

Fall 2011
CHEM 1110.40413
Test 4, Form A

Name: _____

Part I. Multiple Choice: Clearly circle the best answer. (60 pts)

1. The common constituent in all acid solutions is
 - A) H_2SO_4
 - B) H_2
 - C) H^+
 - D) OH^-

2. Which of the following is a weak acid?
 - A) HF
 - B) HBr
 - C) HCl
 - D) H_2SO_4

3. What are the conditions of STP?
 - A) 273.15°C and 760 torr
 - B) 0 K and 1atm
 - C) 273.15 K and 1 atm
 - D) 0°C and 760 atm

4. What is the oxidation number for sulfur in sulfuric acid, H_2SO_4 ?
 - A) -2
 - B) -4
 - C) +6
 - D) +1

5. Select the precipitate that forms when aqueous NH_4S reacts with aqueous $\text{Cu}(\text{NO}_3)_2$.
 - A) NH_4NO_3
 - B) CuS
 - C) $\text{NH}_4(\text{NO}_3)_2$
 - D) Cu_2S

6. What is the process where molecules go directly from the solid phase to the gas phase?
 - A) sublimation
 - B) condensation
 - C) melting
 - D) deposition

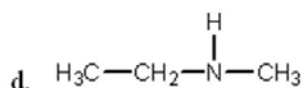
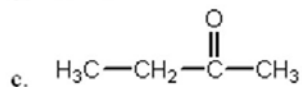
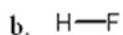
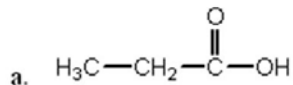
7. Which of the following is a strong acid?
 - A) H_3PO_4
 - B) NaCl
 - C) HNO_3
 - D) $\text{Ba}(\text{OH})_2$

8. Which of the following is a strong base?
 - A) $\text{Al}(\text{OH})_3$
 - B) NH_3
 - C) $\text{B}(\text{OH})_3$
 - D) $\text{Ca}(\text{OH})_2$

9. Which of these chemical equations describes an *acid-base neutralization reaction*?
- $2\text{KBr}(aq) + \text{Cl}_2(g) \rightarrow 2\text{KCl}(aq) + \text{Br}_2(l)$
 - $\text{LiOH}(aq) + \text{HNO}_3(aq) \rightarrow \text{LiNO}_3(aq) + \text{H}_2\text{O}(l)$
 - $2\text{Al}(s) + 3\text{H}_2\text{SO}_4(aq) \rightarrow \text{Al}_2(\text{SO}_4)_3(aq) + 3\text{H}_2(g)$
 - $\text{SO}_2(g) + \text{H}_2\text{O}(l) \rightarrow \text{H}_2\text{SO}_3(g)$
10. Based on the solubility rules, which one of these compounds should be *insoluble* in water?
- MgBr_2
 - AgBr
 - NaCl
 - FeCl_2
11. Deviations from the ideal gas law are greater at
- high temperatures and high pressures.
 - low temperatures and low pressures.
 - high temperatures and low pressures.
 - low temperatures and high pressures.
12. What is the process where molecules go directly from the gas phase to the solid phase?
- sublimation
 - condensation
 - deposition
 - freezing
13. Which one of the following substances should exhibit hydrogen bonding in the liquid state?
- CH_4
 - CH_3OH
 - H_2S
 - PH_3
14. What is the net ionic equation when sodium sulfate is mixed with barium hydroxide?
- $\text{Ba}^+(aq) + \text{SO}_4^{2-}(aq) \rightarrow \text{BaSO}_4(s)$
 - $\text{Ba}^{2+}(aq) + \text{SO}_4^{2-}(aq) \rightarrow \text{BaSO}_4(s)$
 - $\text{Na}^+(aq) + \text{OH}^-(aq) \rightarrow \text{NaOH}(s)$
 - $\text{Na}^+(aq) + \text{SO}_4^{2-}(aq) \rightarrow \text{Na}_2\text{SO}_4(s)$
15. Which of these choices is the correct *net ionic equation* for the reaction that occurs when solutions of $\text{Pb}(\text{NO}_3)_2$ and NH_4Cl are mixed?
- $\text{Pb}^{2+}(aq) + 2\text{NO}_3^-(aq) + 2\text{NH}_4^+(aq) + 2\text{Cl}^-(aq) \rightarrow 2\text{NH}_4^+(aq) + 2\text{NO}_3^-(aq) + \text{PbCl}_2(s)$
 - $\text{Pb}(\text{NO}_3)_2(aq) + 2\text{NH}_4\text{Cl}(aq) \rightarrow \text{NH}_4\text{NO}_3(aq) + \text{PbCl}_2(s)$
 - $\text{NH}_4^+(aq) + \text{NO}_3^-(aq) \rightarrow 2\text{NH}_4\text{NO}_3(s)$
 - $\text{Pb}^{2+}(aq) + 2\text{Cl}^-(aq) \rightarrow \text{PbCl}_2(s)$
16. Based on the solubility rules, which of these processes will occur if solutions of $\text{CuSO}_4(aq)$ and $\text{BaCl}_2(aq)$ are mixed?
- BaCl_2 will precipitate; Cu^{2+} and SO_4^{2-} are spectator ions.
 - CuCl_2 will precipitate; Ba^{2+} and SO_4^{2-} are spectator ions.
 - CuSO_4 will precipitate; Ba^{2+} and Cl^- are spectator ions.
 - BaSO_4 will precipitate; Cu^{2+} and Cl^- are spectator ions.

17. Select the precipitate that forms when the following reactants are mixed. $\text{Na}_2\text{CO}_3(\text{aq}) + \text{BaCl}_2(\text{aq}) \rightarrow$
- A) BaCO_3
 - B) NaCl
 - C) NaCl_2
 - D) Ba_2CO_3

18. In which of the following compounds will the molecules *not* form hydrogen bonds in the liquid state?



19. What is the formula which describes the relationship between the pressure and volume at constant temperature and constant moles?

- A) $P \propto 1/V$
- B) $P \propto V^2$
- C) None of the answers is correct
- D) $P \propto V$

20. Arrange the following gases in order of increasing rate of effusion: C_2H_6 , Ar, HCl, and PH_3 .

- A) $\text{C}_2\text{H}_6 < \text{HCl} < \text{PH}_3 < \text{Ar}$
- B) $\text{Ar} < \text{PH}_3 < \text{C}_2\text{H}_6 < \text{HCl}$
- C) $\text{Ar} < \text{HCl} < \text{PH}_3 < \text{C}_2\text{H}_6$
- D) $\text{C}_2\text{H}_6 < \text{PH}_3 < \text{HCl} < \text{Ar}$

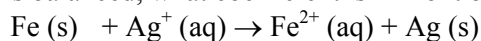
21. The oxidation number of Cr in $\text{Cr}_2\text{O}_7^{2-}$ is

- A) -7
- B) +7
- C) -12
- D) +6

22. Which of the following is insoluble in water?

- A) PbCl_2
- B) Li_2CO_3
- C) $(\text{NH}_4)_2\text{S}$
- D) NaOH

23. When the following redox reaction is balanced, what coefficient is in front of $\text{Ag}(\text{s})$?



- A) 3
- B) 4
- C) 2
- D) 1

24. Based on the solubility rules, which one of these compounds should be *soluble* in water?
- A) PbSO_4
 - B) CaSO_4
 - C) K_2SO_4
 - D) BaSO_4
25. Which of the following should have the highest boiling point?
- A) Cl_4
 - B) CBr_4
 - C) CF_4
 - D) CCl_4
26. Which of the following terms refers to the resistance of a liquid to flow?
- A) Viscosity
 - B) Adhesion
 - C) Capillary action
 - D) Surface tension
27. What is the volume of NH_3 produced in the following reaction when 3.0 L of H_2 reacts with excess N_2 at constant temperature and pressure?
- $$\text{N}_2(\text{g}) + 3\text{H}_2(\text{g}) \rightarrow 2\text{NH}_3(\text{g})$$
- A) 4.5 L
 - B) 3.0 L
 - C) 6.0 L
 - D) 2.0 L
28. What is the formula which describes the relationship between the volume and temperature at constant pressure and constant moles?
- A) $V^2 \propto T$
 - B) None of the answers is correct
 - C) $V \propto T$
 - D) $V \propto 1/T$
29. In the following reaction, what ions, if any, are spectator ions?
- $$\text{Pb}(\text{NO}_3)_2(\text{aq}) + 2\text{NaCl}(\text{aq}) \rightarrow \text{PbCl}_2(\text{s}) + 2\text{NaNO}_3(\text{aq})$$
- A) $\text{Na}^+(\text{aq}), \text{Cl}^-(\text{aq})$
 - B) $\text{Pb}^{2+}(\text{aq}), \text{Cl}^-(\text{aq})$
 - C) $\text{Na}^+(\text{aq}), \text{NO}_3^-(\text{aq})$
 - D) $\text{Pb}^{2+}(\text{aq}), \text{NO}_3^-(\text{aq})$
30. What is the Kelvin temperature at 24°C ?
- A) 11.4 K
 - B) 297 K
 - C) 249 K
 - D) -297 K

Part II. Calculations: Clearly show all work for full credit. (35 pts)

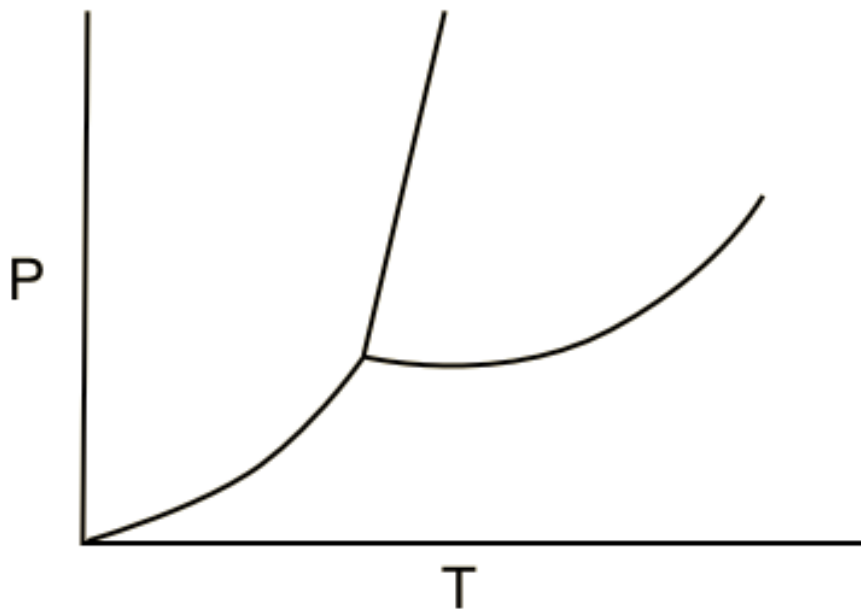
- (10 pts) If a constant number of moles of a gas is at a pressure of 1.35 atm and has a volume of 23.8 L at a temperature of 205.1 K then what is the final volume of the gas if the pressure changes to 2.84 atm and the temperature rises to 233.4 K?

- (15 pts) Elemental chlorine gas is usually produced by the electrolysis of sodium chloride. How many liters of chlorine gas at 25°C and 0.950 atm can be produced by the reaction of 120.0 g of NaCl? ($R = 0.08206 \text{ L} \cdot \text{atm/K} \cdot \text{mol}$, MM of NaCl = 58.43 g/mol)



- (10 pts) What is the mole fraction of NO in a 55.0 L gas cylinder at 30°C which comes from a mixture of N₂ and NO if you have 3.238 mol of N₂ and the gas cylinder has a total pressure of 2.14 atm?

Part III. Phase Diagrams (5 pts): In the phase diagram below, label the three phases (s, l, and g) and the triple point (TP). Also, indicate the phase boundary where sublimation occurs.



	IA																	VIIIA																												
1	1 H 1.008																		2 He 4.00																											
2	3 Li 6.94	IIA	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	VIIIB	VIIIIB			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]																												
	<table border="1"> <tr> <td>57 La 138.9</td> <td>58 Ce 140.1</td> <td>59 Pr 140.9</td> <td>60 Nd 144.2</td> <td>61 Pm [145]</td> <td>62 Sm 150.4</td> <td>63 Eu 152</td> <td>64 Gd 157.3</td> <td>65 Tb 158.9</td> <td>66 Dy 162.5</td> <td>67 Ho 164.93</td> <td>68 Er 167.3</td> <td>69 Tm 168.9</td> <td>70 Yb 173</td> </tr> <tr> <td>89 Ac [227]</td> <td>90 Th 232</td> <td>91 Pa [231]</td> <td>92 U 238</td> <td>93 Np [237]</td> <td>94 Pu [244]</td> <td>95 Am [243]</td> <td>96 Cm [247]</td> <td>97 Bk [247]</td> <td>98 Cf [251]</td> <td>99 Es [252]</td> <td>100 Fm [257]</td> <td>101 Md [258]</td> <td>102 No [259]</td> </tr> </table>																		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]
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