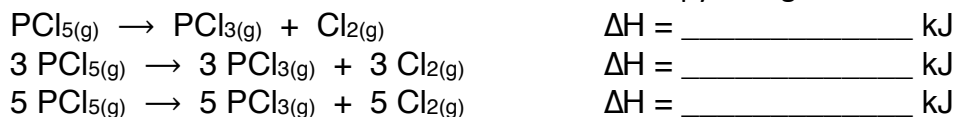


### Question Group 11

#### Question 31

Students are studying the reaction:  $\text{PCl}_{5(g)} \rightarrow \text{PCl}_{3(g)} + \text{Cl}_{2(g)}$

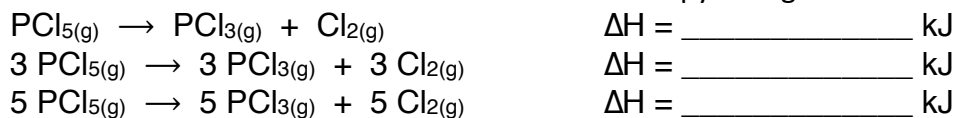
Their calorimetry methods indicate that 22 kJ of heat is absorbed from the surroundings when 0.250 mol of  $\text{PCl}_5$  reacts. Use their data to determine the enthalpy change of the three given reactions.



#### Question 32

Students are studying the reaction:  $\text{PCl}_{5(g)} \rightarrow \text{PCl}_{3(g)} + \text{Cl}_{2(g)}$

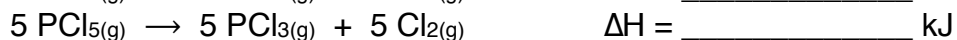
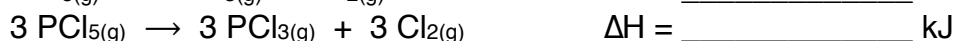
Their calorimetry methods indicate that 44 kJ of heat is absorbed from the surroundings when 0.500 mol of  $\text{PCl}_5$  reacts. Use their data to determine the enthalpy change of the three given reactions.



#### Question 33

Students are studying the reaction:  $\text{PCl}_{5(g)} \rightarrow \text{PCl}_{3(g)} + \text{Cl}_{2(g)}$

Their calorimetry methods indicate that 176 kJ of heat is absorbed from the surroundings when 2.00 mol of  $\text{PCl}_5$  reacts. Use their data to determine the enthalpy change of the three given reactions.

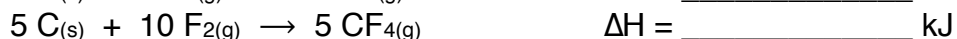


## Question Group 12

### Question 34

Students are studying the reaction:  $\text{C}_{(s)} + 2 \text{ F}_{2(g)} \rightarrow \text{CF}_{4(g)}$

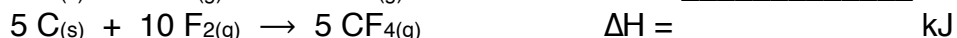
Their calorimetry methods indicate that 340 kJ of heat is released to the surroundings when 0.500 mol of C reacts. Use their data to determine the enthalpy change of the three given reactions.



### Question 35

Students are studying the reaction:  $\text{C}_{(s)} + 2 \text{ F}_{2(g)} \rightarrow \text{CF}_{4(g)}$

Their calorimetry methods indicate that 170 kJ of heat is released to the surroundings when 0.500 mol of  $\text{F}_2$  reacts. Use their data to determine the enthalpy change of the three given reactions.



### Question 36

Students are studying the reaction:  $\text{C}_{(s)} + 2 \text{ F}_{2(g)} \rightarrow \text{CF}_{4(g)}$

Their calorimetry methods indicate that 1360 kJ of heat is released to the surroundings when 2.00 mol of C reacts. Use their data to determine the enthalpy change of the three given reactions.





## Wizard Difficulty Level

### Question Group 13

#### Question 37

Students are studying the reaction:  $\text{N}_{2(g)} + 3 \text{H}_{2(g)} \rightarrow 2 \text{NH}_{3(g)}$

Their calorimetry methods indicate that 46.0 kJ of heat is released to the surroundings when 14.0 grams of  $\text{N}_2$  reacts. Use their data to determine the moles of reactant and the enthalpy change (in kJ) of the given reaction. Include the proper +/- sign on  $\Delta H$ .

moles of reactant:- \_\_\_\_\_

$\Delta H =$  \_\_\_\_\_ kJ

#### Question 38

Students are studying the reaction:  $\text{N}_{2(g)} + 3 \text{H}_{2(g)} \rightarrow 2 \text{NH}_{3(g)}$

Their calorimetry methods indicate that 46.0 kJ of heat is released to the surroundings when 3.00 grams of  $\text{H}_2$  reacts. Use their data to determine the moles of reactant and the enthalpy change (in kJ) of the given reaction. Include the proper +/- sign on  $\Delta H$ .

moles of reactant:- \_\_\_\_\_

$\Delta H =$  \_\_\_\_\_ kJ

#### Question 39

Students are studying the reaction:  $\text{N}_{2(g)} + 3 \text{H}_{2(g)} \rightarrow 2 \text{NH}_{3(g)}$

Their calorimetry methods indicate that 184 kJ of heat is released to the surroundings when 12.0 grams of  $\text{N}_2$  reacts. Use their data to determine the moles of reactant and the enthalpy change (in kJ) of the given reaction. Include the proper +/- sign on  $\Delta H$ .

moles of reactant:- \_\_\_\_\_

$\Delta H =$  \_\_\_\_\_ kJ

### Question Group 14

#### Question 40

Students are studying the reaction:  $\text{C}_{(s)} + 2 \text{F}_{2(g)} \rightarrow \text{CF}_{4(g)}$

Their calorimetry methods indicate that 340 kJ of heat is released to the surroundings when 0.500 grams of C reacts. Use their data to determine the moles of reactant and the enthalpy change (in kJ) of the given reaction. Include the proper +/- sign on  $\Delta H$ .

moles of reactant:- \_\_\_\_\_

$\Delta H =$  \_\_\_\_\_ kJ

**Question 41**

Students are studying the reaction:  $\text{C}_{(s)} + 2 \text{F}_{2(g)} \rightarrow \text{CF}_{4(g)}$

Their calorimetry methods indicate that 170 kJ of heat is released to the surroundings when 0.500 grams of  $\text{F}_2$  reacts. Use their data to determine the moles of reactant and the enthalpy change (in kJ) of the given reaction. Include the proper +/- sign on  $\Delta H$ .

moles of reactant:- \_\_\_\_\_

$\Delta H =$  \_\_\_\_\_ kJ

**Question 42**

Students are studying the reaction:  $\text{C}_{(s)} + 2 \text{F}_{2(g)} \rightarrow \text{CF}_{4(g)}$

Their calorimetry methods indicate that 340 kJ of heat is released to the surroundings when 1.00 grams of  $\text{F}_2$  reacts. Use their data to determine the moles of reactant and the enthalpy change (in kJ) of the given reaction. Include the proper +/- sign on  $\Delta H$ .

moles of reactant:- \_\_\_\_\_

$\Delta H =$  \_\_\_\_\_ kJ

**Question Group 15****Question 43**

Students are studying the reaction:  $\text{C}_{(s)} + \text{O}_{2(g)} \rightarrow \text{CO}_{2(g)}$

Their calorimetry methods indicate that 197 kJ of heat is released to the surroundings when 6.00 grams of C reacts. Use their data to determine the moles of reactant and the enthalpy change (in kJ) of the given reaction. Include the proper +/- sign on  $\Delta H$ .

moles of reactant:- \_\_\_\_\_

$\Delta H =$  \_\_\_\_\_ kJ

**Question 44**

Students are studying the reaction:  $\text{C}_{(s)} + \text{O}_{2(g)} \rightarrow \text{CO}_{2(g)}$

Their calorimetry methods indicate that 98.5 kJ of heat is released to the surroundings when 8.00 grams of  $\text{O}_2$  reacts. Use their data to determine the moles of reactant and the enthalpy change (in kJ) of the given reaction. Include the proper +/- sign on  $\Delta H$ .

moles of reactant:- \_\_\_\_\_

$\Delta H =$  \_\_\_\_\_ kJ

**Question 45**

Students are studying the reaction:  $\text{C}_{(s)} + \text{O}_{2(g)} \rightarrow \text{CO}_{2(g)}$

Their calorimetry methods indicate that 197 kJ of heat is released to the surroundings when 16.0 grams of  $\text{O}_2$  reacts. Use their data to determine the moles of reactant and the enthalpy change (in kJ) of the given reaction. Include the proper +/- sign on  $\Delta H$ .

moles of reactant:- \_\_\_\_\_

$\Delta H =$  \_\_\_\_\_ kJ