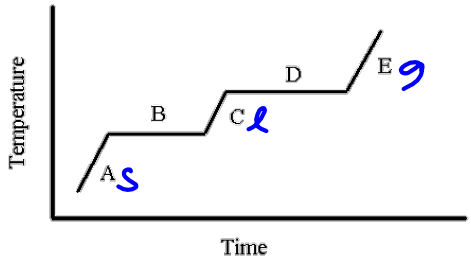
Practice

Use the graph to answer the following questions:



1. What letter represents the melting point?

B

2. What letter represents the substance in the gaseous phase?

E

3. Write the equation for the process happening as you move from C - B -A.

$H_2O(\ell) \rightarrow H_2O(s) + \text{energy}$

May 17-10:44 AM

Practice

Complete the chart below:

Relationship	Pressure	Volume	Temperature	# of moles
direct	increases	constant	↑	constant
indirect	increases	↓	constant	constant
direct	constant	↑	increases	constant
direct	↑	constant	constant	increases

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Practice

What will have to happen to the temperature of a sample of methane if 1000 mL at 98.6 kPa and 25°C is given a pressure of 108.5 kPa and a volume of 900 mL?

$P_1 = 98.6\ kPa$
$V_1 = 1000\ mL$
$T_1 = 25°C + 273 = 298K$
$P_2 = 108.5\ kPa$
$V_2 = 900\ mL$
$T_2 = ?\ K$

$$\frac{P_1V_1}{T_1} = \frac{P_2V_2}{T_2}$$

$$\frac{98.6 \cdot 1000}{298} = \frac{108.5 \cdot 900}{T_2}$$

$$= 295K$$

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Practice

How many moles of gas are in a 30.0 liter scuba canister if the temperature of the canister is 300.0 K and the pressure is 200.0 atmospheres?

$P = 200.0\ atm$
$V = 30.0\ L$
$n = ?\ mol$
$R = 0.0821\ \frac{L \cdot atm}{mol \cdot K}$
$T = 300.\ K$

$200.0 \cdot 30.0 = n \cdot 0.0821 \cdot 300.0$

$$= 2.44\ mol$$

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Practice

If excess HCl is dripped onto 15.0 g of $KMnO_4$, what volume of Cl_2 will be produced at 15°C and 0.959 atm?

$2\ KMnO_4(aq) + 16\ HCl(aq) \rightarrow 2\ KCl(aq) + 2\ MnCl_2(aq) + 8\ H_2O(l) + 5\ Cl_2(g)$

15.0g

$15.0\text{g } KMnO_4 \times \frac{1\text{ mol } KMnO_4}{158\text{g } KMnO_4} \times \frac{5\text{ mol } Cl_2}{2\text{ mol } KMnO_4} = 0.237\text{mol } Cl_2$

P=.959atm
V=? L
n=0.237mol Cl_2
R=0.0821 $\frac{L \cdot atm}{mol \cdot K}$
T=15°C +273=288K

$.959 \cdot V = 0.237 \cdot 0.0821 \cdot 288$

$= 5.85L\ Cl_2$

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Practice

How many liters does 3.75 mol of nitrogen gas occupy at STP?

$3.75\text{mol } N_2 \times \frac{22.4\text{ L}}{1\text{ mol } N_2} = 84\text{L}$

May 17-10:46 AM

REVIEW:

1. A quantity of water is heated from 25.0°C to 36.4°C by absorbing 325 J of heat energy. What is the mass of the water?

$\Delta T = 11.4°C$ $c = 4.184 J/g·°C$ $325 = m \cdot 4.184 \cdot 11.4$

$q = 325J$ $q = mc\Delta T$ $= 6.81g$

$m = ?g$

2. If the total air pressure in a furnace is 0.99 atm, and the partial pressure of carbon dioxide is 0.05 atm, and the partial pressure of hydrogen sulfide is 0.02 atm, what is the partial pressure of the remaining air?

$P_{CO_2} + P_{H_2S} + P_{air} = 0.99 atm$

$0.05 + 0.02 + P_{air} = .99 atm$

$P_{air} = .92 atm$

May 17-10:51 AM

REVIEW:

1. Estimate the amount of energy absorbed/released for the reaction below using bond energies:

H-H Cl-Cl H-Cl H-Cl

$H_2 (g) + Cl_2 (g) \rightarrow 2 HCl (g)$

(+) (−)

H–H	436 kJ/mol	C–H	413 kJ/mol	C=C	614 kJ/mol
H–Cl	431 kJ/mol	C–C	348 kJ/mol	C≡C	839 kJ/mol
H–F	567 kJ/mol	C–N	293 kJ/mol	C=O	799 kJ/mol
N–H	391 kJ/mol	C–O	358 kJ/mol	O=O	495 kJ/mol
N–O	201 kJ/mol	C–F	485 kJ/mol	C≡O	1072 kJ/mol
O–H	463 kJ/mol	C–Cl	328 kJ/mol	C=N	615 kJ/mol
O–O	146 kJ/mol	C–S	259 kJ/mol	N=N	418 kJ/mol
F–F	155 kJ/mol	Cl–Cl	242 kJ/mol	N≡N	941 kJ/mol
				C≡N	891 kJ/mol

$(436 kJ) + 242 kJ + 2(431) = -184 kJ$

May 17-10:51 AM

REVIEW:

releasing energy — absorbing energy

1. Determine if the following are exothermic or endothermic, and (if applicable) if ΔH and ΔS are positive or negative.
   - > $+\Delta H$ endo
   - > $-\Delta H$ exo
   - > $H_2O(l) \rightarrow H_2O(g)$ endo $+\Delta H$ $+\Delta S$
   - > $H_2O(l) \rightarrow H_2O(s)$ exo $-\Delta H$ $-\Delta S$
   - > $2H_2O_2(l) \rightarrow 2H_2O(l) + O_2(g) + 200kJ$ exo $-\Delta H$ $+\Delta S$
   - > $2\ N_2O_5\ (g) + 110\ kJ \rightarrow 4NO_2(g) + O_2(g)$ endo $+\Delta H$ $+\Delta S$

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REVIEW:

1. Calculate the ΔH_{rxn} for the following equation.
   - > $NaOH(s) + HCl(g) \text{----->} NaCl(s) + H_2O(g)$

$$[(-411.2)+(-241.8)]-[(-425.8)+(-92.3)]$$

$$= -134.9\ kJ$$

2. If the standard enthalpy of formation of $H_2SO_4(l)$ is -812.2 kJ/mol, calculate the amount of energy released when 1000 g of sulfur trioxide reacts according to the equation: **$SO_3(g) + H_2O(l) \rightarrow H_2SO_4(l)$** $\Delta H = -812.2$

$$1000g\ SO_3 \times \frac{1\ mol\ SO_3}{80g\ SO_3} \times \frac{-812.2kJ}{1\ mol\ SO_3} = 10153kJ$$

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REVIEW:

1. Calculate the free energy for this reaction at 298 K (room temperature). Determine if the reaction is spontaneous.

$O_2 + O \rightarrow O_3$

$\Delta H = -106.5kJ$

$\Delta S = -127.4\ J/K$

$\Delta G = \Delta H - T\Delta S$

$\Delta G = -106.5kJ - 298K \cdot -.1274$

$= -68.5$

spont.

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