General Chem. 102
First Exam

Time: 60 min.
Date: 29/10/2014

Name:…….. Reg. No.: ……...

Instructor Name: …… Seat No.: ……..

1 atm=760 mmHg , K=^{o}C + 273 , R=8.314 J/mol.K=0.0821 L.atm/mol K

$\ln \frac{P_1}{P_2} = \frac{\Delta H_{vap}}{R}\left[\frac{1}{T_2} - \frac{1}{T_1}\right]$; $\pi = iMRT$; $\Delta T_f = ik_f m$; $\Delta T_b = ik_b m$

$P_{soln.} = P^{o}_{solvent} X_{solvent}$; $\ln[A]_o - \ln[A]_t = kt$; $C = kP$

ANSWER SHEET

1.	a	b	c	d	e	9.	a	b	c	d	e
2.	a	b	c	d	e	10.	a	b	c	d	e
3.	a	b	c	d	e	11.	a	b	c	d	e
4.	a	b	c	d	e	12.	a	b	c	d	e
5.	a	b	c	d	e	13.	a	b	c	d	e
6.	a	b	c	d	e	14.	a	b	c	d	e
7.	a	b	c	d	e	15.	a	b	c	d	e
8.	a	b	c	d	e	16.	a	b	c	d	e

Good Luck

Circle the *correct* answer for each of the following questions and put (✕) on the *corresponding choice* on the *front page*:

1. The inter molecular forces between He atoms in Liquid He is:

   a) dipole-dipole forces b) ion-dipole forces c) dispersion forces
   d) dipole-induced dipole forces e) hydrogen bonding

2. Which one of the following substances will have both dispersion forces and dipole-dipole forces?

   a) HCl b) BCl_3 c) Br_2 d) H_2 e) CO_2

3. Which of the following substances should have the highest boiling point?

   a) CH_4 b) CH_3OH c) Kr d) CH_3Cl e) N_2

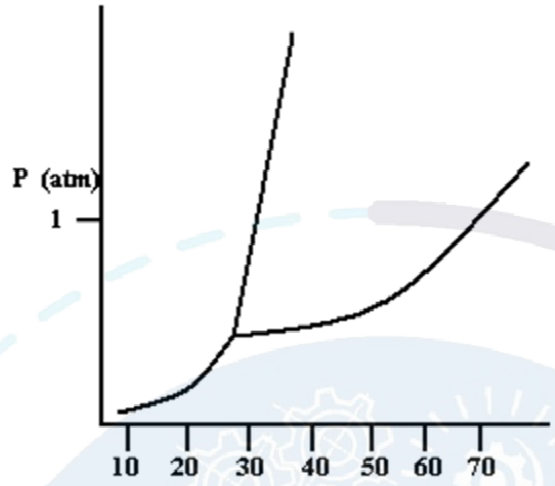
4. Which of the following would be expected to have the **highest** vapor pressure at room temperature?

   a) ethanol, bp = 78°C b) methanol, bp = 65°C c) water, bp = 100°C
   d) acetone, bp = 56°C e) $CHCl_3$, bp = 61°C

5. The vapor pressure of ethanol is 425 mmHg at 67.5°C. Its molar heat of vaporization is 39.3 kJ/mol. What is vapor pressure of ethanol, in mmHg, at 32.5°C?

   a) 86.6 b) 325 c) 232 d) 0.559 e) 1.59

6. Using the following phase diagram of a certain substance, in what phase/phases is the substance at 50°C and 1 atm pressure?



a) Solid b) liquid c) gas d) gas to liquid e) liquid to solid

7. What is the molarity of a solution of 12.5% by mass cadmium sulfate, $CdSO_4$ (molar mass = 208.46 g/mol) by mass? The density of the solution is 1.10 g/mL.

a) 0.778 M b) 0.436 M c) 0.479 M d) 0.048 M e) 0.660 M

8. Calculate the molality of a solution containing 14.3 g of NaCl (molar mass = 58.44 g/mol) in 42.2 g of water.

a) 2.45×10^{-1} m b) 5.80×10^{-4} m c) 5.80 m
d) 103 m e) 2.45×10^{-4} m

9. The solubility of nitrogen gas at 25°C and a nitrogen pressure of 522 mmHg is 4.7×10^{-4} mol/L. What is the value of the Henry's Law constant in mol/L·atm?

a) 9.0×10^{-7} b) 4.7×10^{-4} c) 3.2×10^{-4}
d) 6.8×10^{-4} e) 1.5×10^{3}

10. Dissolving a solute such as KCl in a solvent such as water results in

a) an increase in the melting point of the liquid.
b) a decrease in the boiling point of the liquid.
c) a decrease in the vapor pressure of the liquid.
d) no change in the boiling point of the liquid
e) an increase in the vapor pressure of the liquid.

11. When 12.1 g of a nonelectrolyte solute are dissolved in exactly 800. g of water, the solution has a freezing point of -0.082°C. What is the molar mass (in g/mol) of the solute?K_f of water is 1.86°C/m.

a) 426 b) 99.2 c) 178 g d) 266 e) 343

12. The osmotic pressure of a 0.010 M $MgSO_4$ solution at 25°C is 0.318 atm. Calculate *i*, the van't Hoff factor, for this $MgSO_4$ solution.

a) 0.013 b) 1.3 c) 1.8 d) 2.0 e)76.8

13. The vapor pressure of water at 20°C is 17.5 mmHg. What is the vapor pressure of water((in mmHg) over a solution prepared from 171 g of sucrose ($C_{12}H_{22}O_{11}$,molar mass = 342 g/mol) and and 180. g water(molar mass = 18.0 g/mol)

a) 16.7 b) 17.8 c) 18.9 d) 19.6 e) 14.4

14. For the following reaction, at a particular time:
$-\Delta[C_6H_{14}]/\Delta t = 6.2 \times 10^{-3}$ M/s.

$C_6H_{14}(g) \rightarrow C_6H_6(g) + 4H_2(g)$

Determine $\Delta[H_2]/\Delta t$ for this reaction at the same time.

a) 6.2×10^{-3} M/s b) 1.6×10^{-3} M/s c) 2.5×10^{-2} M/s
d) -1.6×10^{-3} M/s e) -2.5×10^{-2} M/s

15. For a reaction in which A and B react to form C the following initial concentration and rates were obtained.

[A] mol/L	[B] mol/L	Initial rate of formation of C (mol/L.s)
0.10	0.10	1.00
0.20	0.10	4.00
0.20	0.20	4.00

The rate law is:-
a) Rate = k[A][B] b) Rate = $k[A]^2[B]$ c) Rate = k[A]
d) Rate = k[B] e) Rate = $k[A]\,[B]^2$

16. For a certain first order reaction:

$A \rightarrow P$

The rate constant = $1.03x10^{-3}$ s^{-1} at 500 ^oC. If the initial concentration of A was 0.25 M. How long will it take (<u>in minutes</u>) for the concentration of A to decrease from 0.25 M to 0.15 M?

a) 18 b) 9.2 c) 17 d) 13 e) 8.3

② answer is (a) :-

BCl_3 ∢120 so is non polar / Br_2 ∢180 so is non polar

H_2 ∢180 ⇒ non polar / CO_2 ⇒ O=C=O ∢180

so is non polar

③ answer is (b) :-

CH_4 : London force

N_2 : London force

kr : London force

CH_3CL : dipole-dipole force

CH_3OH : Hydrogen bonds

⇒ Hydrogen > dipol > London

bonds ↑ B.P ↑

⇒ CH_3OH ✓

④ answer is (d) :-

b.p ↑ Vapur pressur ↓ so ⇒ highest v.p is the lowest b.p

⇒ aceton , bp = 56 ✓

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⑤ the answer is (a) :-

$$\Rightarrow \ln \frac{P_1}{P_2} = \frac{\Delta H_{vap}}{R}\left[\frac{1}{T_2} - \frac{1}{T_1}\right]$$

$P_1 = 425$ mm Hg

$T_1 = 67.5 \Rightarrow 67.5 + 273 = 340.5$ K

$\Delta H_{vap} = 34.3$ kj/mol $\Rightarrow 34.3 \times 10^3$ J/mol

$P_2 = ?!$

$T_2 = 32.5\,c \Rightarrow 32.5 + 273 = 305.5$ K

$R = 8.314$ J/k.mol

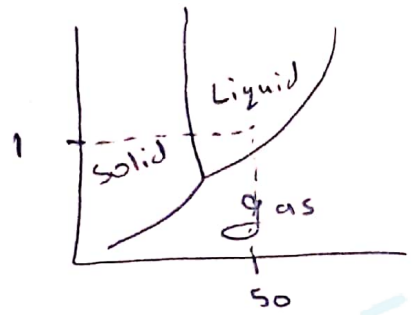
$$\Rightarrow \ln \frac{425}{P_2} = \frac{34.3 \times 10^3}{8.314}\left[\frac{1}{305.5} - \frac{1}{340.5}\right]$$

$$\ln \frac{425}{P_2} = 1.59$$

$$\frac{425}{P_2} = e^{1.59} = 4.5$$

$$\Rightarrow P_2 = 86.63$$

⑥ answer is (b) :-



⇒ liquid ✓

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⑦ answer is (e) :-

12.5 % → mass $CdSO_4$ by mass solution

⇒ base of calculation :-
mass of solution = 100g

(- from mass of solution we found the volume of solution
- from mass of $CdSO_4$ we found the # of moles of solution)

⇒ mass of $CdSO_4$ = 12.5 g

* $\rho = \frac{m}{V}$ = 1.1 g/mL

→ 1.1 g ⟶ 1 mL
100 g ⟶ ?? ⇒ V = 90.91 mL

→ # $n = \frac{\text{mass}}{M.W} \Rightarrow \frac{12.5}{208.46} = 0.059964$ g

$M = \frac{n}{V(L)} = \frac{.059964}{90.91\,(L^3)} = .65M$ ✓

(8) answer is (C) :-

$$\text{molality} = \frac{n}{\text{mass (kg)}} = \frac{.2447}{42.2 * 10^{-3}}$$

$$= 5.798 \approx 5.8 \checkmark$$

$$\# n = \frac{\text{mass}}{M.w} = \frac{14.3}{58.44} = .2447$$

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(9) answer is (d) :-

$P = 522 \text{ mm Hg} \xrightarrow{\text{convert (atm)}}$ 1 atm $\longrightarrow$ 760 mm Hg

is $\longrightarrow$ 522 mm Hg $\Rightarrow$ .6868 atm

Henry's constant = mol/L.atm so we will devide on atm's values

$$= \frac{4.7 * 10^{-4}}{.6868} = 6.842 * 10^{-4} \checkmark$$

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(10) answer is (C) :-

Dissolving solute in water make :-

↑ b.p ↓ m.p ↓ V.P ✓

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(11) answer is (e) :-

$$\Delta T_f = m k_f \rightarrow m = \frac{\Delta T_f}{k_f} = \frac{0 - -.082}{1.86} = .0441$$

$$m = \frac{n}{m(kg)} \rightarrow n = m * m(kg) = .0441 * .8 = .0353$$

$$n = \frac{m}{mw} \rightarrow Mw = \frac{m}{n} = \frac{12.1}{.0353} = \underline{343.1} \checkmark$$

(12) answer is (b)

$\pi = iMRT$

$$.318\ atm = i \left| \frac{.01\ mol}{L} \right| \left| \frac{.0821\ L \cdot atm}{mol \cdot k} \right| (25+273)\ k$$

$i = 1.3$ ✓

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(13) answer is (a) :-

$V_p = 17.5\ mmHg$

$n_{C_{12}H_{22}O_{11}} = \frac{171}{342} = .5$

$n_{H_2O} = \frac{180}{18} = 10$

$X_{solvent} = \frac{n_{solvent}}{n_{solvent} + n_{solvent}} = \frac{10}{10.5} = .952$

$P = P^\circ X = 17.5 \times .952 = 16.67\ mmHg$ ✓

(14)

Refer to the equation:

$$C_6H_{14(g)} \xrightarrow{Pt} C_6H_{6(g)} + 4H_{2(g)}$$

Using Reaction Rate

$$\frac{1}{(1)} \frac{-\Delta[C_6H_{14}]}{\Delta t} = +\frac{1}{4}\frac{[H_2]}{\Delta t}$$

$$4 * 6.2 \times 10^{-3} = \frac{\Delta[H_2]}{\Delta t}$$

(C) $= 24.8 \times 10^{-3} \approx 2.5 \times 10^{-2}$

(15) answer is (c) :-

	A	B	rate	
①	.1	.1	1	
×2	.2	.1	4	×4

so A^2

$1 = k(.1)^x(.1)^y$

$4 = k(.2)^x(.1)^y$

$\frac{1}{4} = (\frac{1}{2})^x \Rightarrow (\frac{1}{2})^2 = (\frac{1}{2})^x$

$x = 2$

	A	B	rate	
②	.2	.1	4	×1
	.2	.2	4	

so B^0

$Rate = k[A]^2$

(في هذا السؤال يوجد خطأ بالخيارات ^^)

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(16) answer is (e) :-

$$\ln[A_0] - \ln[A_t] = kt$$

$$\frac{\ln .25 - \ln .15}{1.03 \times 10^{-3}} = 495.4\ s \xrightarrow{\text{convert to minutes}} \div 60 = 8.27 \approx 8.3 \checkmark$$

good Luck

اسألني عن الهندسة

امل - الهجرة