

Name & Lab Section _____
(Print)

BROOKLYN COLLEGE OF CUNY
Practice Chemistry 1.2 Final Examination: Fall 2005 (Modified)

Information that may be useful:

FORMULAS

$$\lambda = h / m\nu$$

$$E = h\nu$$

$$C = \lambda\nu$$

$$P = X P^0$$

$$\Delta T = K m$$

$$\Pi = M R T$$

$$S = k_H P$$

CONSTANTS

$$c = 3.00 \times 10^8 \text{ m/s} \quad h = 6.63 \times 10^{-34} \text{ J}\cdot\text{s}$$

$$\text{Avogadro's \#} = 6.02 \times 10^{23}$$

$$R = 0.0821 \text{ L atm / K mol} = 8.314 \text{ L kPa / K mol}$$

$$1 \text{ atm} = 760 \text{ Torr} = 760 \text{ mm of Hg}$$

$$1 \text{ nanometer} = 1 \times 10^{-9} \text{ meters}$$

$$\text{For H}_2\text{O} \quad k_f = 1.86 \text{ }^\circ\text{C/m} \quad k_b = 0.52 \text{ }^\circ\text{C/m}$$

1 H 1.008																	2 He 4.003						
3 Li 6.941	4 Be 9.012																	5 B 10.81	6 C 12.01	7 N 14.01	8 O 16.00	9 F 19.00	10 Ne 20.18
11 Na 22.99	12 Mg 24.31																	13 Al 26.98	14 Si 28.09	15 P 30.97	16 S 32.06	17 Cl 35.45	18 Ar 39.95
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 58.70	29 Cu 63.55	30 Zn 65.38	31 Ga 69.72	32 Ge 72.59	33 As 74.92	34 Se 78.96	35 Br 79.90	36 Kr 83.80						
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 112.4	49 In 114.8	50 Sn 118.7	51 Sb 121.8	52 Te 127.6	53 I 126.9	54 Xe 131.3						
55 Cs 132.9	56 Ba 137.3	57 [*] La 138.9	72 Hf 178.5	73 Ta 180.9	74 W 183.9	75 Re 186.2	76 Os 190.2	77 Ir 192.2	78 Pt 195.1	79 Au 197.0	80 Hg 200.6	81 Tl 204.4	82 Pb 207.2	83 Bi 209.0	84 Po (209)	85 At (210)	86 Rn (222)						
87 Fr (223)	88 Ra (226.0)	89 ^{**} Ac (227)	104 Rf	105 Ha	106 Unh	107 Uns	108	109 Uue															

58 Ce 140.1	59 Pr 140.9	60 Nd 144.2	61 Pm (145)	62 Sm 150.4	63 Eu 152.0	64 Gd 157.3	65 Tb 158.9	66 Dy 162.5	67 Ho 164.9	68 Er 167.3	69 Tm 168.9	70 Yb 173.0	71 Lu 175.0
90 ^{**} Th 232.0	91 Pa (231)	92 U 238.0	93 Np (244)	94 Pu (242)	95 Am (243)	96 Cm (247)	97 Bk (247)	98 Cf (251)	99 Es (252)	100 Fm (257)	101 Md (258)	102 No (259)	103 Lr (260)

- As the momentum of an electron increases, its DeBroglie wavelength...
(A) Increases (B) Decreases (C) Doesn't Change (D) Can't be calculated
- A Na lamp emits yellow light with a wavelength of 589 nm. What is the energy of a single photon in this light?
a) $3.37 \times 10^{-19} \text{ J}$ b) $1.12 \times 10^{-25} \text{ J}$ c) $1.17 \times 10^{-33} \text{ J}$ d) $5.09 \times 10^{15} \text{ J}$ e) $5.09 \times 10^{14} \text{ J}$
- Which set of quantum numbers (n, l, m_l) is *not* allowed? (A) $n = 6, l = 1, m_l = 0$ (B) $n = 3, l = 1, m_l = 2$
(C) $n = 3, l = 2, m_l = -2$ (D) $n = 1, l = 0, m_l = 0$ (E) $n = 3, l = 2, m_l = 1$
- Which of the following represents the ground state of vanadium? (A) $1s^2 2s^2 2p^6 3s^2 3p^6 3d^3 4s^2$
(B) $1s^2 2s^2 2p^6 3s^2 3p^6 3d^5$ (C) $1s^2 2s^2 2p^4 3s^2 3p^4 3d^9$ (D) $1s^2 2s^2 2p^4 3s^2 3p^4 3d^7 4s^2$
- Which is a valid spin-orbital diagram for an atom in its ground state?

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- The number of *unpaired* electrons in the ground state of Mn^{2+} is... (A) one (B) three (C) five (D) seven

7) In an experiment on the photoelectric effect, an yellow photon fails to eject an electron from the surface of a metal. Which color may successfully eject an electron? (A) orange (B) red (C) infra-red (D) green (E) none of these

8) The most stable ion of sodium is isoelectronic with the...
(A) magnesium atom. (B) most stable ion of fluorine. (C) argon atom. (D) sodium atom.

9) Which of these isoelectronic ions is the largest? (A) Ca^{2+} (B) K^+ (C) Sc^{3+} (D) S^{2-}

10) Which pair is given in the order of increasing size? A) Cl^- , Cl B) Fe^{3+} , Fe^{2+} C) Sr, Ca D) K, K^+

11) In which reaction is the energy term referred to as the ionization energy?

(A) $\text{NaCl}(s) + \text{energy} \rightarrow \text{Na}^+(g) + \text{Cl}^-(g)$ (B) $\text{Na}(g) + \text{energy} \rightarrow \text{Na}^+ + e^-$
(C) $\text{Cl}(g) + e^- \rightarrow \text{Cl}^-(g) + \text{energy}$ (D) $\text{Cl}^-(g) + \text{H}^+(g) \rightarrow \text{HCl}(g) + \text{energy}$
(E) $\text{Cl}_2(g) + \text{energy} \rightarrow 2\text{Cl}(g)$

12) Which reaction in question 11 shows the lattice energy? (Same choices as question 11) ____

13) What is the correct electron configuration of the ion Fe^{2+} ? (A) $[\text{Ar}] 3d^4 4s^2$ (B) $[\text{Ar}] 3d^6 4s^2$ (C) $[\text{Ar}] 3d^6$ (D) $[\text{Ar}]$

14) Which set of atoms is correctly arranged in order of **increasing** electronegativity? A) $\text{Br} < \text{Rb} < \text{Cl} < \text{I}$
B) $\text{I} < \text{Rb} < \text{Cl} < \text{Br}$ C) $\text{Rb} < \text{I} < \text{Br} < \text{Cl}$ D) $\text{Cl} < \text{Br} < \text{Rb} < \text{I}$ E) $\text{Br} < \text{Cl} < \text{I} < \text{Rb}$

15) Which contains both covalent and ionic bonds? (A) NH_4Cl (B) NF_3 (C) BaCl_2 (D) CH_2O

16) Which molecule contains two pairs of valence electrons? (A) H_2O (B) NH_3 (C) CH_4 (D) NaCl

17) Which of following molecules are polar?

1) CH_4 2) PH_3 3) $\text{N}\equiv\text{N}-\text{O}$ 4) XeF_4 5) BF_3 6) SO_2
(A) all of them (B) none of them (C) only 2 (D) only 6 (E) 2,3, and 6

18) What is the molecular geometry of SeF_3^+ ?

(A) trigonal pyramidal. (B) square planar. (C) tetrahedral. (D) rectangular planar.

19) Which is planar? (A) NH_3 (B) SO_3^{2-} (C) CO_3^{2-} (D) H_3O^+

20). Which has the greatest lattice enthalpy? a. SrS b. MgS c. MgO d. NaI e. NaCl

21) Draw the correct Lewis structure for the cyanide ion, CN^- . The formal charges of the carbon atom and nitrogen atom, respectively, are: a. -1 & +1 b. -1 & 0 c. 0 & -1 d. +1 and -1 e. none of the preceding choices

22) Which of the following molecules is a free radical? a. N_2O b. NO c. N_2O_3 d. N_2H_4 e. none of the preceding

23) Estimate ΔH for the reaction $\text{CH}_4(g) + \text{Cl}_2(g) \rightarrow \text{CH}_3\text{Cl}(g) + \text{HCl}(g)$

Given: BOND ENTHALPY DATA (kJ/mol)

C - H 413 Cl - Cl 242 H - Cl 431 C - Cl 328 C - C 346

a. -104 kJ b. +104 kJ c. -1416 kJ d. +1416 kJ e. none of these

24) One mole each of gaseous N_2 , NH_3 , and N_2O are injected into an evacuated container to produce a total pressure of 3 atm. How do the partial pressures of N_2 , NH_3 , and N_2O compare?

(A) $P_{\text{N}_2} = P_{\text{NH}_3} = P_{\text{N}_2\text{O}} = 1 \text{ ATM}$ (B) $P_{\text{N}_2} = P_{\text{NH}_3} = P_{\text{N}_2\text{O}} = 3 \text{ ATM}$ (C) $P_{\text{NH}_3} < P_{\text{N}_2} < P_{\text{N}_2\text{O}}$ (D) $P_{\text{N}_2\text{O}} < P_{\text{N}_2} < P_{\text{NH}_3}$

25) What is the volume of 15 g of N_2 gas at 25 °C and 760 torr ?

a. 13 L b. 15 L c. 24 L d. 42 L e. 420 L

Given information for next two questions: Molar Mass (g.mol⁻¹) SF_6 146 S_2F_{10} 254

26) What is the density of SF_6 gas at 0.950 atm and 301 K?

a. 3.62 g/L b. 5.63 g/L c. 6.28 g/L d. 6.52 g/L e. 4.33×10^3 g/L

27) What would be the ratio of the rates of effusion of SF₆ to S₂F₁₀ if they are allowed to escape through a pinhole under identical conditions? (A) 1.32/1 (B) 1.74/1 (C) 3.03/1 (D) 3.48/1

28) The electrical conductivity of a solid is slight at 25 °C and much greater at 525 °C. The solid is most likely a(n) (A) ionic compound (B) insulator (C) metal (D) semiconductor

39) When the substances below are arranged in order of increasing entropy values, which is the correct order? (A) CO₂(s) < CO₂(aq) < CO₂(g) (B) CO₂(g) < CO₂(aq) < CO₂(s) (C) CO₂(s) < CO₂(g) < CO₂(aq) (D) CO₂(g) < CO₂(s) < CO₂(aq)

30) The interactions between atoms that are responsible for Ne being a liquid at 27K are best described as... (A) dipole-dipole (B) dipole-induced dipole (C) London dispersion (D) hydrogen bonding (E) covalent bonds

31) Given the three bonds: C—C C=C C≡C Which statement is true? (A) The single bond is the longest (B) The triple bond has the greatest bond enthalpy (C) The triple bond is the shortest (D) Both A and B (E) All of the choices A, B, and C

32) Calculate the solubility of oxygen at 20°C in a lake where the partial pressure of oxygen is 152 Torr. Henry's constant for oxygen is 0.0013 M/atm at 20°C in water. (A) 2.0 x 10⁻¹ M (B) 1.3 x 10⁻² M (C) 8.8 x 10⁻⁷ M (D) 2.6 x 10⁻⁴ M (E) 6.6 x 10⁻³ M

33) Which of these will raise the boiling point of water the most in 0.1 molal solutions? (A) NaCl (B) FeCl₃ (C) CaCl₂ (D) glucose, C₆H₁₂O₆ (E) all will have the same effect

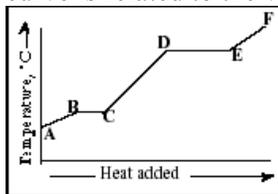
34) A gas is most soluble in a liquid at: (A) low temperature and low pressure (B) high temperature and high pressure (C) low temperature and high pressure (D) high temperature and low pressure

35) What is the vapor pressure of a solution containing 0.500 mol of glucose (non-volatile) and 9.50 mol of water at 100 °C? (Need to consider what is the vapor pressure of water at this temperature.) (A) 0.0500 atm (B) 0.950 atm (C) 1.00 atm (D) 1.05 atm (E) none of these

36) When 0.60 grams of a non-electrolyte unknown compound is dissolved in 10 grams of water, the freezing point of the solution is -1.86°C. Given that the freezing point of pure water is 0°C and that the freezing-point depression constant for water is 1.86 °C/mol/kg, calculate the molecular mass (g/mol) of the unknown compound. A) 166 B) 60 C) 207 D) 1097

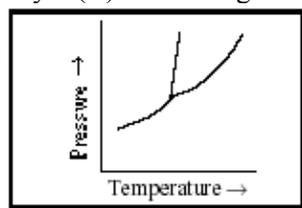
37) Calculate the osmotic pressure of a 0.0010 M solution of a nonelectrolyte at 25°C . A. 1.6 mmHg B. 7.3 mmHg C. 14 mmHg D. 19 mmHg

38) This curve is produced when a pure substance is heated. Which characteristic of this curve is related to the value for the enthalpy of vaporization of the substance?



A) length of AB (B) length of BC (C) slope of AB (D) slope of CD (E) length of DE

39) According to the phase diagram below, which phases exist at pressures lower than the triple point pressure? (A) gas only (B) solid and gas only (C) liquid only (D) solid and liquid only



40) Graphite is a two dimensional _____ solid. A) ionic B) molecular C) network D) metallic