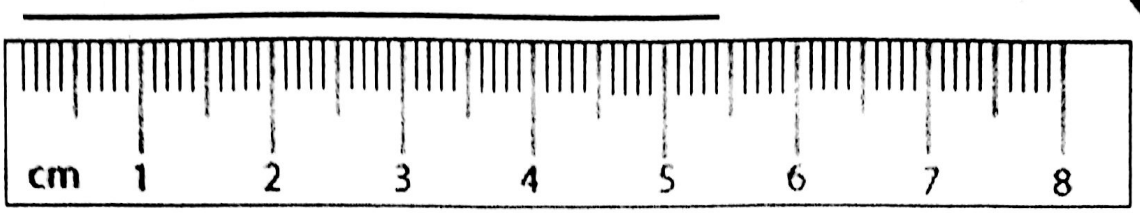
Key

STATION 1: Significant Figures

1

When we record data from a lab, it is very important that the data is reported with the correct number of significant figures. The more significant figures, the more precise the measuring instrument. All significant figures include ALL digits of certainty plus one uncertain digit. Consider the ruler below:

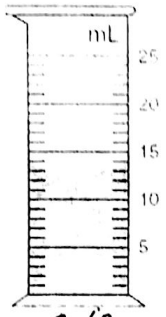
***String:*



How many significant figures can be recorded from this instrument? Let's measure the string above on the instrument. It can certainly be said that the string is 5.4 centimeters. However, the hundredths place is uncertain. Therefore, one digit of uncertainty MUST be estimated using this ruler. 5.40cm, 5.41cm, or 5.42cm for example, are all acceptable measurements of this string. This particular ruler can measure 3 significant figures. Two digits (the ones and the tenths place) are certain and one digit (the hundredths place) is uncertain.

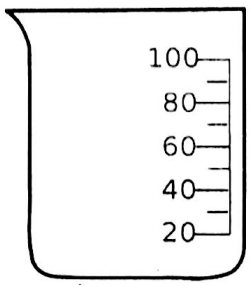
Underneath each picture write how many significant figures could be recorded using each instrument:

A. Graduated Cylinder



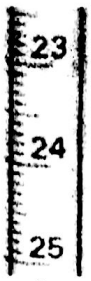
3 (2 certain, 1 uncertain)

B. Beaker



2 (1 certain, 1 uncertain)

C. Buret



4 (3 certain, 1 uncertain)

Rules for counting significant figures:

1.) All nonzeros are significant (1 – 9)
2.) All zeros sandwiched between nonzeros are significant.
3.) **If there is a decimal**, all zeros AFTER A NONZERO are significant.

Data	# of Sig Figs	How many digits of certainty?	How many digits of uncertainty?	Which Instrument from above could the data have come from?
24 mL	*2*	*1*	*1*	*B. Beaker*
24.0 mL	3	2	1	A
24.00 mL	4	3	1	C
18.5 mL	3	2	1	A
18.50 mL	4	3	1	C
18.25 mL	4	3	1	C
18.2 mL	3	2	1	A
18.0 mL	3	2	1	A
18 mL	2	1	1	B

1. Counting

How many significant figures are in:

a. 11,000,000 = 2
b. 11,000,000. = 8
c. 11,000,000.00 = 10
d. 0.0000011 = 2
e. 0.00000110 = 4
f. 2,002,000 = 4
g. 2,002 = 4
h. 2,002,000.00 = 9
i. 0.00000008 = 1
j. 3.00×10^{23} = 3
k. 2.1×10^{-5} = 2
l. 9.9900×10^{33} = 5

2. Rounding.

Round the following numbers to 2 significant figures:

a. 2,552 = 2,600
b. 0.2552 = 0.26
c. 0.002552 = 0.0026
d. 3,211 = 3,200
e. 339,378,999 = 340,000,000
f. 0.088888 = 0.089

Round the following numbers to 3 significant figures:

a. 2,578 = 2,580
b. 0.2578 = 0.258
c. 0.002578 = 0.00258
d. 3,211 = 3,210
e. 339,378,999 = 339,000,000
f. 0.088888 = 0.0889

***READ THIS:** When performing calculations with multiplication or division, it is important that your answer is recorded with the correct number of significant figures. Whichever number has the LEAST amount of significant figures will determine how many significant figures should be in your final answer.

3. Calculate.

Solve the following calculations. Then record your answer with the correct number of significant figures.

a. 7.25 x 0.33 = 2.4
b. 0.75 ÷ 0.222 = 3.4
c. 2,000 x 123 = 200,000
d. 0.002 x 1,780 = 4
e. 93.1 x 0.899 = 83.4
f. 50 ÷ 23 = 2
g. 0.79 x 0.20 = 0.16
h. 801 ÷ 23 = 35
i. 1.20 ÷ 0.300 = 4.00
j. 2.000 x 54.2 = 108
k. 0.0300 x 34.1 = 1.02
l. 0.05 ÷ 0.85 = 0.04
m. 3.45 ÷ 2.10 = 1.64
n. 1,010 x 0.24 = 240

Application.

4. How many moles are in 6.89 x 10^{25} atoms of silver?

$$6.89 \times 10^{25}\ \text{atoms} \left| \frac{1\ \text{mol}}{6.022 \times 10^{23}\ \text{atoms}} \right. = 144\ \text{mol}$$

5. How many atoms are in 0.25 moles of aluminum?

1.5×10^{23} atoms

6. How many atoms are in 23.7 g of strontium?

$$23.7\ \text{g} \left| \frac{1\ \text{mol}}{87.62\ \text{g}} \right| \frac{6.022 \times 10^{23}\ \text{atom}}{1\ \text{mol}} = 1.63 \times 10^{23}\ \text{atom}$$

7. What is the mass, in grams, of 4.9 moles of arsenic?

370 g

Name KEY Date _____ Period _____

REVIEW STATION 2: States of Matter

2

1. Ask your teacher to fill your 800 mL beaker full of ice to about the 500 mL mark.
2. Place the beaker onto the hotplate and adjust the thermometer so it is held about halfway into the ice. Record the initial temperature in the table below:

Time (minutes)	Temperature (Celcius)	Time (Minutes)	Temperature (Celcius)
Initial (0 minutes)		7 minutes	
1 minute		8 minutes	
2 minutes		9 minutes	
3 minutes		10 minutes	
4 minutes		11 minutes	
5 minutes		12 minutes	
6 minutes		13 minutes	

3. Set the timer for 1 minute and answer the questions below while you wait. After each minute, record the temperature in the box above. Continue answering the questions as you wait.

A. Which box:
   a. Has a fixed volume but not a fixed shape and takes the shape of its container? B (liquid)
   b. Has a fixed volume and fixed shape? A (solid)
   c. Does not have a fixed volume nor fixed shape? C (gas)

Box A Box B Box C

B. Which phase of matter does each box represent?
   Box A: Solid Box B: liquid Box C: gas

C. Rank the motion of the particles from **fastest** to **slowest** in boxes A, B, and C.
   fastest → C, B, A ← slowest

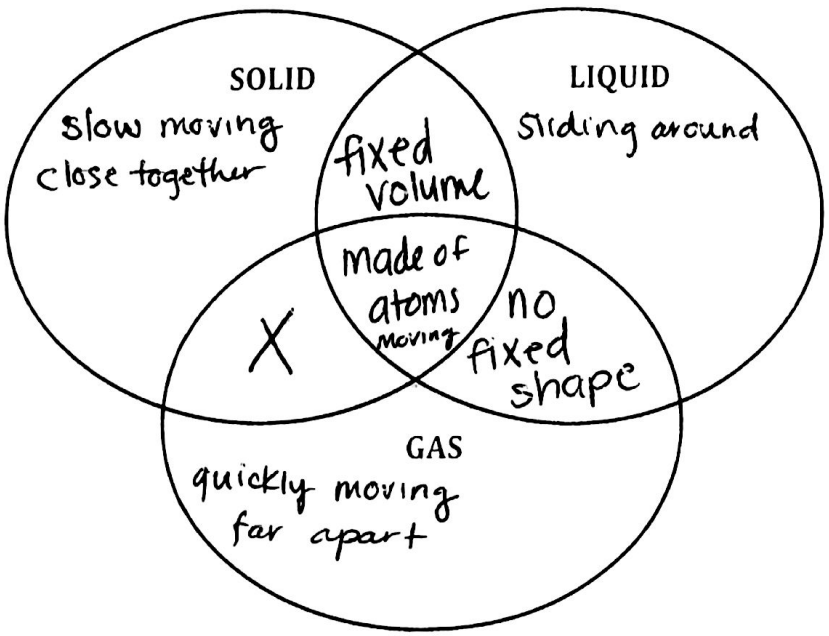
D. Describe the motion of the particles in the three common states of matter using at least 1 sentence for each.

Solid: Particles are close together + vibrate in place.

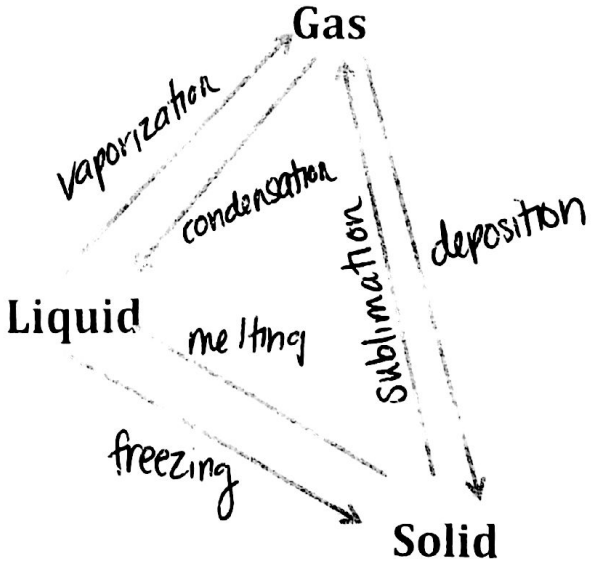
Liquid: Particles are loosely connected + slide past each other

Gas: Particles are moving fast & far apart.

E. Complete the venn diagram comparing the three states of matter:



F. Fill in the phase changes in the diagram below:



F. Give an example of each of the following phase changes:

a. Melting ice cube in drink
b. Freezing liquid ice cream to solid
c. Vaporization boiling soup
d. Condensation dew on grass
e. Sublimation dry ice
f. Deposition frost

G. What is the definition of an **exothermic** reaction?

reaction that releases heat to the environment (system loses energy)

H. Which of the phase changes above are exothermic?

condensation, freezing, deposition (all decrease energy)

I. What is the definition of an **endothermic** reaction?

reacton that absorbs heat energy (system gains energy)

J. Which of the phase changes above are endothermic?

vaporization, melting, sublimation (all increase energy

K. In what part of the curve would substance X have a definite shape and definite volume?

(solid) I

L. In what part of the curve would substance X have a definite volume but no definite shape?

(liquid) III

M. In what part of the curve would substance X have no definite shape or volume?

(gas) IV

N. What part of the curve represents a mixed solid/liquid phase of substance X?

II (melting/freezing)

O. What part of the curve represents a mixed liquid/gas phase of substance X?

IV (condensation/vaporization)

P. What is the melting temperature of substance X?

5°C (II)

Q. What is the boiling temperature of substance X?

55°C (IV)

R. What part of the curve would have the largest kinetic energy?

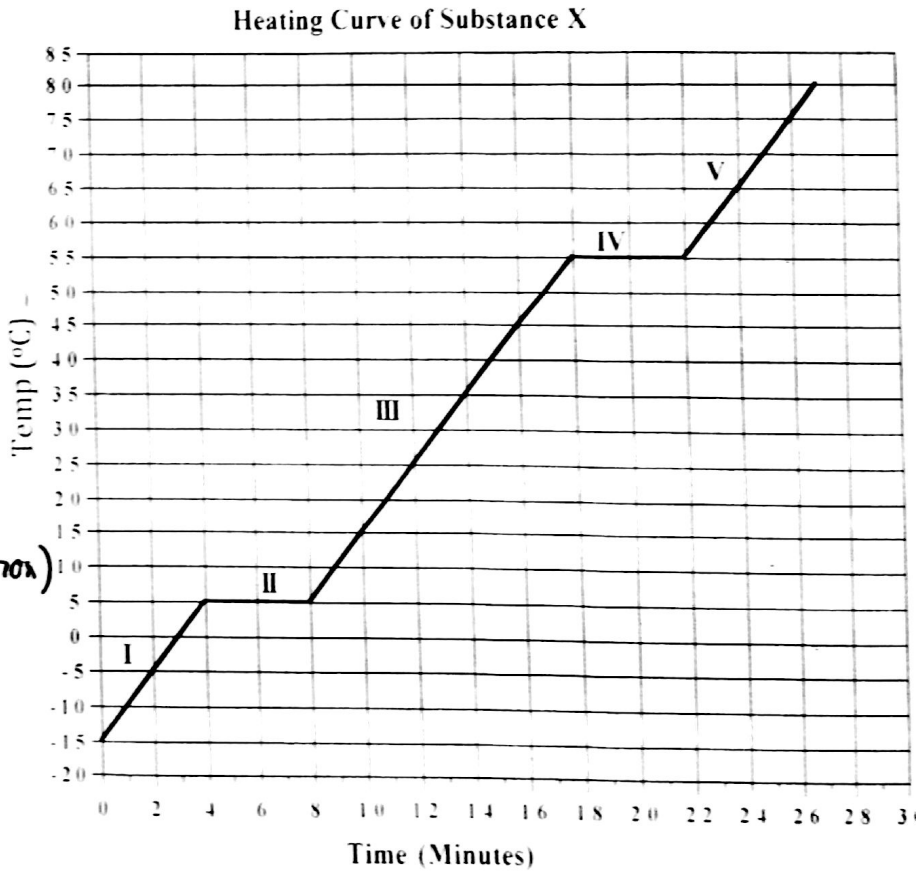
V (gas)

S. What part of the curve would have the lowest kinetic energy?

I (solid)

T. In what part of the curve would the molecules of the substance bet he farthest apart?

V (gas)



***POST LAB:** What do you notice about the temperature of the ice/water over time? How does this compare to the graph above?

temperature stays the same during phase changes.

Key

REVIEW STATION 3: Specific Heat Calculations

3

Equations:

$Q = C \cdot m \cdot \Delta T$	$C = \frac{Q}{m \cdot \Delta T}$	$m = \frac{Q}{C \cdot \Delta T}$	$\Delta T = \frac{Q}{C \cdot m}$

Variables and units:

Specific Heat: (C) the amount of energy needed to raise the temp of 1 gram of a substance by 1°C

Heat energy: (Q) heat that transfers due to temp. differences (always hot → cold)

Positive heat energy = heat gained / absorbed
Negative heat energy = heat lost / released

Change in temperature: $\Delta T = T_{final} - T_{initial}$

Steps to Solve:
1. Create variables list & determine unknown.
2. Select equation to solve for unknown.
3. Plug in known values and solve.
4. Be sure your answer has correct sig figs and units and that it makes sense!

EXAMPLE: The temperature change of 335 grams (m) of water is 2.1 °C (Δt), how much heat did this sample absorb? (The specific heat for water = 4.18 J/g°C) (c)

q = ?
c = 4.18 J/g°C (3 sig.figs)
m = 335 grams (3 sig figs)
Δt = 2.1°C (2 sig figs)

$Q = C \cdot m \cdot \Delta T$
$Q = (4.18\ J/g°C)(335\ g)(2.1°C)$
$Q = 2940.63\ J$
$Q = 2900\ J$

1. 1220. grams of water is heated using 309000 J what is the change in temperature? (Specific heat = 4.18 J/g°C)

q = 309,000 J
c = 4.18 J/g°C
m = 1220. g
Δt = ?

$\Delta T = 60.6°C$

2. A 26.0 gram sample of metal that has been cooled from an initial temperature of 82.25 °C to a final temperature of 28.34 °C the heat energy released was 1225 J what is the specific heat capacity?
   ↳ negative Q!!!

q = −1225 J
c = ?
m = 26.0 g
Δt = 28.34°C − 82.25°C = −53.91°C

$C = .874\ J/g°C$

3. What is the specific heat of silicon if it takes 192 J to raise the temperature of 45.0 grams of silicon by 6.00 °C ?

q = 192 J
c = ?
m = 45.0 g
Δt = 6.00°C

$C = .711\ J/g°C$

energy released when the temperature is decreased from 25.0°C to 3.00°C, what is the mass of the Coca-Cola? ↳ -Q

q = -3220. J
c = 4.18 J/g°C
m = ?
Δt = 3.00°C − 25.0°C = -22.0°C

m = 35.0 g

5. Titanium metal is used as a structural material in many high-tech applications what is the specific heat capacity in J/g°C if it takes 89.7 J to raise the temperature of a 33.0 g block by 5.20 °C.

q = 89.7 J
c = ?
m = 33.0 g
Δt = 5.20°C

C = .523 J/g°C

6. Copper has a specific heat of 0.385 J/g°C, a piece of copper absorbs 5550 J of energy undergoes a temperature change of 100.°C to 200.°C what is the mass of the copper?

q = 5550 J
c = 0.385 J/g°C
m = ?
Δt = 200°C − 100°C = 100.°C

m = 144 g

7. A 40. gram sample of water absorbs 500. J of energy how much did the water temperature change? The specific heat of water is 4.18 J/g°C.

q = 500 J
c = 4.18 J/g°C
m = 40 g
Δt = ?

Δt = 3.0 °C

negative Q

8. If an unknown water loses 9750 J of heat going from 65.5 °C to 45.5 °C, calculate the mass of the water. Assume the specific heat of the water is 4.18 J/g°C

q = -9750 J
c = 4.18 J/g°C
m = ?
Δt = 45.5°C − 65.5°C = -20.0°C

m = 117 g

*****CHALLENGE QUESTION!!!***** (HONORS SHOULD KNOW!)

9. What is the final temperature of a 225g sample of water if it takes 14,100 J of energy is put into a sample with an initial temperature of 25.0 °C. The specific heat of water is listed in #9 above.

q = 14,100 J
c = 4.18 J/g°C
m = 225 g
Δt = ?

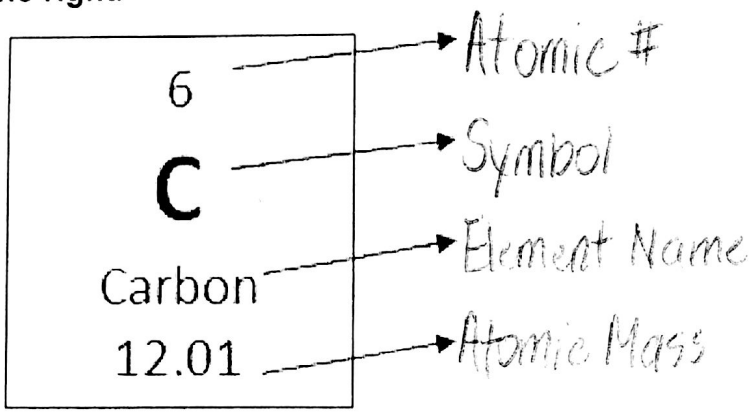
ΔT = 15.0°C
Final temp = 40.0°C

Name: _____ Date: _____ Period: _____

REVIEW STATION 4: Structure of an Atom/ Periodic Table

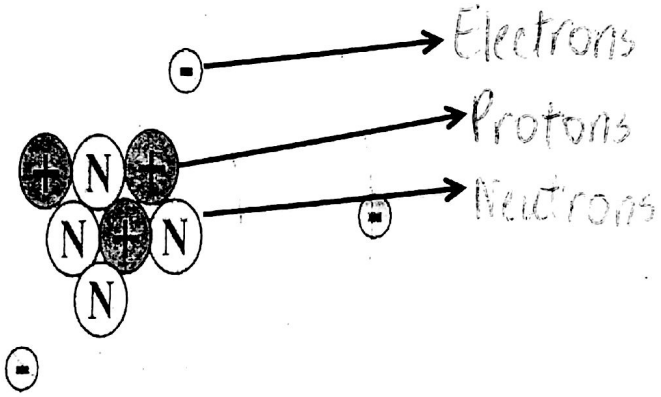
4

Label the pictures below and complete statements to the right.



The **atomic number** represents the number of protons or electrons in an atom.

The **atomic mass** equals the number of protons + neutrons in an atom.



Neutrons are subatomic particles with a neutral charge found in the nucleus of an atom.

Electrons are subatomic particles with a **negative** charge found in the orbitals of an atom.

Protons are subatomic particles with a positive charge found in the **nucleus** of an atom?

What is the name of the atom represented by the Bohr model to the left? Lithium

Fill in the missing information in the boxes below using your periodic table.

8 O Oxygen 15.999	30 Zn Zinc 65.39	3 Li Lithium 6.941
Atomic # = 8	Atomic # = 30	Atomic # = 3
Atomic Mass = 15.999	Atomic Mass = 65.39	Atomic Mass = 6.941
# of Protons = 8	# of Protons = 30	# of Protons = 3
# of Neutrons = 8	# of Neutrons = 35	# of Neutrons = 4
# of Electrons = 8	# of Electrons = 30	# of Electrons = 3

For each of the following isotopes, write the number of protons, neutrons, and electrons.

	Chromium-58	Chromium-63
# of protons	24	24
# of neutrons	34	39
# of electrons	24	24

	Carbon-12	Carbon-16
# of protons	6	6
# of neutrons	6	10
# of electrons	6	6

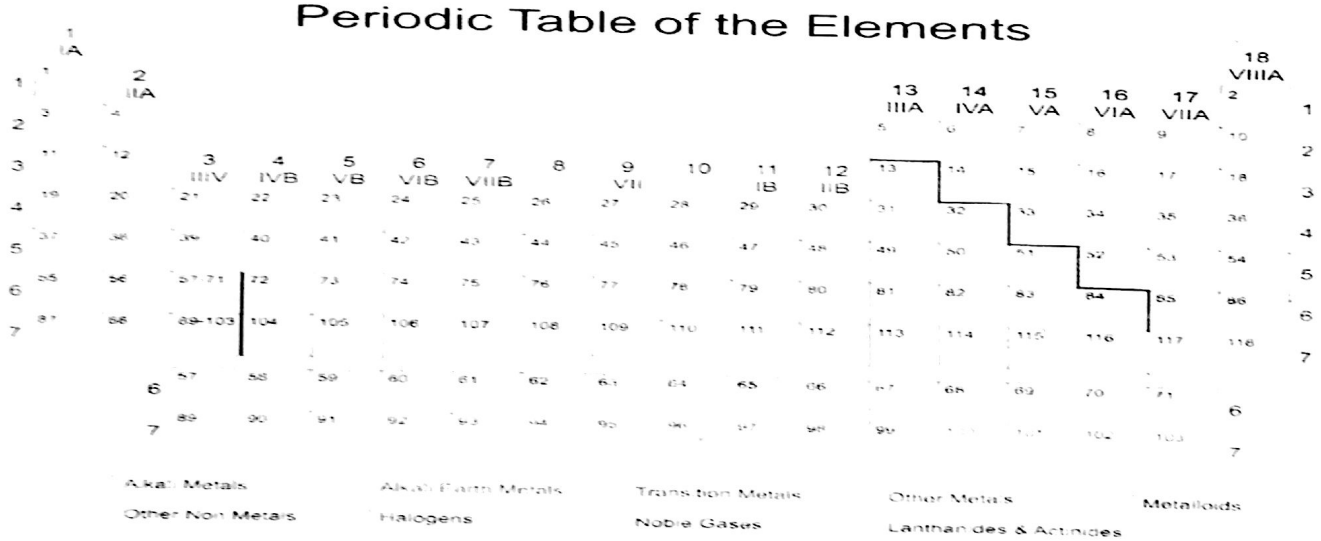
	Nitrogen-15	Nitrogen-20
# of protons	7	7
# of neutrons	8	14
# of electrons	7	7

	Sulfur-23	Sulfur-25
# of protons	16	16
# of neutrons	7	9
# of electrons	16	16

Color the periodic table and the key included below based on these instructions. Check the box once complete.

- ☐ Shade in the **alkali metals** with the color red. BE CAREFUL ABOUT HYDROGEN!!!!!!!
- ☐ Shade in the **alkaline earth metals** with the color yellow.
- ☐ Shade in the **transition metals** with the color green.
- ☐ Shade in the **halogens** with the color blue.
- ☐ Shade in the **Noble Gases** with the color orange.
- ☐ Shade in the **metalloids** with the color light blue.
- ☐ Shade in the **other non-metals** with the color pink.

Periodic Table of the Elements



Name a halogen: anything from 7A

Name an alkaline earth metal: anything from 2A

Name a metalloid: boron, silicon, arsenic (along staircase)

Name a noble gas: anything from 8A

Name an alkali metal: anything from 1A except Hydrogen

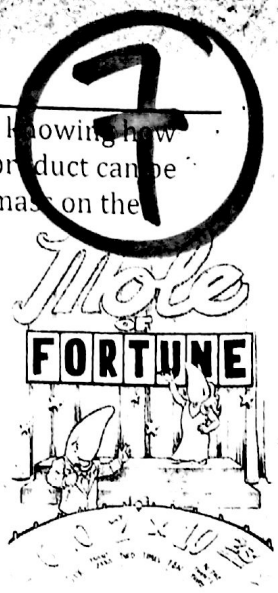
Name a transition metal: elements in middle section (B columns)

Answer Key:

1. x-axis: temperature in K, y-axis: pressure ($x10^5$) Pa
2. a. solid
   b. liquid
   c. gas
   d. soild
   e. gas
3. 20 K
4. 13 K
5. 14 K and 1($x10^5$) Pa (various answers along the line will work)
6. 20 K and 1($x10^5$) Pa
7. 14 K and 0.1 ($x10^5$) Pa
8. melting
9. vaporization
10. deposition

STATION REVIEW: Mole Calculations (Key)

Atoms are too small to see so we cannot count them by conventional methods. However, knowing how many atoms are present at the start of a reaction is crucial to understanding how much product can be produced through chemical means. Therefore, to count atoms we will use their relative mass on the periodic table to calculate the number of atoms present.



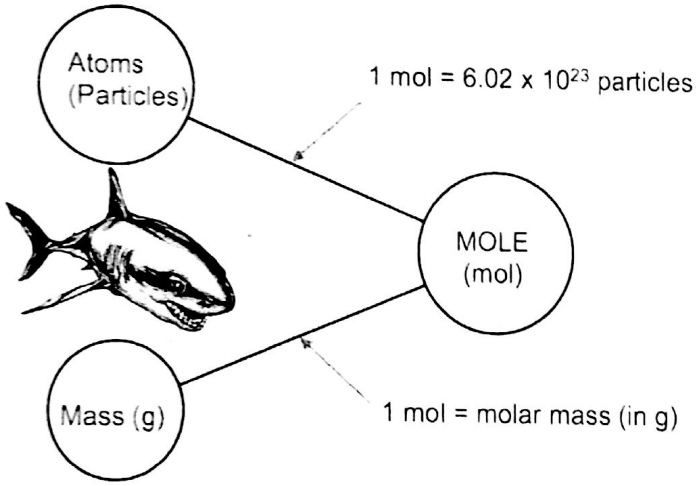
Don't forget:

1 mole = 6.022×10^{23} items which in standard notation is 602,200,000,000,000,000,000,000 items. That's a lot of items! To put this in perspective, if you had 1 mole of dollars, you could spend a billion dollars a second for OVER 19 million years before running out of money!

Calculations:

Use "Mole Island" to help you navigate problems.

Mole Island



Example 1: How many moles are in 3.4×10^{24} atoms of sodium?

$$\frac{3.4\times10^{24}\ \text{atoms}}{} \times \frac{1\ \text{mole}}{6.022\times10^{23}\ \text{atoms}} = 5.6\ \text{mol}$$

Example 2: How many atoms are in 52.1 grams of calcium?

$$\frac{52.1\ \text{grams}}{} \times \frac{1\ \text{mol}}{40.08\ \text{grams}} \times \frac{6.022\times10^{23}\ \text{atoms}}{1\ \text{mol}} = 7.83\ \text{atoms}$$

***Solve the following problems. Then fill in the letter of the correct answer on the riddle on the bottom of page 2. Underline your given and circle your desired before solving.**

1) How many atoms of lithium are in .0211 moles of lithium metal (Li)

$$\frac{\text{mol}}{} \times \frac{\text{atom}}{\text{mol}} = 1.27\times10^{22}\ \text{atoms}$$

m. 1.27×10^{23} atoms *n. 1.27×10^{22} atoms* *o. 6.35×10^{23} atoms* *p. 6.35×10^{22} atoms*

2) How many moles of neon are in 4.3×10^{24} atoms of neon (Ne)?

$$\frac{\text{atoms}}{} \times \frac{\text{mol}}{\text{atoms}} =$$

m. 71 mol *n. 0.71 mol* *o. 7.1 mol* *p. 2.6×10^{48} mol*

3) How many moles of sodium chloride are in 3.28×10^{23} formula units of sodium chloride (NaCl)?

**Hint: Think of a formula unit as a particle.*

$$\frac{\text{Formula units}}{} \times \frac{1\ \text{mol}}{6.022\times10^{23}\ \text{formula units}} = 0.545\ \text{mol}$$

q. 1.98×10^{47} mol *r. 0.0545 mol* *s. 5.45 mol* *t. 0.545 mol*

$1.55\ mol \left| \frac{molecule}{mol} \right. = 9.33 \times 10^{23}\ molecules$

typo Sorry!

m. 0.0933 molecules n. 0.933 molecules o. 24.8 molecules p. ~~9.33 molecules~~ 9.33×10^{23} molecules

5) What is the mass of 3.72 moles of silver atoms?

$mol \left| \frac{g}{mol} \right. =$

u. 401g v. 40.1 g w. 0.0344g x. 0.344g

6) How many moles of mercury are in 1,026 grams of mercury?

$g \left| \frac{1\ mol}{1{,}026\ g} \right. =$

q. 511.5 mol r. 6.179×10^{26} mol s. 205,800 mol t. 5.115 mol

7) How many atoms are in 80.2 grams of magnesium?

$g \left| \frac{mol}{g} \right| \frac{atom}{mol} = 1.99 \times 10^{24}\ atoms$

h. 4.00 atoms i. 1.99×10^{24} atoms j. 1.99×10^{22} atoms k. 4.00×10^{24} atoms

8) What is the mass, in grams, of 7.65×10^{23} atoms of sulfur?

$atom \left| \frac{mol}{atom} \right| \frac{g}{mol} =$

q. 0.407g r. 1.27g s. 0.127g t. 40.7g

9) How many moles are in 99.5g of carbon?

a. 5.99×10^{25} mol b. 0.0828 mol c. 1.00 mol d. 8.28 mol

10) What is the mass, in grams, of 4.88×10^{24} atoms of beryllium?

$= 73.0\ g$

m. 52.1g n. 8.01 g o. 73.0 g p. 9.01g

11) How many cesium atoms are in 0.015moles of cesium?

$= 9.0 \times 10^{21}\ atoms$

u. 132.91 atoms v. 2.0 atoms w. 9.0×10^{21} atoms x. 9.0×10^{23} atoms

12. What is the mass of 0.0033 moles of gold?

m. 196.97g n. 0.65 g o. 65g p. 2.0×10^{21}g

Have you heard about the chemist reading about that book on helium? He just could

_____!

Sodium	$1s^2 2s^2 2p^6 3s^1$
Nitrogen	$1s^2 2s^2 2p^3$
Krypton	$1s^2 2s^2 2p^6 3s^2 3p^6 4s^2 3d^{10} 4p^6$
Titanium	$1s^2 2s^2 2p^6 3s^2 3p^6 4s^2 3d^2$
Rubidium	$1s^2 2s^2 2p^6 3s^2 3p^6 4s^2 3d^3$
Aluminum	$1s^2 2s^2 2p^6 3s^2 3p^1$
Xeon	$1s^2 2s^2 2p^6 3s^2 3p^6 4s^2 3d^{10} 4p^6 5s^2 4d^{10} 5p^6$
Gallium	$1s^2 2s^2 2p^6 3s^2 3p^6 4s^2 3d^{10} 4p^1$
Chlorine	$1s^2 2s^2 2p^6 3s^2 3p^5$
Silicon	$1s^2 2s^2 2p^6 3s^2 3p^2$
Magnesium	$1s^2 2s^2 2p^6 3s^2$
Manganese	$1s^2 2s^2 2p^6 3s^2 3p^6 4s^2 3d^5$
Helium	$1s^2$
Lithium	$1s^2 2s^1$
Lead	$1s^2 2s^2 2p^6 3s^2 3p^6 4s^2 3d^{10} 4p^6 5s^2 4d^8$
Potassium	$1s^2 2s^2 2p^6 3s^2 3p^6 4s^1$

Answer Key

Task 1:

Ionization energy increases right across a period and up a group

Atomic radius increases down a group and decreases across a period (gets smaller).

Electronegativity increases up a group and across a period, except for noble gases (group 7A) which do not have an electronegativity due to their complete octet

Task 3:

Atomic radius

1) Radium as you move down a group the radius gets larger
2) 2.25 angstroms – sodium, 0.75 angstroms – hydrogen and 0.95 angstroms – chlorine
3) The element in group 1A because it is the first in the period
4) An answer for rubidium above 2.25 angstroms then a decrease in the atomic radius as you move across the period ending the smallest element in group 8A (neon)

Ionization energy

1) Beryllium as you move down a group the ionization energy gets smaller so the largest would be at the top
2) 5 volts for sodium, 13 volts for hydrogen and 13 volts for chlorine
3) Fluorine in group 7A because the ionization energy increases across a period.
4) The lowest point would be potassium which would be around 4 volts while krypton would be the highest around 15 volts. The amounts would steadily increase across the period from 3 volts to 15 volts.

Name: _____ Date: _____ Period: _____

REVIEW STATION 10: Ions and Ionic Compounds

10

Below are questions related to ionic compounds and ionic compound formation. Use your quiz results to determine which problem you need to complete.

If you missed a problem on the quiz, complete the problem with the SAME NUMBER below.

ANSWER QUESTIONS ON SEPARATE SHEET OF PAPER

1) How is an ion formed? An ion is formed when an atom gains or loses electrons

2) What is the charge of an oxygen ion? Why does this charge exist?
2⁻, the atoms gains 2 electrons.

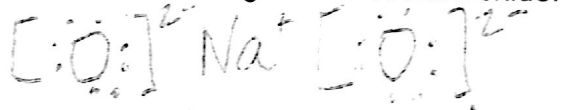
3) When Aluminum forms an ion it will have a charge of 3+ so that it has a valence of 6.

4) Cations form positive ions because they lose electrons. Anions form negative ions because they gain electrons.

5) A new element with 113 protons would form an ion with what charge? 3+

6) List 3 properties of an ionic compound? High melting point, not malleable, conductive when in water, crystalline solid at room temp

7) Draw the Lewis dot diagram for sodium oxide.



8) An ionic bond is formed when cations transfer electrons ~~with~~ to anions.

9) What is the chemical name for $Ni(NO_3)_3$? Nickel(III) Nitrate

10) What is the chemical name for K_2S? Potassium Sulfide

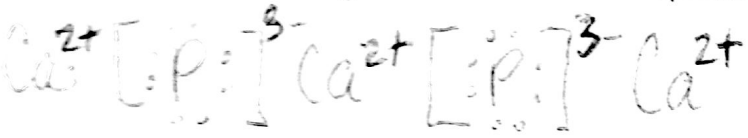
11) What is the chemical formula for Chromium (II) Nitride? Cr_3N_2

12) Which of the following is NOT an ionic compound: Al_2O_3, NaCl, NO_2? Explain.
NO_2 because N and O are BOTH non-metals.

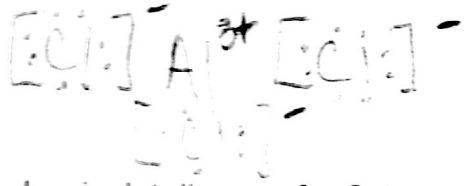
13) How do you name an ionic compound?
The cation is named first and the anion is named last. If the anion is NOT polyatomic it gets an -ide ending. If the metal is a type II metal roman numerals are needed.

Free Response Problems

1) Draw the Lewis dot diagram for Calcium Phosphide.



2) Draw the Lewis dot diagram for Aluminum Chloride.



3) Draw the Lewis dot diagram for Cobalt (III) Fluoride.