Kor

# Chem 11 Final Exam Mult. Choice Practice

Instructions: For each question, select the **BEST** answer from those provided and circle the letter corresponding to your choice. Transfer your answers to the answer form provided.

1. Express 165,000 in exponential notation

   a) 1.65000×10^5 (b) 1.65×10^5
   c) 1.6500×10^{-5} d) 1.65×10^{-5}
   e) 165×10^3

   1.65×10^5

2. How many significant figures are there in the number 3.14000?

   a) 1   b) 2
   c) 3   d) 4
   (e) 5

3. Using the rules of significant figures, calculate the following:
   $4.0021 - 0.004$

   (a) 3.998   b) 4
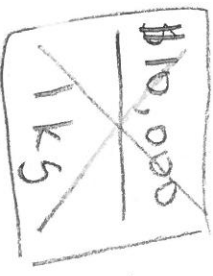   c) 3.9981   d) 4.00
   e) 4.0
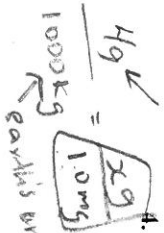
4. It is estimated that uranium is relatively common in the earth's crust, occurring in amounts of 4g/metric ton. A metric ton is 1000kg. At this concentration, what mass of uranium is present in 1.0mg of the earth's crust?

   (a) 4 nanograms   b) 4 micrograms
   (c) 4 milligrams   d) 4×10^{-5} grams
   e) 4 centigrams

   $\frac{4g}{1000kg} = \frac{x g}{1.0 mg}$
   uranium
   $1000kg \rightarrow$ earth's crust

5. A titration was performed to find the concentration of hydrochloric acid with the following results:

Trial	Molarity
1	1.25 +/- 0.01
2	1.24 +/- 0.01
3	1.26 +/- 0.01

   The actual concentration of HCl was determined to be 1.000M; the results of the titration are:

   a) both accurate and precise
   b) accurate but imprecise
   (c) precise but inaccurate
   d) both inaccurate and imprecise
   e) accuracy and precision are impossible to determine with the available information.

6. The state of matter for an object that has definite volume but not a definite shape is

   a) solid   (b) liquid
   c) gas   d) elemental
   e) mixed

7. In 1928, rhenium cost $10,000/kg. It now costs $40/troy ounce. What is the present cost of one gram of rhenium? (1 troy ounce = 31.10g)

   a) less than $1.00   (b) between $10 and $10
   c) between $10 and $50   d) between $50 and $100
   e) over $100

   $\frac{\$10,000}{1 kg} = \frac{\$40}{31.10g}$

   $\frac{\$40}{31.10g} = \$40$

8. A 20.0mL sample of glycerol has a mass of 25.2g. What is the mass of a 53mL sample of glycerol?

   a) 66.8g   (b) 67g
   c) 25.2g   d) 9.5g
   e) 42g

9. A solution is also called a

   (a) homogeneous mixture   b) heterogeneous mixture
   c) pure mixture   d) compound
   e) distilled mixture

10. A method of separation that employs a system with two phases of matter, a mobile phase and a stationary phase, is called

a) filtration
b) chromatography
c) distillation
d) vaporization
e) homogenization

11. Which of the following pairs of compounds can be used to illustrate the law of multiple proportions?

a) NH_4 and NH_4Cl
b) ZnO_2 and $ZnCl_2$
c) H_2O and HCl
d) NO and NO_2
e) CH_4 and CO_2

12. Rutherford's experiment was important because it showed that:

a) radioactive elements give off alpha particles
b) gold foil can be made to be only a few atoms thick
c) a zinc sulfide screen scintillates when struck by a charged particle
d) the mass of the atom is uniformly distributed throughout the atom
e) an atom is mostly empty space

13. The element rhenium (Re) exists as two stable isotopes and 18 unstable isotopes. Rhenium-185 has in its nucleus

a) 75 protons, 75 neutrons
b) 75 protons, 130 neutrons
c) 130 protons, 75 neutrons
d) 75 protons, 110 neutrons
e) not enough information is given

14. $^{40}_{20}Ca^{2+}$ has

a) 20 protons, 20 neutrons, and 18 electrons
b) 20 protons, 20 neutrons, and 20 electrons
c) 20 protons, 22 neutrons, and 18 electrons
d) 22 protons, 18 neutrons, and 18 electrons
e) 20 protons, 20 neutrons, and 22 electrons

15. Which of the following pairs is **incorrect**?

a) NH_4Br, ammonium bromide
b) K_2CO_3, potassium carbonate
c) $BaPO_4$, barium phosphate
d) $CuCl$, copper(I) chloride
e) MnO_2, Manganese(IV) oxide

16. Naturally occurring copper exists in two isotopic forms: ^{63}Cu and ^{65}Cu. The atomic mass of copper is 63.55amu (or g/mol). What is the approximate natural abundance of ^{63}Cu?

a) 63%
b) 90%
c) 70%
d) 50%
e) 30%

17. What is the molar mass of ethanol (CH_3CH_2OH)?

a) 45.07
b) 38.90
c) 46.07
d) 34.17
e) 62.07

18. Roundup, an herbicide manufactured by Monsanto, has the formula $C_3H_8NO_5P$. How many moles of molecules are there in a 5.00×10^2 g sample of Roundup?

a) 0.338
b) 1.75
c) 2.96
d) 84.5
e) none of these

19. Which compound contains the highest percent by mass of hydrogen?

a) HCl
b) H_2O
c) H_2SO_4
d) H_2S
e) HF

20. What is the coefficient for water when the following equation in balanced?

$$As(OH)_{3(s)} + H_2SO_{4(aq)} \rightarrow As_2(SO_4)_{3(aq)} + H_2O_{(l)}$$

a) 1
b) 2
c) 4
d) 6
e) 12

21. An oxide of iron has the formula Fe_3O_4. What mass percent of iron does it contain?

a) 0.72%
b) 28%
c) 30.%
d) 70.%
e) 72%

22. Adipic acid contains 49.32% C, 43.84% O, and 6.85% H by mass. What is the empirical formula?

a) $C_3H_5O_2$
b) $C_3H_3O_4$
c) C_2HO_3
d) $C_2H_5O_4$
e) C_3HO_3

23. The empirical formula of styrene is CH; its molar mass is 104.1g/mol. What is the molecular formula of styrene?

a) C_2H_4
b) C_8H_8
c) $C_{10}H_{12}$
d) C_6H_6
e) none of these

24. When 125.0g of ethylene (C_2H_4) burns in oxygen, how many grams of CO_2 are formed?
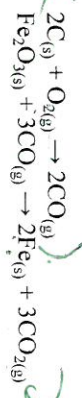
a) 392.2g
b) 250.0g
c) 57.50g
d) 425.6g
e) 327.0g

25. When the following equation is balanced, what is the sum of the coefficients?

$$Al_2(SO_4)_3 + Ca(OH)_2 \rightarrow Al(OH)_3 + CaSO_4$$

a) 4
b) 9
c) 8
d) 3
e) 10

26. Iron is produced from its ore by the reactions:

$$2C_{(s)} + O_{2(g)} \rightarrow 2CO_{(g)}$$
$$Fe_2O_{3(s)} + 3CO_{(g)} \rightarrow 2Fe_{(s)} + 3CO_{2(g)}$$

$\frac{3}{2}\left(2C_{(s)} + O_{2(g)} \rightarrow 2CO_{(g)}\right)$

How many moles of $O_{2(g)}$ are needed to produce 1 mole of $Fe_{(s)}$?

a) 0.5mol O_2
b) 0.75mol O_2
c) 1mol O_2
d) 1.5mol O_2
e) none of these

$\frac{3}{2} O_2 \rightarrow 2Fe$

$\frac{3}{4} O_2 \rightarrow 1Fe$

27. Consider the following reaction:

$$CH_{4(g)} + 4Cl_{2(g)} \rightarrow CCl_{4(g)} + 4HCl_{(g)}$$

What mass of CCl_4 will be produced if 1.20mol of methane react with 1.60mol of chlorine?

a) 229g
b) 171g
c) 114g
d) 61.5g
e) 17.1g

28. A 54.8g sample of $SrCl_2$ is dissolved in 112.5mL of solution. Calculate the molarity of this solution.

a) 0.346M
b) 3.07M
c) 3.96M
d) 8.89M
e) none of these

29. What volume of 18.0M sulfuric acid must be used to prepare 15.5L of 0.195M H_2SO_4?

a) 226mL
b) 0.336L
c) 92.3mL
d) 168mL ✓
e) none of these

30. What mass of NaOH is required to titrate 25.0mL of 1.2M H_2SO_4?

a) 1.2g
b) 1.8g
c) 2.4g ✓
d) 3.5g
e) none of these

31. You have two solutions: 75.0mL of a 2.50M Na_2CrO_4 solution, and 125mL of a 2.50M $AgNO_3$ solution. Calculate the $[Na^+]$ after the two solutions are added together.

a) 0.00M
b) 0.938M
c) 2.50M
d) 1.88M ✓
e) 5.00M

32. The electron configuration of S^{3+} is

a) $[Ne]3s^23p^6$
b) $[Ne]3s^23p^8$
c) $[Ne]3s^23p^1$ ✓
d) $[Ar]4s^1$
e) none of these

33. All halide elements have the following number of valence electrons

a) 1
b) -1
c) 8
d) 3
e) 7 ✓

34. How many unpaired electrons are there in an atom of elemental sulfur?

a) 1
b) 2 ✓
c) 3
d) 4
e) 0

35. Order the elements S, Cl, and F in terms of increasing ionization energy.

a) S, Cl, F ✓
b) Cl, F, S
c) F, S, Cl
d) F, Cl, S
e) S, F, Cl

36. Which of the following statements is **incorrect**?

a) Ionic bonding results from the transfer of electrons from one atom to another.
b) Dipole moments result from the unequal distribution of electrons within a molecule.
c) The electrons in a polar bond are found nearer to the more electronegative element.
d) A molecule with very polar bonds can be nonpolar.
e) Linear molecules cannot have a net dipole moment. ✓

37. Atoms with very similar electronegativities are expected to form

a) no bonds
b) covalent bonds ✓
c) triple bonds
d) ionic bonds
e) strong dipole moments

38. Metals typically have _____ electronegativity values.

a) High
b) Low ✓
c) Negative
d) No
e) Two of these

39. Which of the following bonds would be least polar yet still be considered polar covalent?

a) Mg-O
b) C-O
c) O-O
d) Si-O ✓
e) N-O

40. Which of the following has an incomplete octet in its Lewis structure?

a) NO ✓
b) ICl
c) CO_2
d) F_2

4. Use the VSEPR theory to complete the following table.

Left-margin calculations (top to bottom):

CCl₃Br:
$3Cl = 21$
$1Br = 7$
$1C = 4$
$\overline{32}$

BF₃:
$3F = 21$
$1B = 3$
$\overline{24}$

HOCl:
$1Cl = 7$
$1O = 6$
$1H = 1$
$\overline{14}$

PH₃:
$1P = 5$
$3H = 3$
$\overline{8}$

I₂:
$2F = 14$

Compound	Lewis Diagram	Shape	Polar/Nonpolar	# of LP	# of BP
CCl₃Br	(Br–C–Cl with Cl's)		Polar	0	4
BF₃	(F–B–F with F)		n-p	0	3
HOCl	(Cl–O–H)		Polar	2	2
PH₃	(H–P–H with H)		Polar	1	3
I₂	(I–I)		n-p	N/A	N/A

NOTE: # of LP = number of lone pairs around the central atom
# of BP = number of bonding pairs around the central atom

5. List three differences between ionic and covalent compounds. Give an example of each.

Ionic
- Solids @ room temp
- dissolve to make conductive solns
- high melting + boiling pts

Covalent
- Solid, liquid or gas
- dissolve yet do not make conductive solns
- lower melting + boiling pts

6. Show all work for the following questions. Be sure to include the correct number of significant digits, and circle final answers.

a) How many grams of SnF₂ can be made by reacting 7.98×10^{22} molecules of HF with tin?

$$Sn + 2HF \rightarrow SnF_2 + H_2$$

$1\ Sn = 118.7$
$2\ F = 38.0$
$\overline{156.7\ g}$

$$7.98 \times 10^{22}\ mc.\ HF \times \frac{1\ mol\ HF}{6.02 \times 10^{23}\ mc.} \times \frac{1\ mol\ SnF_2}{2\ mol\ HF} \times \frac{156.7\ g\ SnF_2}{1\ mol\ SnF_2}$$

$$= \boxed{10.4\ g\ SnF_2}$$

b) How many liters of nitrogen dioxide are produced when 3.54 g of oxygen reacts with an excess of nitrogen monoxide? (Assume STP)

$$2NO + O_2 \rightarrow 2NO_2$$

$$3.54\ g\ O_2 \times \frac{1\ mol\ O_2}{32.0\ g\ O_2} \times \frac{2\ mol\ NO_2}{1\ mol\ O_2} \times \frac{22.4\ L\ NO_2}{1\ mol\ NO_2}$$

$$= \boxed{4.96\ L\ NO_2}$$

7. Write **balanced** equations for the following chemical reactions. ✗ include the states of matter.

a) mercury and oxygen are prepared by heating mercury(II) oxide

$2HgO(s) \longrightarrow 2Hg(\ell) + O_2(g)$
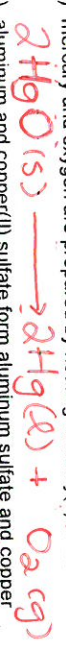
b) aluminum and copper(II) sulfate form aluminum sulfate and copper

$2Al(s) + 3CuSO_4(aq) \longrightarrow Al_2(SO_4)_3(aq) + 3Cu(s)$

c) ammonium sulfate and calcium hydroxide react to produce calcium sulfate and ammonium hydroxide

$(NH_4)_2SO_4(aq) + Ca(OH)_2(aq) \longrightarrow CaSO_4(s) + 2NH_4OH(aq)$

d) aluminum and chlorine react to form aluminum chloride

$2Al(s) + 3Cl_2(g) \longrightarrow 2AlCl_3(s)$

e) decane ($C_{10}H_{22}$) burns in the presence of oxygen to produce carbon dioxide and water

$C_{10}H_{22}(\ell) + O_2(g) \longrightarrow CO_2(g) + H_2O(g)$

8. Identify the type of each reaction in the question above.

a) Decomposition
b) single replacement
c) double replacement
d) synthesis
e) combustion

9. Complete the following table.

Electron Configuration	Name of Element	Symbol of Element	# of Unpaired Electrons	# of Valence Electrons
$1s^2 2s^2 2p^6 3s^1$	Sodium	Na	1	1
$1s^2 2s^2 2p^3$	Nitrogen	N	3	5
$1s^2 2s^2 2p^6 3s^2 3p^6 3d^{10} 4s^2 4p^4$	Selenium	Se	2	6

10. Why can't the ionic compound KCl be represented by the following diagram?

K—Cl

$\therefore [K]^+ [\overset{\cdot\cdot}{\underset{\cdot\cdot}{\cdot Cl \cdot}}]^-$

it does not "share" electrons
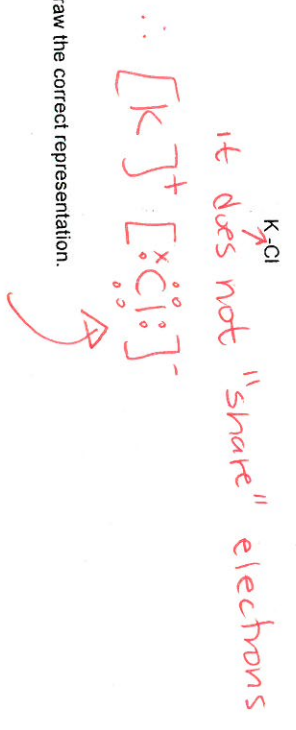
Draw the correct representation.

11. Define electronegativity – the tendency of an atom to attract electrons from neighbouring atoms

Using electronegativity values, determine the type of bond between the following: (Show work.)

a) C and Cl

$2.8 - 2.5 = 0.3$ true covalent

b) O and O

$3.5 - 3.5 = 0.0$ true covalent

c) Mg and F

$3.9 - 1.2 = 2.7$ ionic

12. Define the following terms:

a) catalyst – Substance that speeds up a chemical rxn.

b) limiting reagent – substance that determines the amount of product that can form.

c) electron configuration – the current understanding of electron placement according to the quantum mechanic models

d) valence electron – electrons involved in the "bonding"

e) lone pair – an un-bonding pair of electrons