

**CHEM1612 (Pharmacy) - November 2013****These answers have not been checked.****2013-N-2**

- A perfect pure crystal at absolute zero (0 K) has zero entropy.  
The pressure that needs to be applied to prevent water from flowing across a semipermeable membrane due to osmosis.  
A species that can form a bond by donating a lone pair of electrons, *e.g.* H<sub>2</sub>O.
- At 0 °C, any heat transferred into or out of the system is either causing the ice to melt or the water to freeze – there is no change in the temperature. Specific heat capacity is defined as  $c = q/m\Delta T$ . As there is no change in temperature,  $\Delta T = 0$  and  $c$  is undefined.

**2013-N-3**

- +0.16 kJ mol<sup>-1</sup>
- $1 \times 10^{-17}$  M

**2013-N-4**

- 0.201 mol  
MM = 5.21 g / 0.201 mol = 25.9 g mol<sup>-1</sup>  
C<sub>2</sub>H<sub>2</sub>  
CaC<sub>2</sub>(s) + 2H<sub>2</sub>O(l) → Ca<sup>2+</sup>(aq) + 2OH<sup>-</sup>(aq) + C<sub>2</sub>H<sub>2</sub>(g)

**2013-N-5**

- $Q = 64$        $Q > K_c$ , therefore the reaction will shift to the left until  $Q = K_c$ .  
Initial [CH<sub>4</sub>] = 1.00 mol / 0.25 L = 4.00 M. As final [CH<sub>4</sub>] = 5.56 M, the change in [CH<sub>4</sub>] = 5.56 – 4.00 = 1.56 M. Set up an “ICE” table.  
Increase in [H<sub>2</sub>S] = 2 × 1.56 M. Decrease in [CS<sub>2</sub>] = 1.56 M.  
Decrease in [H<sub>2</sub>] = 4 × 1.56 M.

	CH <sub>4</sub> (g)	+ 2H <sub>2</sub> S(g)	↔	CS <sub>2</sub> (g)	+ 4H <sub>2</sub> (g)
Initial	4.00	8.00		4.00	8.00
Change	+1.56	+3.12		-1.56	-6.24
Equilibrium	5.56	11.12		2.44	1.76

$$Q = \frac{[\text{CS}_2][\text{H}_2]^4}{[\text{CH}_4][\text{H}_2\text{S}]^2} = \frac{(2.44)(1.76)^4}{(5.56)(11.12)^2} = 0.0336 \approx K_c$$

Hence system at equilibrium

**2013-N-6**

- $101 \text{ J K}^{-1} \text{ mol}^{-1}$   
 $17,000 \text{ g mol}^{-1}$

**2013-N-7**

- 530
- $-136 \text{ J K}^{-1} \text{ mol}^{-1}$

**2013-N-8**

- $3.6 \times 10^5$   
 $57 \text{ kJ mol}^{-1}$

**2013-N-9**

- ${}^0_1e$                       positron emission  
 ${}^4_2\text{He}$                        $\alpha$  decay  
 ${}^0_{-1}e$                       electron capture
- 0.016 mol

**2013-N-10**

• +II	8	$\uparrow\downarrow$	$\uparrow\downarrow$	$\uparrow\downarrow$	$\uparrow\downarrow$	
+VII	0					
+II	7	$\uparrow\downarrow$	$\uparrow\downarrow$	$\uparrow$	$\uparrow$	$\uparrow$
+III	3	$\uparrow$	$\uparrow$	$\uparrow$		

Paramagnetic:  $(\text{NH}_4)_2[\text{CoCl}_4]$  and  $[\text{Cr}(\text{NH}_3)_5(\text{OH}_2)]\text{Cl}_3$

Diamagnetic:  $\text{K}_2[\text{PtCl}_4]$  and  $\text{Na}[\text{MnO}_4]$

**2013-N-11**

- $-0.0296 \text{ V}$
- 283 g
- From the table of standard reduction potentials:



Water has a greater reduction potential than  $\text{Na}^+$  and hence is preferentially reduced.

### 2013-N-12

- The layers of ions on a colloidal particle. The inner (Stern) layer consists of ions that are electrostatically attracted to the charged particle. The outer (diffuse) layer consists of counter ions.

Ions of opposite charge.

The pH value at which an amino acid or peptide has zero net charge.

The zeta potential is a measure of repulsion between adjacent, similarly charged particles in a colloid (*i.e.* the stability of a colloid). Colloids with high zeta potentials are electrically stabilized, whilst those with low potentials tend to coagulate.

The process in which colloidal particles clump together to form larger particles causing separation of the colloid.

The movement of colloidal particles in response to the application of an electric field.

### 2013-N-13

- $\text{Rate} = k[\text{H}_2\text{SeO}_3][\text{I}^-]^3[\text{H}^+]^2$   
 $5 \times 10^5 \text{ L}^5 \text{ mol}^{-5} \text{ s}^{-1}$