Final Exam Practice Problems:

R = 0.0821 Latm/molK N_A = 6.022X10^{23} h = 6.626X10^{-34} Js

c = 2.998X10^8 m/s

1. Identify a liquid.
    A) Definite volume and definite shape.
    B) Definite volume and no definite shape.
    C) No definite volume and no definite shape.
    D) No definite volume and definite shape.

2. A substance that can't be chemically broken down into simpler substances is considered to be
    A) a homogeneous mixture.
    B) an element.
    C) a heterogeneous mixture.
    D) a compound.
    E) an electron.

3. Which of the following are examples of a chemical change?
    A) coffee brewing
    B) water boiling
    C) leaves turning color in the fall
    D) salt dissolves in water
    E) None of the above are chemical changes.

4. A student performs an experiment to determine the density of a sugar solution. She obtains the
following results: 4.11 g/mL, 4.81 g/mL, 4.95 g/mL, 3.75 g/mL. If the actual value for the
density of the sugar solution is 4.75 g/mL, which statement below best describes her results?
    A) Her results are precise, but not accurate.
    B) Her results are accurate, but not precise.
    C) Her results are both precise and accurate
    D) Her results are neither precise nor accurate.
    E) It isn't possible to determine with the information given.

5. The mass number is equal to
    A) the sum of the sum of the electrons and protons.
    B) the sum of the sum of the neutrons and electrons.
    C) the sum of the number of protons, neutrons, and electrons.
    D) the sum of the number of protons and neutrons.

6. Which of the following statements about subatomic particles is TRUE?
    A) A neutral atom contains the same number of protons and electrons.
    B) Protons have about the same mass as electrons.
    C) Electrons make up most of the mass of an atom.
    D) Protons and neutrons have opposite, but equal in magnitude, charges.
    E) Neutrons and electrons are found in the nucleus of an atom.

7. Write the formula for barium nitrite.
    A) Ba_3N_2
    B) $BaNO_3$
    C) BN
    D) $Ba(NO_2)_2$
    E) $B(NO_2)_3$

8. Calculate the molar mass for $Mg(ClO_4)_2$.
    A) 223.21 g/mol
    B) 123.76 g/mol
    C) 119.52 g/mol
    D) 247.52 g/mol
    E) 75.76 g/mol

9. What is the average mass, in grams, of one atom of iron?

10. The percent composition by mass of a compound is 76.0% C, 12.8% H, and 11.2% O. The molar mass of this compound is 284.5 g/mol. What is the molecular formula of the compound?

    A. $C_{10}H_6O$
    B. $C_9H_{18}O$
    C. $C_{16}H_{28}O_4$
    D. $C_{20}H_{12}O_2$
    E. $C_{18}H_{36}O_2$

11. How many grams of Cl_2 can be prepared from the reaction of 16.0 g of MnO_2 and 30.0 g of HCl according to the following chemical equation?

    $$MnO_2 + 4HCl \rightarrow MnCl_2 + Cl_2 + 2H_2O$$

12. Based on the solubility rules, which one of these compounds should be *insoluble* in water?

    A. $NaCl$
    B. $MgBr_2$
    C. $FeCl_2$
    D. $AgBr$
    E. $ZnCl_2$

13. How many sodium atoms are there in 6.0 g of Na_3N?

14. A sample of a gas occupies 1.40×10^3 mL at 25°C and 760 mmHg. What volume will it occupy at the same temperature and 380 mmHg?

15. A 20.00 mL sample of 0.1015 M nitric acid is introduced into a flask, and water is added until the volume of the solution reaches 250. mL. What is the concentration of nitric acid in the final solution?

16. Octane (C_8H_{18}) undergoes combustion according to the following thermochemical equation:

$2C_8H_{18}(l) + 25O_2(g) \rightarrow 16CO_2(g) + 18H_2O(l)$ = -11,020 kJ/mol
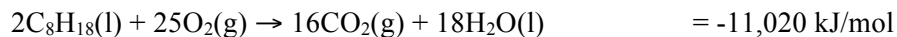
Given that $[CO_2(g)]$ = -393.5 kJ/mol and $[H_2O(l)]$ = -285.8 kJ/mol, calculate the standard enthalpy of formation of octane.

    A.   -210 kJ/mol
    B.   -11,230 kJ/mol
    C.   22,040 kJ/mol
    D.   -420 kJ/mol
    E.   420 kJ/mol

17. Which of these atoms has the largest radius?

    A.   B
    B.   Ga
    C.   Br
    D.   Si
    E.   Cl

18. Which of these elements has the greatest electronegativity?

    A.   Li
    B.   As
    C.   K
    D.   N
    E.   Be

19. According to the VSEPR theory, the molecular shape of ammonia is

    A.   linear.
    B.   trigonal planar.
    C.   bent.
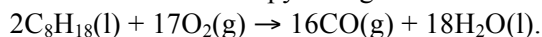   D.   tetrahedral.
    E.   trigonal pyramidal.

20. A liquid boils when its

    A.   vapor pressure is exactly 1 atmosphere.
    B.   vapor pressure is equal to, or greater than, the external pressure pushing on it.
    C.   temperature is equal to 273 K (standard temperature).
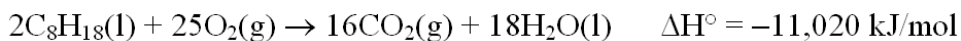   D.   temperature is greater than room temperature.

21. The electron configuration of a ground-state copper atom is

    A. $[Ar]4s^24d^4$.
    B. $[Ar]4s^24p^63d^3$.
    C. $[Ar]4s^23d^9$.
    D. $[Ar]3d^9$.
    E. $[Ar]4s^13d^{10}$.

22. Calculate the standard enthalpy change for the reaction
        $2C_8H_{18}(l) + 17O_2(g) \rightarrow 16CO(g) + 18H_2O(l)$.

    Given:
    $2C_8H_{18}(l) + 25O_2(g) \rightarrow 16CO_2(g) + 18H_2O(l)$ $\Delta H° = -11{,}020$ kJ/mol
    $2CO(g) + O_2(g) \rightarrow 2CO_2(g)$ $\Delta H° = -566.0$ kJ/mol

    A.   10,450 kJ/mol
    B.   6,492 kJ/mol
    C.   15,550 kJ/mol
    D.   -6,492 kJ/mol
    E.   -10.450 kJ/mol

23. Which set of quantum numbers if allowed?

	n	l	m_l	m_s
A	1	0	-1	-1/2
B	1	0	0	+1/2
C	1	0	1	-1/2
D	1	1	0	+1/2

24. Which two electron configurations represent elements that would have similar chemical properties?
    (1) $1s^22s^22p^4$
    (2) $1s^22s^22p^5$
    (3) $[Ar]4s^23d^{10}4p^3$
    (4) $[Ar]4s^23d^{10}4p^4$

    A.   (1) and (2)
    B.   (1) and (3)
    C.   (1) and (4)
    D.   (2) and (4)
    E.   (2) and (3)

25. Draw a Lewis Dot Structure for CH_2Cl_2

26. Determine the name for P_4O_{10}.
A) phosphorus (IV) oxide
B) diphosphorus pentoxide
C) phosphorus oxide
D) phosphorus (II) oxide
E) tetraphosphorus decoxide

27. How many C_2H_4 molecules are contained in 45.8 mg of C_2H_4? The molar mass of C_2H_4 is 28.05 g/mol.

28. Determine the empirical formula for a compound that is 36.86% N and 63.14% O by mass.

29. How many moles of oxygen are formed when 58.6 g of KNO_3 decomposes according to the following reaction? The molar mass of KNO_3 is 101.11 g/mol.

$$4\ KNO_3(s)\ \rightarrow\ 2\ K_2O(s) + 2\ N_2(g)\ + 5\ O_2(g)$$
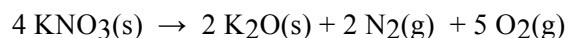
30. Give the **complete ionic equation** for the reaction (if any) that occurs when aqueous solutions of lithium sulfide and copper (II) nitrate are mixed.
A) $Li^+ (aq) + SO_4^{2-}(aq)\ + Cu^+(aq)\ + NO_3^-(aq)\ \rightarrow CuS(s) +\ Li^+(aq)\ + NO_3^-(aq)$
B) $Li^+ (aq) + S^-(aq)\ + Cu^+(aq)\ + NO_3^-(aq)\ \rightarrow CuS(s) +\ LiNO_3(aq)$
C) $2\ Li^+(aq) + S^{2-}(aq)\ + Cu^{2+}(aq)\ + 2\ NO_3^-(aq)\ \rightarrow Cu^{2+}(aq) + S^{2-}(aq)\ + 2\ LiNO_3(s)$
D) $2\ Li^+(aq) + S^{2-}(aq)\ + Cu^{2+}(aq) + 2\ NO_3^-(aq)\ \rightarrow CuS(s) + 2\ Li^+(aq) + 2\ NO_3^-(aq)$
E) No reaction occurs.

31. The titration of 25.0 mL of an unknown concentration H_2SO_4 solution requires 83.6 mL of 0.12 M LiOH solution. What is the concentration of the H_2SO_4 solution (in M)?

32. A large balloon is initially filled to a volume of 25.0 L at 353 K and a pressure of 2575 mm Hg. What volume of gas will the balloon contain at 1.35 atm and 253 K?

33. A mixture of 0.220 moles CO, 0.350 moles H_2 and 0.640 moles He has a total pressure of 2.95 atm. What is the pressure of CO?

34. Use Lewis theory to determine the chemical formula for the compound formed between Mg and Br.

35. Give the change in condition to go from a liquid to a gas.
    A) Increase heat or reduce pressure
    B) Increase heat or increase pressure
    C) Cool or reduce pressure
    D) Cool or increase pressure
    E) None of the above

36. Draw the best Lewis structure for the free radical, NO_2^- What is the formal charge on the N?
A) 0
B) +1
C) -1
D) +2
E) -2

37. What element is undergoing oxidation (if any) in the following reaction?

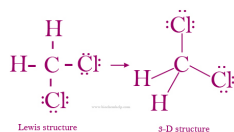$$CH_4(g) + 2 \ O_2(g) \rightarrow CO_2(g) + 2 \ H_2O(g)$$
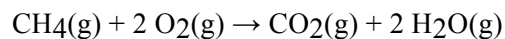
A) O
B) H
C) C
D) both C and H
E) None of the elements is undergoing oxidation.

38. Determine the oxidation state of P in PO_3^{3-}.

Answers:
1. B
2. B
3. C
4. D
5. D
6. A
7. D
8. A
9. 9.28×10^{-23} grams
10. E
11. 13.0 grams
12. D
13. 1.30×10^{23} Na atoms
14. 2.8 L
15. 8.12×10^{-3} M
16. A
17. B
18. D
19. E
20. B
21. C
22. D
23. B
24. C

25.

26. E
27. 9.8×10^{20} atoms
28. N_2O_3
29. 0.724 moles O_2
30. D
31. 0.401 M H_2SO_4
32. 48.1 L
33. 0.54 atm
34. $MgBr_2$
35. A
36. A
37. C
38. +3