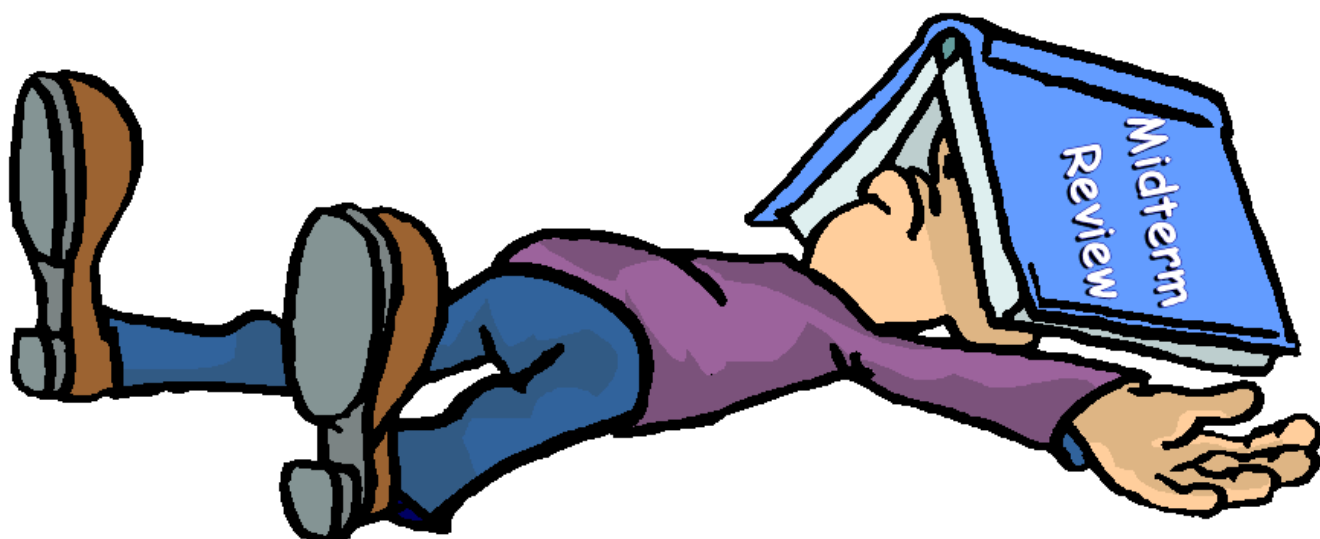




Chemistry 11

Midterm Review Package



- **Unit 1: Measurement**
- **Unit 2: Matter & Naming**
- **Unit 3: The Mole**
- **Unit 4: Chemical Reactions**

Name: _____

Block: _____

Study Checklist

This review booklet is by no means a "practice final". It is a collection of practice questions on each unit, meant to guide your final exam studying and prepare you for the types of questions you are likely to see. DO NOT treat this booklet as a practice test. If you're stuck on a question, look it up and ask for help! DO NOT go straight to the answer key when you come across a question you cannot remember how to do. Difficult questions SHOULD guide your study! Always look up a concept in your class notes if you are stuck, then attempt the question again.

BEFORE beginning this booklet you should:

- read through your class notes booklet on each topic
- make your own "quick summary page" of important formulas & key concepts for the unit
- review quizzes & tests from the unit to recall strengths & weaknesses (*a great study method would be to re-do old quizzes & tests on a separate piece of paper*)

WHILE working through this booklet you should:

- look up concepts & example problems in your class notes when you come across a problem you are stuck on
- make a list of "questions to ask my teacher" so you can come to class and use your time efficiently.

Questions I'm having difficulty with:

Page	Question Number #	Topic

1. Measurement and Communication:

A. Scientific Notation:

- Conversion of numbers from decimal into scientific notation and vice versa

B. Uncertainty in Measurement

- Difference between accuracy and precision
- Significant figures (multiplication, division, adding and subtracting)

C. Unit Conversions

- metric SI prefixes (milli, centi, micro, etc.)
- converting between units (ie. millimetres to micrometres, etc.)

2. Classification of Matter

A. Matter: (text pgs. 65-73)

- definition of matter
- states of matter – solid, liquid, gas, plasma
- properties of matter – physical properties (hardness, malleability, ductility, luster, viscosity, diffusion, vapor, vapor pressure, boiling point, melting point, freezing point)
- changes in matter – physical and chemical changes
- Law of Conservation of Matter (mass)

B. Classification of Matter (text pgs. 74-76)

- Matter Map –
- differences between heterogeneous and homogeneous mixtures
- solvent, solute, aqueous solution
- atom, ion, molecule

C. Separation Techniques for Mixtures (text pgs. 77-79)

- know the techniques and when they are used/what they separate (mechanical separation, evaporation, filtration, floatation, settling, electrolysis, centrifugation, distillation, crystallization, chromatography)

2. Inorganic Naming:

A. Names and Formulae of Ionic and Molecular Compounds (text pgs. 231-234, 244-247)

- properties of ionic compounds vs. molecular compounds
- writing formulae for ionic and covalent compounds
- naming ionic and covalent compounds
- names and formulae for ionic hydrates

B. Names and Formulae of Acids and Base compounds (text pgs. 248-249)

- properties of acid and base compounds
- rules for naming acids

1. Measurement and Communication:

2. Classification of Matter

3. The Mole:

A. Molar Mass (text pgs. 311-322)

B. Mole Conversions (text pgs. 323-331)

- Converting between moles and atoms/molecules
(Avogadro's number; 1 mole = 6.022×10^{23} atoms/molecules/particles)
- Converting between moles and mass (grams)
- Multi-step conversions (ie. grams to moles to molecules)
- Conversions using molar volume (litres per mole) of a gas
(at STP 1 mole = 22.4L)

C. Percentage Composition, Empirical and Molecular Formulae (text pgs. 332-339)

D. Molarity (Molar concentration = M)

- Calculating molarity (mol/L) using unit conversions
- Dilutions ($m_1v_1 = m_2v_2$)

4. Chemical Reactions and Equations:

A. Balancing Equations (text pgs. 282-289)

B. Classifying Reaction Types (text pgs. 291-296)

- synthesis, decomposition, single replacement, double replacement, neutralization, combustion
- predicting products of reactions

C. Energy of Reactions

- exothermic and endothermic reactions

-

Unit 1: Measurement & Communication

- ___ 32. Standards of measurement are chosen because they
- can be related to everyday objects.
 - are reproducible in another laboratory.
 - cannot be destroyed by any common physical or chemical means.
 - are easily changed.
- ___ 33. Which of these statements does *not* describe a measurement standard?
- Measurement standards avoid ambiguity.
 - Measurement standards must be unchanging.
 - A standard can be easily changed to suit the experiment.
 - Confusion is eliminated when the correct measurement is applied.
- ___ 34. Which of these statements about units of measurement is *not* true?
- A unit compares what is being measured with a previously defined quantity.
 - A unit is usually preceded by a number.
 - Measurements can be compared without knowing their units.
 - The choice of unit depends on the quantity being measured.
- ___ 35. Which of these is *not* an SI base unit?
- kilogram
 - second
 - liter
 - Kelvin
- ___ 36. The SI base units for length and time are
- centimeter and second.
 - meter and hour.
 - centimeter and hour.
 - meter and second.
- ___ 37. The metric unit for length that is closest to the diameter of a pencil is the
- micrometer.
 - millimeter.
 - centimeter.
 - decimeter.
- ___ 38. The symbols for units of length in order from largest to smallest are
- m, cm, mm, km.
 - mm, m, cm, km.
 - km, mm, cm, m.
 - km, m, cm, mm.
- ___ 39. Which of these metric units is used to measure mass?
- m
 - mm
 - g
 - L
- ___ 40. The liter is defined as
- 1000 m^3 .
 - 1000 cm^3 .
 - 1000 g^3 .
 - 1000 c^3 .
- ___ 41. The standard base unit for mass is the
- gram.
 - cubic centimeter.
 - meter.
 - kilogram.
- ___ 42. Which of these symbols represents a unit of volume?
- mL
 - mg
 - mm
 - cm
- ___ 43. Which of these is the abbreviation for the SI base unit of time?
- hr
 - h
 - sec
 - s

- ___ 44. The most appropriate SI unit for measuring the length of an automobile is the
- millimeter.
 - kilometer.
 - meter.
 - liter.
- ___ 45. All of the following are SI units for density *except*
- kg/m^3 .
 - kg/L .
 - g/cm^3 .
 - g/m^2 .
- ___ 46. A change in the force of gravity on an object will affect its
- mass.
 - density.
 - weight.
 - kinetic energy.
- ___ 47. Which of these is a measure of the amount of material?
- density
 - weight
 - volume
 - mass
- ___ 48. Which of these statements about mass is true?
- Mass is expressed in pounds or newtons.
 - Mass is usually measured with a spring scale.
 - The mass of an object depends on the force of gravity acting on it.
 - The mass of an object is determined by comparing it to an object of known mass.
- ___ 49. The relationship between the mass m of a material, its volume V , and its density D is
- $D = mV$.
 - $D = V/m$.
 - $D = m/V$.
 - $D = m + v$.
- ___ 50. The density of an object is calculated by
- multiplying its mass times its volume.
 - dividing its mass by its volume.
 - dividing its volume by its mass.
 - adding its mass to its volume.
- ___ 51. When density is measured,
- a graduated cylinder is always used.
 - the units are always kg/m^3 .
 - the temperature should be specified.
 - the material must be a pure substance.
- ___ 52. Which of these statements about density is true?
- Larger objects are more dense.
 - Density does not depend on temperature.
 - Density is a physical property.
 - The density of an object depends on the force of gravity.
- ___ 53. A sample of gold has a mass of 96.5 g and a volume of 5.00 cm^3 . The density of gold is
- 0.0518 g/cm^3 .
 - 19.3 g/cm^3 .
 - 101.5 g/cm^3 .
 - 483 g/cm^3 .
- ___ 54. The density of pure diamond is 3.5 g/cm^3 . What is the volume of a diamond with a mass of 0.25 g?
- 0.071 cm^3
 - 0.875 cm^3
 - 3.75 cm^3
 - 14 cm^3
- ___ 55. What is the density of 37.72 g of material whose volume is 6.80 cm^3 ?
- 0.180 g/cm^3
 - 5.55 g/cm^3
 - 30.9 g/cm^3
 - $256. \text{ g/cm}^3$
- ___ 56. 100 milliliters is equivalent to
- 1 hectoliter.
 - 1 microliter.
 - 1 centiliter.
 - 1 deciliter.
- ___ 57. 0.25 g is equivalent to
- 250 kg.
 - 250 mg.
 - 0.025 mg.
 - 0.025 kg.

- ___ 58. 0.05 cm is the same as
- | | |
|----------------|------------|
| a. 0.000 05 m. | c. 0.05 m. |
| b. 0.005 mm. | d. 0.5 mm. |
- ___ 59. How many minutes are in 1 week?
- | | |
|-------------|----------------|
| a. 168 min | c. 10 080 min |
| b. 1440 min | d. 100 800 min |
- ___ 60. If 1 inch equals 2.54 cm, how many centimeters equal 1 yard?
- | | |
|--------------|------------|
| a. 0.0706 cm | c. 30.5 cm |
| b. 14.2 cm | d. 91.4 cm |
- ___ 61. How is the measurement 0.000 065 cm written in scientific notation?
- | | |
|----------------------------|----------------------------|
| a. 65×10^{-6} cm | c. 6.5×10^{-6} cm |
| b. 6.5×10^{-5} cm | d. 6.5×10^{-4} cm |
- ___ 62. The measurement 0.020 L is the same as
- | | |
|----------------------------|----------------------------|
| a. 2.0×10^{-3} L. | c. 2.0×10^{-2} L. |
| b. 2.0×10^2 L. | d. 2.0×10^{-1} L. |
- ___ 63. The speed of light is 300 000 km/s. In scientific notation, this speed is written to one significant figure as
- | | |
|----------------------------|----------------------------|
| a. 3×10^5 km/s. | c. $3. \times 10^6$ km/s. |
| b. 3.0×10^5 km/s. | d. 3.0×10^6 km/s. |
- ___ 64. The average distance between the Earth and the moon is 386 000 km. Expressed in scientific notation, this distance is written as
- | | |
|--------------------------|---------------------------|
| a. 386×10^3 km. | c. 3.9×10^5 km. |
| b. 39×10^4 km. | d. 3.86×10^5 km. |
- ___ 65. When 6.02×10^{23} is multiplied by 9.1×10^{-31} , the product is
- | | |
|---------------------------|----------------------------|
| a. 4.3×10^{-8} . | c. 4.3×10^{-7} . |
| b. 4.3×10^{54} . | d. 4.3×10^{-53} . |
- ___ 66. Two variables are directly proportional if their ___ has a constant value.
- | | |
|---------------|-------------|
| a. sum | c. quotient |
| b. difference | d. product |
- ___ 67. Two variables are inversely proportional if their ___ has a constant value.
- | | |
|---------------|-------------|
| a. sum | c. product |
| b. difference | d. quotient |
- ___ 68. The graphs of two variables that are inversely proportional to one another is
- | | |
|---------------------|-----------------|
| a. a straight line. | c. a parabola. |
| b. an ellipse. | d. a hyperbola. |
- ___ 69. In the equation $density = mass/volume$, mass divided by volume has a constant value. This means that the
- | |
|----------------------------------------------------------|
| a. equation graphs as a straight line. |
| b. variables mass and volume are inversely proportional. |
| c. equation graphs as a hyperbola. |
| d. product of mass and volume is a constant. |

Measurement and Communication:

1. complete the following table of prefixes.

Factor	Prefix	Abbreviation
10^6		
	kilo	
		h
10^1		
	deci	
		c
10^{-3}		
	micro	
		n
10^{-12}		

2. student weighed a mass 4 times and obtained the following masses:

25.5g, 29.6g, 23.6g, 27.3g

The actual value is known to be 10.20045g

What can be said about the accuracy and precision of the measurements?

3. write the following numbers in scientific notation with the same number of significant digits.

- a) 0.000005187 _____
b) 7,2 _____
c) 16,140 _____
d) 0.09 _____

4. convert the following numbers from scientific notation into decimal form.

- a) 4.562×10^6 _____
b) 8.276×10^{-8} _____

5. complete the following calculations. Include all units and don't forget about sig figs.

- a) $1.0068\text{g} + 2.15\text{g} + 8.3\text{g} =$
b) $21.0 \text{ m} - 12.1\text{cm} =$
c) $\frac{1.50 \times 10^{-2} \text{ mol}}{40.0\text{mL}} =$
d) $\frac{432.8\text{g}}{21.8\text{cm} \times (7.645\text{cm} - 3.58\text{cm})} =$

6. convert 12 milliamperes into megaamperes.

7. convert $42.6\mu\text{mol/mL}$ into mol/L .

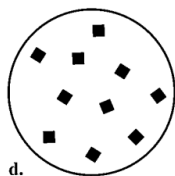
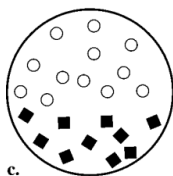
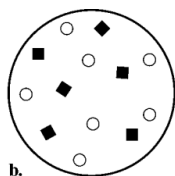
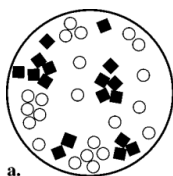
8. determine how many significant figures are in each of the following numbers:

- a) 1.00300
b) 780.
c) 0.1110
d) 30
e) 0.003050
f) 7,000,8
g) 0.005
h) 3.0

Unit 2: Matter & Naming

- ___ 1. Which of the following is an extensive property of matter?
- melting point
 - boiling point
 - volume
 - density
- ___ 2. The two most important properties of all matter are
- the ability to carry an electric current well and to hold electric charge.
 - taking up space and having mass.
 - being brittle and hard.
 - being malleable and ductile.
- ___ 3. An atom is
- the smallest unit of matter that maintains its chemical identity.
 - the smallest unit of a compound.
 - always made of carbon.
 - smaller than an electron.
- ___ 4. A compound is
- a pure substance that cannot be broken down into simpler, stable substances.
 - a substance, made of two or more atoms that are chemically bonded, that can be broken down into simpler, stable substances.
 - the smallest unit of matter that maintains its chemical identity.
 - any substance, whether it is chemically bonded or not.
- ___ 5. A measure of the quantity of matter is
- density.
 - weight.
 - volume.
 - mass.
- ___ 6. Matter includes all of the following *except*
- air.
 - light.
 - smoke.
 - water vapor.
- ___ 7. A true statement about mass is that
- mass is often measured with a spring scale.
 - mass is expressed in pounds.
 - as the force of Earth's gravity on an object increases, the object's mass increases.
 - mass is determined by comparing the mass of an object with a set of standard masses that are part of a balance.
- ___ 8. A student recorded the following while completing an experiment.
Color of substance: yellow, shiny powder
Effect of magnet: yellow, shiny powder was attracted
The student should classify the substance as a(n)
- element.
 - compound.
 - mixture.
 - plasma.
- ___ 9. Which of the following is *not* a physical change?
- grinding
 - cutting
 - boiling
 - burning
- ___ 10. Which of the following is *not* a chemical change?
- rusting
 - igniting
 - melting
 - burning
- ___ 11. A physical change occurs when a
- peach spoils.
 - silver bowl tarnishes.
 - bracelet turns your wrist green.
 - glue gun melts a glue stick.

- ___ 12. Nitrogen monoxide and oxygen, both colorless gases, form a red-brown gas when mixed. Nitrogen monoxide and oxygen are called the
- products.
 - equilibria.
 - synthetics.
 - reactants.
- ___ 13. A state of matter in which a material has no definite shape but has a definite volume is the ___ state.
- gas
 - liquid
 - plasma
 - solid
- ___ 14. Under ordinary conditions of temperature and pressure, the particles in a gas are
- closely packed.
 - very far from one another.
 - held in fixed positions.
 - unevenly distributed.
- ___ 15. The liquid state of matter can be described as
- having definite shape and definite volume.
 - having neither a definite shape nor a definite volume.
 - having lost electrons owing to energy content.
 - having a definite volume but not a definite shape.
- ___ 16. A solid substance is
- always frozen regardless of its container.
 - always a crystal regardless of its container.
 - always the same shape regardless of its container.
 - always losing particles regardless of its container.
- ___ 17. Plasma is the fourth state of matter. In the plasma state
- atoms gain electrons.
 - atoms lose electrons.
 - atoms form molecules.
 - atomic nuclei break down.
- ___ 18. What happens to the energy in a substance when it changes state?
- It is destroyed.
 - It is changed into matter.
 - It changes form, but is neither destroyed nor increased.
 - The energy remains unchanged.
- ___ 19. Which part of the illustration below shows the particles in a heterogeneous mixture?



a. a
b. b

c. c
d. d

- ___ 20. A mixture is
- a combination of pure substances bonded chemically.
 - any substance with a uniform composition.
 - a blend of any two or more kinds of matter, as long as each maintains its own unique properties.
 - any group of elements that are chemically bonded to one another.

Matter:

3. Define the term “matter”.

4. Differentiate between an atom, ion and molecule (hint, use their definitions).

Mixtures vs. Pure Substances:

5. Match each separation technique with its appropriate description.

<u>Technique</u>	<u>Description</u>
___ centrifugation	A. components of a mixture separate into layers on their own
___ chromatography	B. solid component of the mixture becomes trapped in a screen, allowing the liquid component to pass through
___ crystallization	C. oil, detergent, or some other chemical is added to a mixture, air is forced through the mixture as a means of stirring, and the desired component is skimmed off the top
___ distillation	D. mixture is spun at high speeds creating a force which pulls heavier solid particles towards the bottom of the container
___ electrolysis	E. the mixture is heated until a liquid component reaches its boiling point and is evaporated, leaving the other component behind
___ filtration	F. the mixture is concentrated and cooled until the solid component slowly forms at the bottom of the container
___ floatation	G. the mixture is applied to a solid support and separated into its components by a solvent which carries the various components up the solid support at different rates
___ settling	H. a process in which an electric current is applied to a sample, decomposing the sample into its component elements

6. State three things that distinguish a pure substance from a mixture (consider nature, properties)

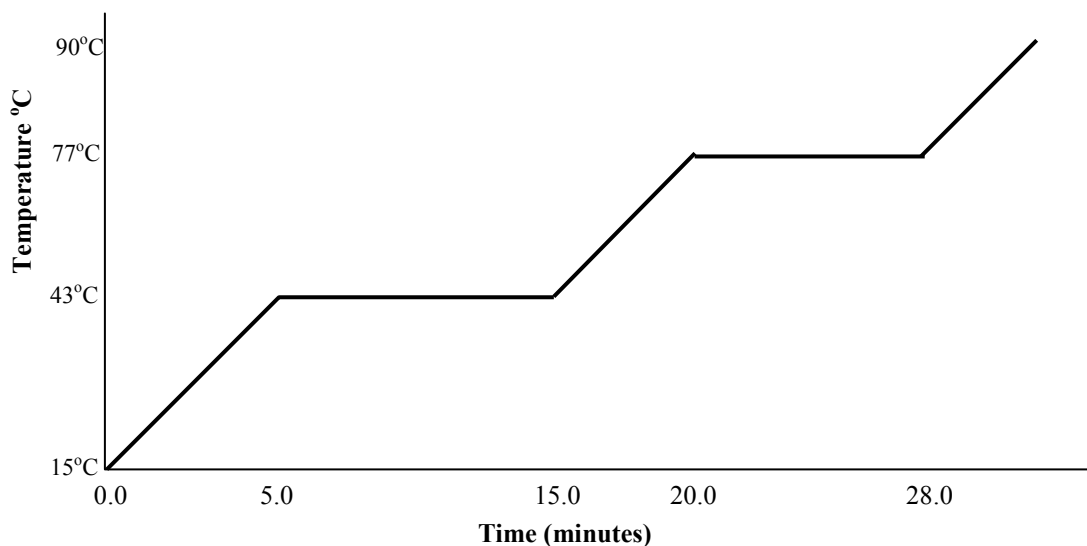
7. Describe what a MECHANICAL MIXTURE is (its nature and properties), provide an example, and state the separation method that should be used to isolate its component parts.

8. How is it possible to determine whether a pure substance is an element or a compound? Provide an example of an element and a compound.

9. How can you determine whether a material is “homogeneous” or “heterogeneous”?

10. Sketch the phase diagram that would be produced when solid nitrogen is heated. Label all states and phase changes.

6. Given the following graph of Temperature vs. Time for warming substance “X” which starts out as a solid, answer the questions below:

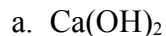


- a) During time 0.0 – 5.0 minutes, the added heat energy is being used to _____
- b) During time 5.0 – 15.0 minutes, the added heat energy is being used to _____
- c) During time 15.0 – 20.0 minutes, the added heat energy is being used to _____
- d) During time 20.0 – 28.0 minutes, the added heat energy is being used to _____
- e) The melting point of substance “X” is _____
- f) The boiling point of substance “X” is _____
- g) If a greater amount of substance “X” was used, the melting point would be
1. a lower temperature
2. a higher temperature
3. the same temperature Answer _____
- h) What phase is substance “X” at 90°C? _____
- i) Explain WHY the curve levels off between 5.0 min. and 15.0 min.

Acids and Bases:

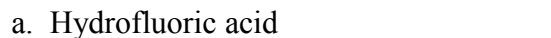
1. State three properties of acids and three properties of bases. (you might need your textbook)

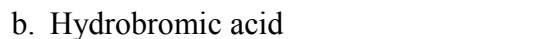
2. Write the correct names for the following bases.





3. Provide the missing formula or name for the following simple (binary) acids.

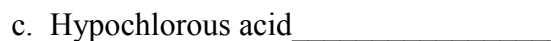




4. Provide the missing formula or name for the following complex acids.

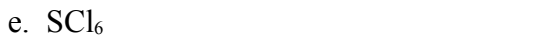




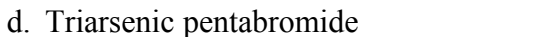
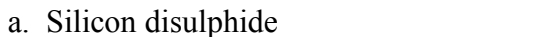


Molecular Compounds:

1. Write the correct name for each of the following molecular compounds.



2. Write the correct formula for each of the following molecular compounds.



Mixed Naming:

1) Provide the correct name for each of the following compounds.



Names and Formulas for Compounds

1. Write the correct formula for the following compounds:

- a) ammonium chlorate _____
- b) copper (II) sulphite..... _____
- c) zinc carbonate tetrahydrate _____
- d) nitric acid _____
- e) phosphorus pentaiodide _____
- f) iron (III) thiocyanate..... _____
- g) sulphuric acid _____
- h) dinitrogen tetrafluoride _____

2. Write the correct names for the following compounds:

- a) $\text{Mn}(\text{SO}_4)_2$ _____
- b) $\text{PbCrO}_4 \cdot 6\text{H}_2\text{O}$ _____
- c) As_2O_3 _____
- d) CH_3COOH _____ acid
- e) $\text{Ni}_2(\text{C}_2\text{O}_4)_3$ _____
- f) NF_3 _____
- g) $(\text{NH}_4)_2\text{HPO}_4$ _____
- h) $\text{Ba}(\text{OH})_2 \cdot 10\text{H}_2\text{O}$ _____

Unit 3: The Mole

- ___ 71. If each atom of element D has 3 mass units and each atom of element E has 5 mass units, a molecule composed of one atom each of D and E has
- 2 mass units.
 - 8 mass units.
 - 15 mass units.
 - 35 mass units.
- ___ 72. If 6.0 g of element K combine with 17 g of element L, how many grams of element K combine with 85 g of element L?
- 17 g
 - 23 g
 30. g
 - 91 g
- ___ 73. If two or more compounds are composed of the same two elements, the ratio of the masses of one element that combine with a fixed mass of the other element is a simple whole number. This is a statement of the law of
- conservation of mass.
 - mass action.
 - multiple proportions.
 - definite composition.
- ___ 74. If 63.5 g of copper (Cu) combine with 16 g of oxygen (O) to form the compound CuO, how many grams of oxygen will be needed to combine with the same amount of copper to form the compound CuO₂?
- 16 g
 - 32 g
 - 64 g
 - 127 g
- ___ 75. According to the law of conservation of mass, when sodium, hydrogen, and oxygen react to form a compound, the mass of the compound is ___ the sum of the masses of the individual elements.
- equal to
 - greater than
 - less than
 - either greater than or less than
- ___ 107. The number of atoms in a mole of any pure substance is called
- its atomic number.
 - Avogadro's constant.
 - its mass number.
 - its gram-atomic number.
- ___ 108. Molar mass
- is the mass in grams of one mole of a substance.
 - is numerically equal to the average atomic mass of the element.
 - Both (a) and (b)
 - Neither (a) nor (b)
- ___ 109. The mass of a sample containing 3.5 mol of silicon atoms (atomic mass 28.0855 amu) is approximately
- 28 g.
 - 35 g.
 - 72 g.
 - 98 g.
- ___ 110. A prospector finds 39.39 g of pure gold (atomic mass 196.9665 amu). She has
- 1.204×10^{23} atoms of Au.
 - 2.308×10^{23} atoms of Au.
 - 4.306×10^{23} atoms of Au.
 - 6.022×10^{23} atoms of Au.

The Mole Concept

1. Make the following conversions, clearly showing your steps. Include proper units in all of your work and in your answer.

a) 133.44 grams of PCl_5 = ? moles

Answer _____

b) 0.00256 moles of $\text{Li}_2\text{Cr}_2\text{O}_7$ = ? grams

Answer _____

c) 170.24 L of NO_2 at STP = ? moles

Answer _____

d) 570.625 g of PCl_3 gas = ? L (STP)

Answer _____

e) 1030.4 mL of C_2H_6 gas at STP = ? g

Answer _____

f) 5.00 kg of nitrogen gas = ? L (STP)

Answer _____

g) 0.5696 kg of $\text{CH}_4(\text{g}) = ? \text{ mL}$

Answer _____

2. The density of liquid ethanol ($\text{C}_2\text{H}_5\text{OH}$) is 0.790 g/mL. Calculate the number of molecules in a 35.0 mL sample of liquid ethanol. (NOTE: You CAN'T use 22.4 L/mol since this is NOT a gas at STP!)

Answer _____

3. A 100.0 mL sample of liquid mercury contains 6.78 moles. Calculate the density of liquid mercury from this data.

Answer _____

4. Calculate the density of $\text{PCl}_3(\text{g})$ at STP.

Answer _____

5. a) The density of a gas at STP is 4.955 g/L. Calculate the molar mass of this gas.

- b) The gas is an oxide of selenium. Determine the molecular formula.

Answer _____

6. Find the percent composition (% by mass of each element) in the following compound: $\text{Sr}_3(\text{PO}_4)_2$. Show your work.

Answer _____ %Sr, _____ %P, _____ ~~2/0~~

7. A compound was analyzed and the following results were obtained:

Molar mass: 270.4 g/mol

Mass of sample: 162.24 g

Mass of potassium: 46.92 g

Mass of sulphur: 38.52 g

Mass of oxygen: the remainder of the sample is oxygen

a) Determine the mass of oxygen in the sample.

Answer _____

b) Determine the empirical formula for this compound.

Answer: Empirical Formula: _____

c) Determine the molecular formula for this compound.

Answer: Molecular Formula: _____

8. 123.11 g of zinc nitrate, $\text{Zn}(\text{NO}_3)_2$ are dissolved in enough water to form 650.0 mL of solution. Calculate the $[\text{Zn}(\text{NO}_3)_2]$ Include proper units in your work and in your answers.

Answer _____

9. Calculate the mass of potassium sulphite (K_2SO_3) needed to make 800.0 mL of a 0.200 M solution of K_2SO_3 . Include proper units in your work and in your answers.

Answer _____

10. What volume of 2.50 M Li_2CO_3 would need to be evaporated in order to obtain 47.232 g of solid Li_2CO_3 ? Include proper units in your work and in your answers.

Answer _____

11. 150.0 mL of water are added to 400.0 mL of 0.45 M HNO_3 . Calculate the final $[\text{HNO}_3]$. Include proper units in your work and in your answers.

Answer _____

12. What volume of water needs to be added to 150.0 mL of 4.00 M H_2SO_4 in order to bring the concentration down to 2.50 M? Include proper units in your work and in your answers.

Answer _____

13. Give directions on how to make 5.00 L of 0.020 M $\text{Ca}(\text{ClO})_2$ using solid $\text{Ca}(\text{ClO})_2$ and water. Include proper units in your work and in your answers.

Molarity Calculations:

1. If a 4.50g sample of solid NaOH is dissolved to make 0.500L of solution, what is the molarity of the solution?
2. How many grams of Na₂CO₃ would be required to produce 400.0mL of 0.600M Na₂CO₃?
3. If 75.7g of Magnesium chloride are mixed with sufficient water to make a 0.885M solution, what is the volume of the solution?
4. How many mL of 16.4 M H₂SO₄ are needed to prepare 755mL of 0.25M H₂SO₄?

Unit 4: Chemical Reactions and Equations:

1. Balance and classify the following chemical reactions. Type of Reaction
- a) $\underline{\hspace{1cm}} \text{KNO}_3 \rightarrow \underline{\hspace{1cm}} \text{KNO}_2 + \underline{\hspace{1cm}} \text{O}_2$

- b) $\underline{\hspace{1cm}} \text{Ca} + \underline{\hspace{1cm}} \text{O}_2 \rightarrow \underline{\hspace{1cm}} \text{Ca} + \underline{\hspace{1cm}} \text{CO}_2$

- c) $\underline{\hspace{1cm}} \text{C}_5\text{H}_{12} + \underline{\hspace{1cm}} \text{O}_2 \rightarrow \underline{\hspace{1cm}} \text{CO}_2 + \underline{\hspace{1cm}} \text{H}_2\text{O}$

- d) $\underline{\hspace{1cm}} \text{K}_2\text{SO}_4 + \underline{\hspace{1cm}} \text{BaCl}_2 \rightarrow \underline{\hspace{1cm}} \text{KCl} + \underline{\hspace{1cm}} \text{BaSO}_4$

- e) $\underline{\hspace{1cm}} \text{KOH} + \underline{\hspace{1cm}} \text{H}_2\text{SO}_4 \rightarrow \underline{\hspace{1cm}} \text{K}_2\text{SO}_4 + \underline{\hspace{1cm}} \text{H}_2\text{O}$

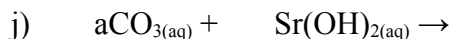
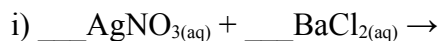
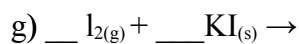
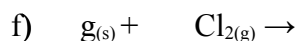
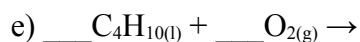
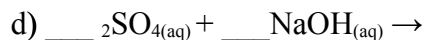
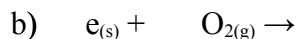
- f) $\underline{\hspace{1cm}} \text{Ca(OH)}_2 + \underline{\hspace{1cm}} \text{NH}_4\text{Cl} \rightarrow \underline{\hspace{1cm}} \text{NH}_4\text{OH} + \underline{\hspace{1cm}} \text{CaCl}_2$

- g) $\underline{\hspace{1cm}} \text{C}_4\text{H}_8\text{S} + \underline{\hspace{1cm}} \text{O}_2 \rightarrow \underline{\hspace{1cm}} \text{CO}_2 + \underline{\hspace{1cm}} \text{SO}_2 + \underline{\hspace{1cm}} \text{H}_2\text{O}$

- h) $\underline{\hspace{1cm}} \text{C}_{15}\text{H}_{30} + \underline{\hspace{1cm}} \text{O}_2 \rightarrow \underline{\hspace{1cm}} \text{CO}_2 + \underline{\hspace{1cm}} \text{H}_2\text{O}$

- i) $\underline{\hspace{1cm}} \text{BN} + \underline{\hspace{1cm}} \text{F}_2 \rightarrow \underline{\hspace{1cm}} \text{BF}_3 + \underline{\hspace{1cm}} \text{N}_2$

2. Classify, complete **AND balance** the following chemical equations. **Type of Reaction**



3. Write a balanced chemical equation for each of the following, and classify each as synthesis, decomposition, single replacement, double replacement, neutralization or combustion.

a) potassium sulphate is mixed with cobalt (III) nitrate

b) liquid propanol ($\text{C}_3\text{H}_7\text{OH}$) is burned in air

c) ammonium nitrate is decomposed into its elements

d) a piece of zinc is placed in a test-tube containing a solution of silver nitrate

e) bromine reacts with sodium iodide

f) bromine reacts with aluminum

g) rubidium reacts with chlorine gas

h) hydrochloric acid reacts with strontium hydroxide

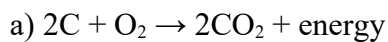
Energy of Reactions:

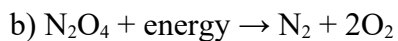
1. Define ENDOTHERMIC and EXOTHERMIC reactions.

Endothermic: _____

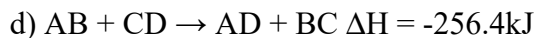
Exothermic: _____

2. Classify the following reactions as either endothermic or exothermic.

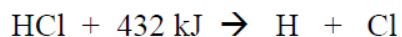




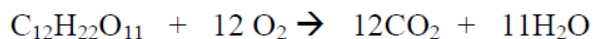




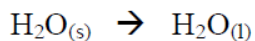
3. State whether each of the following are *exothermic* or *endothermic*.



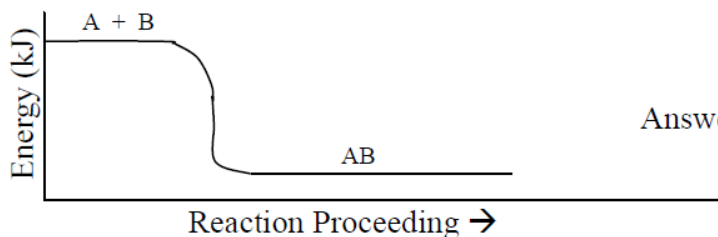
Answer _____



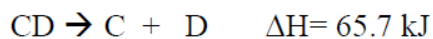
$\Delta H = -5638 \text{ kJ}$ Answer _____



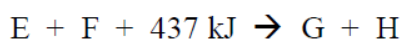
Answer _____



Answer _____



Answer _____



Answer _____

1 Exothermic and endothermic reactions

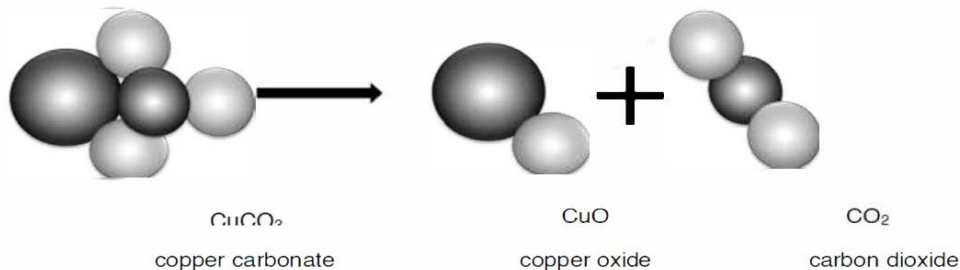
Decide whether each of these reactions is exothermic or endothermic:

- a) When two chemicals mix their temperature rises: ____
- b) A solid burns brightly and releases heat, light and sound: ____
- c) When two chemicals are mixed their temperature drops: ____
- d) Two chemicals will only react if you heat them continually: ____
- e) Plants take in light energy for photosynthesis: ____

2 Making and breaking bonds

During chemical reactions the bonds between atoms break and new bonds form. Energy must be absorbed to break a bond, so breaking bonds is endothermic. Making new bonds is exothermic because energy is released.

a) When green copper carbonate decomposes, the equation is:



Is the reaction exothermic or endothermic? Use ideas about bonds to explain why.

b) Draw diagrams to show what happens when hydrogen reacts with oxygen. Mark the bonds broken in blue and the new bonds formed in red. The equation is:



Energy Changes in Chemical reactions

1. In an exothermic reaction does the temperature go up or down?
.....
2. In an endothermic reaction does the temperature go up or down?
.....
3. Name two examples of exothermic reactions
.....
4. Name two examples of endothermic reactions
.....
5. Circle the correct answers.

The bonds between the atoms of the reactants / products need to be broken first, this is an endothermic / exothermic process. These bonds are made between the atoms of the reactants / products, this is an endothermic / exothermic process.

6. Use the table to answer this question

Reaction	Starting temperature °C	Final temperature °C
A	20	31
B	22	18
C	21	25

a. Decide whether each reaction is endothermic or exothermic, explain how you could tell.

.....
.....
.....

b. Which reaction has the largest energy change?

.....

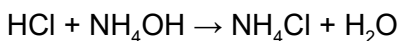
7. In an exothermic reaction, is enthalpy change positive or negative?

.....

8. In an endothermic reaction, is enthalpy change positive or negative?

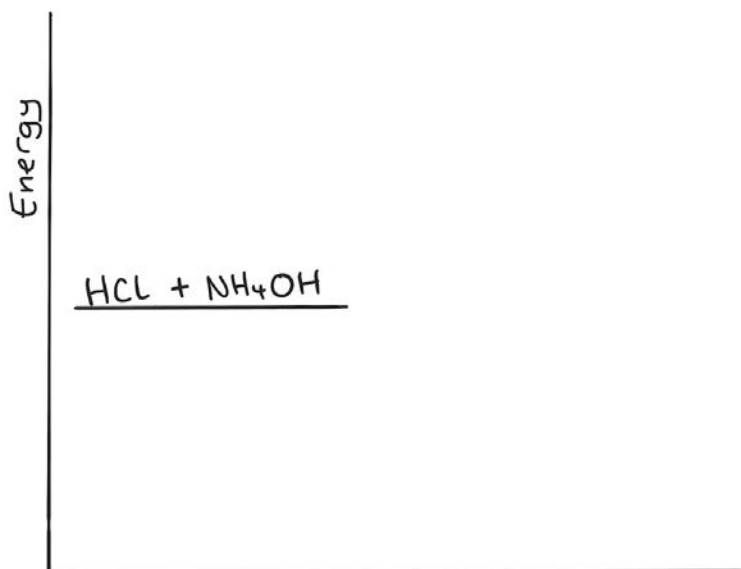
.....

9. When hydrochloric acid reacts with ammonium hydroxide in a beaker, the temperature goes up.



$$\Delta H = -53.4 \text{ kJ/mol}$$

Complete the energy profile diagram and state whether the reaction is endothermic or exothermic, explain your answer.

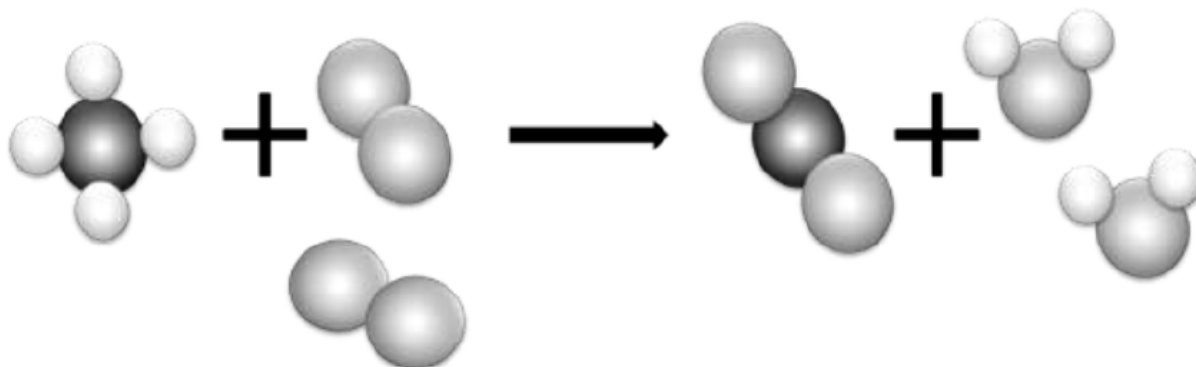


10. What are the units for enthalpy change, ΔH

.....

3 'Make or break'

- a) Most reactions involve bond breaking and bond making. This equation shows what happens when methane (CH_4) burns in oxygen (O_2). Mark the bonds broken in blue and the bonds formed in red.



- b) Complete the table to show the number of bonds broken and formed:

Bonds broken	Number	Bonds formed	Number
between carbon and hydrogen		between carbon and oxygen	
between oxygen atoms		between hydrogen and oxygen	

- c) Is the reaction exothermic or endothermic overall?
- d) The overall energy change is decided by the strength of the bonds that are broken or formed during the reaction. The stronger the bond the larger the energy change. Which bonds must be stronger in this reaction – the bonds broken or the new bonds formed?
- e) An energy level diagram shows the energy taken in and released during the reaction. Add the reactants, products and their separated atoms to the correct places on the diagram.

