

CHM 211 FINAL EXAM

$$h = 6.63 \times 10^{-34} \text{ J}\cdot\text{s}$$

$$c = 3.00 \times 10^8 \text{ m}\cdot\text{s}^{-1}$$

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

- The density of iron is $7.9 \text{ g}/\text{cm}^3$. What is the volume of a 450 g iron block?
a) 3400 cm^3 b) 0.018 cm^3 c) 57 cm^3 d) 460 cm^3 e) 440 cm^3
- Report the answer for the following problem in the correct number of significant digits
$$\frac{41.83}{7.44} + 6.3$$

a) 11.9223 b) 11.9 c) 12 d) 11.92 e) 11.922
- Which of the following statements is not correct?
a) Sodium and chlorine are elements.
b) Sodium chloride is a compound.
c) Sodium chloride is a pure substance.
d) Sodium chloride is a heterogeneous mixture.
e) Sodium chloride added to water forms a solution.
- Body temperature is 37°C . What is this temperature in K?
a) 77 K b) -12.6 K c) 310 K d) -236 K e) 74 K
- What length in cm is equal to 0.125 km?
a) 0.0125 cm b) 12500 cm c) 1.25 cm d) 12.5 cm e) 125 cm
- A $^{23}\text{Na}^+$ ion has ___ protons, ___ neutrons, and ___ electrons.
a) 11,12,11 b) 10,11,12 c) 23,12,22 d) 11,12,10
- Chlorine, sodium and argon are, in order, members of what families?
a) Noble gases, alkali metals, chalcogens
b) Halogens, alkali metals, noble gases
c) Halogens, alkali earth metals, noble gases
d) Chalcogens, alkali metals, noble gases
e) Alkaline earth metals, halogens, chalcogens
- What is the correct formula of calcium nitrate?
a) Ca_3N_2 b) CaNO_3 c) Ca_2NO_3 d) $\text{Ca}(\text{NO}_3)_2$ e) Ca N_2

9. What primary subatomic particles are found in the nucleus?
- a) Protons and electrons c) Protons, neutrons and electrons e) Protons only
b) Protons and neutrons d) Electrons and neutrons
10. What is the name for N_2O_3 ?
- a) nitrogen trioxygen c) nitrogen trioxide e) trinitrogen dioxide
b) dinitrogen trioxygen d) dinitrogen trioxide
11. How many moles of SO_3 are there in a 24 gram sample?
- a) 56 b) 12 c) 0.60 d) 0.38 e) 0.30
12. 3.01×10^{24} molecules of CO_2 is how many moles?
- a) 5.0 b) 0.20 c) 0.50 d) 0.050 e) 50
13. An oxide of phosphorous contains 43.7% P and 56.3% O. It has a molecular weight of 284 g/mole. What is the molecular formula of the compound?
- a) P_2O_5 b) P_2O_3 c) P_4O_{10} d) P_2O_6 e) P_4O_6
14. Given the reaction:
- $$\text{N}_2\text{H}_4 + 4 \text{F}_2 \rightarrow \text{N}_2\text{F}_4 + 4 \text{HF}$$
- What quantity of HF will result from the reaction of 8.0 grams of N_2H_4 ?
- a) 32 g b) 8.0 g c) 80 g d) 5.0 g e) 20 g
15. When 48.0 g of nitrogen reacts with an excess of hydrogen, it gives a yield of 5.90 g of NH_3 . What is the percent yield of NH_3 for the experiment?
- $$\text{N}_2 + 3 \text{H}_2 \rightarrow 2 \text{NH}_3$$
- a) 82.3% b) 58.3% c) 10.1% d) 60.7% e) 22.3%
16. What is the molarity of a phosphoric acid, H_3PO_4 , solution containing 175 g of the acid in 800 mL of solution?
- a) 0.56 M b) 0.70 M c) 1.42 M d) 1.79 M e) 2.23 M
17. What is the molarity of a 300 mL solution of 5.0 M HCl after the addition of 600 mL of water?
- a) 1.67 M b) 2.50 M c) 1.0 M d) 15 M e) 10 M
18. HNO_3 is a _____.
- a) non-electrolyte c) weak electrolyte e) weak base
b) strong electrolyte d) neutral solution

19. Which ion(s) is/are spectator ions in the formation of a precipitate of AgBr after combining aqueous solutions of CoBr₂ and AgNO₃?
- a) Co⁺² and NO₃⁻ c) Co⁺² and Ag⁺
 b) NO₃⁻ and Br⁻ d) Br⁻
20. What volume of a 0.76 M KOH solution is needed to neutralize 100 mL of 4.0 M H₂SO₄?
- a) 0.53 L b) 1.1 L c) 2.2 L d) 1.1 mL e) 800 mL
21. From the following thermochemical equation, calculate the amount of heat released when 1.57 moles of Na₂O₂ are reacted in excess water?
- $$2\text{Na}_2\text{O}_{2(s)} + 2\text{H}_2\text{O}_{(l)} \rightarrow 4\text{NaOH}_{(aq)} + \text{O}_{2(g)} \quad \Delta H = -126 \text{ kJ}$$
- a) 98.9 kJ b) 126 kJ c) 198 kJ d) 396 kJ e) 791 kJ
22. For a given process at constant pressure, ΔH is positive. This means that the process is:
- a) exothermic b) endothermic c) equithermic d) a state function
23. What is the mass of an aluminum sample if 819 J caused its temperature to increase from 25°C to 51°C? (C_s = 0.90 J/g-K)
- a) 7.53 g b) 17.8 g c) 18.6 g d) 28.4 g e) 35.0 g
24. What is ΔH°_{rxn} for the following reaction:
- $$\text{C}_3\text{H}_{8(g)} + 5\text{O}_{2(g)} \rightarrow 3\text{CO}_{2(g)} + 4\text{H}_2\text{O}_{(g)}$$
- a) -2044 kJ d) -1764 kJ
 b) -505.5 kJ e) -531.5 kJ
 c) -739.2 kJ
- | Compound | ΔH° _f (kJ/mol) |
|----------------------------------|---------------------------|
| C ₃ H _{8(g)} | -103.85 |
| CO _{2(g)} | -393.5 |
| H ₂ O _(g) | -241.82 |
25. A gas initially has a volume of 2.58 L at a pressure of 0.92 atm. If the gas is compressed to 1.53 L, what is the resulting pressure of the gas?
- a) 0.64 atm b) 1.55 atm c) 0.55 atm d) 1.83 atm e) 3.63 atm
26. Oxygen is generated by the thermal decomposition of potassium chlorate,
- $$2\text{KClO}_{3(s)} \rightarrow 2\text{KCl}_{(s)} + 3\text{O}_{2(g)}$$
- How much KClO₃ is needed to generate 153.0 L of oxygen at 0.91 atm and 273 K?
- a) 0.34 moles b) 3.7 moles c) 8.3 moles d) 6.2 moles e) 4.1 moles
27. Which of the following gases has a density of 2.09 g/L at 19°C and 1.25 atm?
- a) CH₄ b) N₂ c) O₂ d) Ar e) CO₂
28. Which of the following gases would have the highest rms speed at room temperature?
- a) CO₂ b) H₂O c) NH₃ d) CO e) H₂

29. Which of the following assumptions in the kinetic molecular theory fails for real gases at low temperatures?
- Gases consist of large numbers of molecules in continuous, random motion.
 - The combined volume of all gas molecules is negligible relative to the total volume of the gas container.
 - Attractive and repulsive forces between gas molecules are negligible.
 - Energy is transferred between molecules during collisions but the average kinetic energy of the molecules does not change with time at constant temperature.
30. What is the wavelength (in m) of a photon that has an energy of 5.25×10^{-19} J?
- a) 3.79×10^{-7} b) 2.64×10^6 c) 2.38×10^{23} d) 4.21×10^{-24} e) 3.79×10^7
31. Which set of quantum numbers would be correct for an electron in a 2s orbital?
- a) $n=1, l=0, m_l=0$ c) $n=1, l=1, m_l=1$
b) $n=2, l=0, m_l=0$ d) $n=2, l=1, m_l=0$
32. How many unpaired electrons does a nitrogen atom have?
- a) 0 b) 1 c) 2 d) 3 e) 4
33. Which group of the periodic table contains elements with valence shell electron configuration of ns^2np^6 ?
- a) alkali metals b) chalcogens c) halogens d) noble gases e) solids
34. Which one of the following atoms has the largest radius?
- a) O b) F c) S d) Cl e) Ne
35. Which equation correctly represents the first ionization of aluminum?
- a) $Al^-(g) \rightarrow Al(g) + e^-$ c) $Al(g) + e^- \rightarrow Al^-(g)$
b) $Al^+(g) + e^- \rightarrow Al(g)$ d) $Al(g) \rightarrow Al^+(g) + e^-$
36. A _____ covalent bond is the shortest.
- a) single b) double c) triple d) sigma
37. What type(s) of bonds are present in the compound $KClO_3$?
- a) ionic b) covalent c) metallic d) ionic and covalent e) ionic and metallic

Consider the following species when answering questions 38 and 39 below:

- (i) PCl_3 (ii) CH_2Cl_2 (iii) HCN (iv) $COCl_2$

38. In the Lewis structures of _____ the central atom has one lone pair of electrons.
- a) i b) ii c) iii d) iv e) i and iv

39. The Lewis structures of _____ have to have multiple bonds in order to satisfy octet on all atoms other than hydrogen.

- a) i b) iii c) iv d) ii and iii e) iii and iv

40. What is the molecular geometry of PCl_3 ?

- a) tetrahedral d) trigonal planar
b) triangular e) T- shaped
c) trigonal pyramidal

41. For resonance forms of a molecule or ion:

- a) One always corresponds to the observed structure
b) The observed structure keeps alternating between different resonance forms
c) The observed structure is an average of the resonance forms
d) The same atoms need not to be bonded to each other in all resonance forms

42. For the molecule: $\begin{array}{c} \text{H} \\ | \\ \text{H}-\text{C}-\text{C}^*=\ddot{\text{O}} \\ | \quad | \\ \text{H} \quad \text{H} \end{array}$ What is the hybridization on the indicated carbon atom?

- a) sp b) sp^2 c) sp^3 d) sp^3d e) sp^3d^2

43. In which of the following arrangements are some positions not equivalent?

- a) linear c) tetrahedral e) trigonal planar
b) octahedral d) trigonal bipyramidal

44. The Li_2^+ ion has how many π -electrons?

- a) 0 b) 1 c) 2 d) 3 e) 4

45. How many sigma (σ) and pi (π) bonds are there in CH_3COCH_3 ?

- a) 6 sigma, 1 pi c) 9 sigma, 1 pi e) 10 sigma, 0 pi
b) 6 sigma, 2 pi d) 9 sigma, 2 pi

Answers:

- | | | | | |
|-------|-------|-------------|-------|-------|
| 1) C | 11) E | 21) A | 31) B | 41) C |
| 2) B | 12) A | 22) B | 32) D | 42) B |
| 3) D | 13) C | 23) E | 33) D | 43) D |
| 4) C | 14) E | 24) A | 34) C | 44) A |
| 5) B | 15) C | 25) B | 35) D | 45) C |
| 6) D | 16) E | 26) E | 36) C | |
| 7) B | 17) A | 27) D | 37) D | |
| 8) D | 18) B | 28) E | 38) A | |
| 9) B | 19) A | 29) C(b OK) | 39) E | |
| 10) D | 20) B | 30) A | 40) C | |