Spring 2012
CHEM 1110.20784
Test 4, Form A

Part 1. Multiple Choice: Clearly indicate the best answer on the scantron form. (60 pts)

1. A sample of a trapped ideal gas has its volume doubled while its temperature remains constant. If the original pressure was 100 torr, what is the new pressure?
   A) 50 torr
   B) 100 torr
   C) 200 torr
   D) 1000 torr
   E) 10 torr

2. Which of these chemical equations describes a *precipitation reaction*?
   A) $CaBr_2(aq) + H_2SO_4(aq) \rightarrow CaSO_4(s) + 2HBr(g)$
   B) $2KBr(aq) + Cl_2(g) \rightarrow 2KCl(aq) + Br_2(l)$
   C) $2H_2(g) + O_2(g) \rightarrow 2H_2O(l)$
   D) $2Al(s) + 3H_2SO_4(aq) \rightarrow Al_2(SO_4)_3(aq) + 3H_2(g)$
   E) $2KNO_3(s) \rightarrow 2KNO_2(s) + O_2(g)$

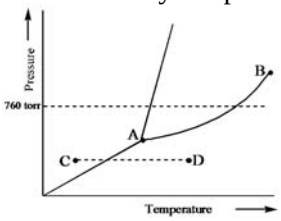
3. Which of the following is a strong acid?
   A) HF
   B) H_3PO_4
   C) CH_3COOH
   D) H_2O
   E) HNO_3

4. What name is given to a quantitative measure of the elastic force in the surface of a liquid?
   A) Polarity
   B) Capillary action
   C) Adhesion
   D) Cohesion
   E) Surface tension

5. What is the name given to the attractive forces that hold particles together in the condensed phase?
   A) covalent bonds
   B) intermolecular forces
   C) electronegativity
   D) electron attraction
   E) ionic bonds

6. What is the defined as the maximum amount of solute that will dissolve in a given quantity of solvent at a specific temperature?
   A) Solubility
   B) Precipitation
   C) Dilution
   D) Combustion
   E) Super saturation

7. Consider the following phase diagram and identify the process occurring as one goes from point C to point D.
   A) freezing
   B) no phase change occurs
   C) sublimation
   D) deposition
   E) melting

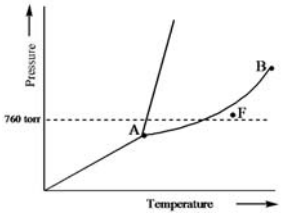


8. At very high pressures (~ 1000 atm), the measured pressure exerted by real gases is greater than that predicted by the ideal gas equation. This is mainly because
   A) gas phase collisions prevent molecules from colliding with the walls of the container.
   B) the volume occupied by the gas molecules themselves becomes significant.
   C) real gases will condense to form liquids at 1000 atm pressure.
   D) such high pressures cannot be accurately measured.
   E) of attractive intermolecular forces between gas molecules.

9. What is the mole fraction of He in a mixture if the mixture contains 5.0 mol He, 10.5 mol N_2 and 2.3 mol O_2?
   A) 0.39
   B) 0.28
   C) 3.56
   D) 0.48
   E) 18

10. Which of the following kind(s) of intermolecular force exist between molecules of propane, C_3H_8?
    I. dispersion forces II. dipole-dipole interactions III. ion-dipole interactions
    A) I and III
    B) III only
    C) I, II, and III
    D) I only
    E) II only

11. Examine the following phase diagram and determine what phase exists at point F.
    A) supercritical fluid
    B) liquid
    C) gas and liquid
    D) gas
    E) solid



12. Which of these chemical equations describes an *acid-base neutralization reaction*?
    A) $CaBr_2(aq) + H_2SO_4(aq) \rightarrow CaSO_4(s) + 2HBr(g)$
    B) $2Al(s) + 3H_2SO_4(aq) \rightarrow Al_2(SO_4)_3(aq) + 3H_2(g)$
    C) $2KBr(aq) + Cl_2(g) \rightarrow 2KCl(aq) + Br_2(l)$
    D) $SO_2(g) + H_2O(l) \rightarrow H_2SO_3(g)$
    E) $LiOH(aq) + HNO_3(aq) \rightarrow LiNO_3(aq) + H_2O(l)$

13. Based on the solubility rules, which of these processes will occur when solutions of $ZnSO_4(aq)$ and $MgCl_2(aq)$ are mixed?
    A) $MgSO_4$ will precipitate; Zn^{2+} and Cl^- will be spectator ions.
    B) $MgCl_2$ will precipitate; Zn^{2+} and SO_4^{2-} will be spectator ions.
    C) $ZnSO_4$ will precipitate; Mg^{2+} and Cl^- will be spectator ions.
    D) No precipitate will form.
    E) $ZnCl_2$ will precipitate; Mg^{2+} and SO_4^{2-} will be spectator ions.

14. What is the volume of NH_3 produced in the following reaction when 4.0 L of N_2 reacts with 3.0 L of H_2?

$$N_2(g) + 3H_2(g) \rightarrow 2NH_3(g)$$

A) 0.5 L
B) 1.5 L
C) 2.0 L
D) 8.0 L
E) 0.66 L

15. Select the precipitate that forms when the following reactants are mixed: $Mg(CH_3COO)_2(aq) + LiOH(aq) \rightarrow$
A) MgOH
B) $Mg(OH)_2$
C) CH_3OH
D) $LiCH_3COO$
E) $Li(CH_3COO)_2$

16. Krypton has a *higher* melting point than argon because of its
A) ionic bonds.
B) hydrogen bonding.
C) stronger dispersion forces.
D) greater ionization energy.
E) permanent dipole moment.

17. Based on the solubility rules, which one of these compounds should be *insoluble* in water?
A) $MgSO_4$
B) Na_2SO_4
C) Rb_2SO_4
D) $CuSO_4$
E) $BaSO_4$

18. What is the Kelvin temperature at 24°C?
A) 297 K
B) 249 K
C) 11.4 K
D) –297 K
E) –249 K

19. Which of the responses includes all of the following that can form hydrogen bonds with water molecules?
(1) Na^+ (2) CH_3COOH (3) C_2H_6 (4) CH_3NH_2
A) (3) and (4)
B) (2) and (3)
C) (2) and (4)
D) (1) and (2)
E) (1) and (3)

20. "The volume of an ideal gas is directly proportional to its absolute temperature at constant pressure and number of moles" is a statement of _____ Law.
A) Dalton's
B) Charles's
C) Gay-Lussac's
D) Boyle's
E) Avogadro's

21. Which of the following is/are characteristic(s) of gases?
    A) High compressibility
    B) Relatively large distances between molecules
    C) Formation of homogeneous mixtures regardless of the nature of gases
    D) A and B
    E) A, B, and C

22. Which process defines how ionic compounds break apart into its constituent ions upon dissolution?
    A) Dissolution
    B) Dissociation
    C) Decomposition
    D) Division
    E) Electrolysis

23. Select the precipitate that forms when aqueous lead (II) nitrate reacts with aqueous sodium sulfate.
    A) PbS
    B) Pb_2SO_4
    C) Na_2NO_3
    D) $PbSO_4$
    E) $NaNO_3$

24. The distinguishing characteristic of all electrolyte solutions is that they
    A) react with other solutions.
    B) contain molecules.
    C) conduct electricity.
    D) conduct heat.
    E) always contain acids.

25. "The pressure of an ideal gas is inversely proportional to its volume at constant temperature and number of moles" is a statement of _____ Law.
    A) Amontons's
    B) Avogadro's
    C) Gay-Lussac's
    D) Charles's
    E) Boyle's

26. Based on the solubility rules, which one of these compounds should be *soluble* in water?
    A) Na_2S
    B) Ag_2S
    C) Hg_2Cl_2
    D) $BaSO_4$
    E) Ag_2CO_3

27. Based on the solubility rules, which one of these compounds should be *soluble* in water?
    A) AgCl
    B) $AgNO_3$
    C) Ag_2S
    D) Ag_2CO_3
    E) AgBr

28. In the following reaction, what ions, if any, are spectator ions?

$$Pb(NO_3)_2(aq) + 2NaCl(aq) \rightarrow PbCl_2(s) + 2NaNO_3(aq)$$

A) There are no spectator ions
B) $Pb^{2+}(aq)$, $NO_3^-(aq)$
C) $Na^+(aq)$, $Cl^-(aq)$
D) $Pb^{2+}(aq)$, $Cl^-(aq)$
E) $Na^+(aq)$, $NO_3^-(aq)$

29. Which of the following gases effuses most rapidly?
A) HCl
B) CO
C) NH_3
D) O_2
E) N_2

30. In hydrogen iodide _____ are the most important intermolecular forces.
A) covalent bonds
B) hydrogen bonding
C) polar covalent bonds
D) London dispersion forces
E) dipole-dipole forces

Part 2. Calculations: Clearly show <u>all</u> work on the <u>blank space on the scantron answer sheet</u> for full credit. (40 pts)

1. How many grams of sodium tetrafluoroborate ($NaBF_4$) are needed to make 2.50L of a 0.540 M solution (MM of $NaBF_4$ = 109.79 g/mol).

2. Students in a laboratory class were provided with 6.00 M hydrochloric acid solution from the stockroom. The instructions in the experiment called for 75.0 mL of 2.00 M hydrochloric acid. How many liters of the 6.00 M solution should be used to prepare the dilute solution?

3. How many liters of oxygen gas, measured at 15°C and 1.20 atm, are required for the complete combustion of 6.01 grams of pentane (C_5H_{12})? (MM of C_5H_{12} = 72.15 g/mol)

$$C_5H_{12} + 8\ O_2 \rightarrow 5\ CO_2 + 6\ H_2O$$

4. A sample of a gas occupies a volume of 1.462 liters at STP. It was placed in a different vessel in which the pressure was measured as 0.951 atm when the temperature was 25°C. What was the volume of this new vessel, in liters?

	IA																VIIIA
1	1 **H** 1.008	IIA											IIIA	IVA	VA	VIA	VIIA	2 **He** 4.00
2	3 **Li** 6.94	4 **Be** 9.01											5 **B** 10.81	6 **C** 12.01	7 **N** 14.01	8 **O** 16.00	9 **F** 19.00	10 **Ne** 20.18
3	11 **Na** 22.99	12 **Mg** 24.31	IIIB	IVB	VB	VIB	VIIB	VIIIB			IB	IIB	13 **Al** 26.98	14 **Si** 28.09	15 **P** 30.97	16 **S** 32.06	17 **Cl** 35.45	18 **Ar** 39.95
4	19 **K** 39.10	20 **Ca** 40.08	21 **Sc** 44.96	22 **Ti** 47.90	23 **V** 50.94	24 **Cr** 52.00	25 **Mn** 54.94	26 **Fe** 55.85	27 **Co** 58.93	28 **Ni** 58.71	29 **Cu** 63.55	30 **Zn** 65.37	31 **Ga** 69.72	32 **Ge** 72.59	33 **As** 74.92	34 **Se** 78.96	35 **Br** 79.90	36 **Kr** 83.80
5	37 **Rb** 85.47	38 **Sr** 87.62	39 **Y** 88.91	40 **Zr** 91.22	41 **Nb** 92.91	42 **Mo** 95.94	43 **Tc** [98]	44 **Ru** 101.1	45 **Rh** 102.9	46 **Pd** 106.4	47 **Ag** 107.9	48 **Cd** 112.40	49 **In** 114.8	50 **Sn** 118.7	51 **Sb** 121.8	52 **Te** 127.60	53 **I** 126.90	54 **Xe** 131.30
6	55 **Cs** 132.9	56 **Ba** 137.3	71 **Lu** 175	72 **Hf** 178.5	73 **Ta** 181	74 **W** 183.9	75 **Re** 186.2	76 **Os** 190.2	77 **Ir** 192.2	78 **Pt** 195.1	79 **Au** 197	80 **Hg** 200.59	81 **Tl** 204.4	82 **Pb** 207.2	83 **Bi** 209	84 **Po** [209]	85 **At** [210]	86 **Rn** [222]
7	87 **Fr** [223]	88 **Ra** [226]	103 **Lr** [262]	104 **Rf** [267]	105 **Db** [268]	106 **Sg** [271]	107 **Bh** [272]	108 **Hs** [270]	109 **Mt** [276]	110 **Ds** [281]	111 **Rg** [280]	112 **Uub** [285]	113 **Uut** [284]	114 **Uuq** [289]	115 **Uup** [288]	116 **Uuh** [293]		118 **Uuo** [294]

57 **La** 138.9	58 **Ce** 140.1	59 **Pr** 140.9	60 **Nd** 144.2	61 **Pm** [145]	62 **Sm** 150.4	63 **Eu** 152	64 **Gd** 157.3	65 **Tb** 158.9	66 **Dy** 162.5	67 **Ho** 164.93	68 **Er** 167.3	69 **Tm** 168.9	70 **Yb** 173
89 **Ac** [227]	90 **Th** 232	91 **Pa** [231]	92 **U** 238	93 **Np** [237]	94 **Pu** [244]	95 **Am** [243]	96 **Cm** [247]	97 **Bk** [247]	98 **Cf** [251]	99 **Es** [252]	100 **Fm** [257]	101 **Md** [258]	102 **No** [259]