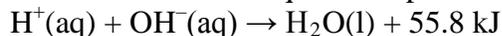


Name: _____

Balancing and Reaction Types Station

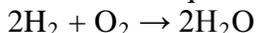
- 1.) Given the balanced equation representing a reaction:



In this reaction there is conservation of

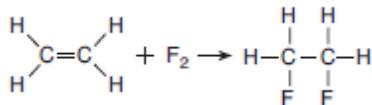
- (1) mass, only
(2) mass and charge, only
(3) mass and energy, only
(4) mass, charge, and energy
- 2.) Which equation shows conservation of atoms?
(1) $\text{H}_2 + \text{O}_2 \rightarrow \text{H}_2\text{O}$
(2) $\text{H}_2 + \text{O}_2 \rightarrow 2\text{H}_2\text{O}$
(3) $2\text{H}_2 + \text{O}_2 \rightarrow 2\text{H}_2\text{O}$
(4) $2\text{H}_2 + 2\text{O}_2 \rightarrow 2\text{H}_2\text{O}$
- 3.) In a chemical reaction, there is conservation of
(1) energy, volume, and mass
(2) energy, volume, and charge
(3) mass, charge, and energy
(4) mass, charge, and volume

- 4.) Given the balanced equation representing a reaction:



What is the total mass of water formed when 8 grams of hydrogen reacts completely with 64 grams of oxygen?

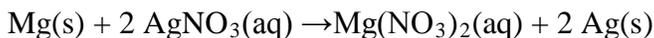
- (1) 18 g
(2) 36 g
(3) 56 g
(4) 72 g
- 5.) Given the balanced equation representing a reaction:



Which type of reaction is represented by this equation?

- (1) addition
(2) fermentation
(3) polymerization
(4) substitution
- 6.) Given the balanced equation representing a reaction:
 $\text{K}_2\text{CO}_3(\text{aq}) + \text{BaCl}_2(\text{aq}) \rightarrow 2\text{KCl}(\text{aq}) + \text{BaCO}_3(\text{s})$
Which type of reaction is represented by this equation?
(1) synthesis
(2) decomposition
(3) single replacement
(4) double replacement

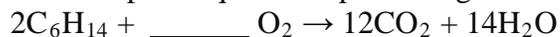
- 7.) Given the reaction:



Which type of reaction is represented?

- (1) single replacement
(2) double replacement
(3) synthesis
(4) decomposition
- 8.) Given the balanced equation representing a reaction:
 $\text{H}_2\text{SO}_4(\text{aq}) + 2\text{KOH}(\text{aq}) \rightarrow \text{K}_2\text{SO}_4(\text{aq}) + 2\text{H}_2\text{O}(\text{l})$
Which type of reaction is represented by this equation?
(1) decomposition
(2) neutralization
(3) single replacement
(4) synthesis

9.) Given the incomplete equation representing a reaction:



What is the coefficient of O_2 when the equation is completely balanced using the smallest whole number coefficients?

(1) 13

(3) 19

(2) 14

(4) 26

10.) Balance the equation below, using the smallest whole-number coefficients.



Base your answers to questions 11 and 12 on the balanced chemical equation below.



11.) What type of reaction does this equation represent?

12.) How does the balanced chemical equation show the Law of Conservation of Mass?

Base your answers to questions 13 and 14 on the information below.

Given the unbalanced equation:



13.) Balance the equation provided *above* using the lowest whole-number coefficients.

14.) Identify the type of reaction represented.

Name: _____

Gas Law Station

- 1.) Under which conditions does a real gas behave most like an ideal gas?
 - (1) at low temperatures and high pressures
 - (2) at low temperatures and low pressures
 - (3) at high temperatures and high pressures
 - (4) at high temperatures and low pressures

- 2.) The kinetic molecular theory assumes that the particles of an ideal gas
 - (1) are in random, constant, straight-line motion
 - (2) are arranged in a regular geometric pattern
 - (3) have strong attractive forces between them
 - (4) have collisions that result in the system losing energy

- 3.) A sample of a gas is contained in a closed rigid cylinder. According to kinetic molecular theory, what occurs when the gas inside the cylinder is heated?
 - (1) The number of gas molecules increases.
 - (2) The number of collisions between gas molecules per unit time decreases.
 - (3) The average velocity of the gas molecules increases.
 - (4) The volume of the gas decreases.

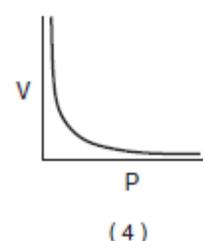
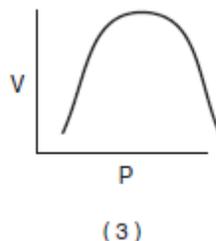
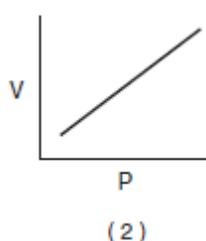
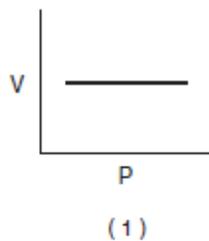
- 4.) According to the kinetic molecular theory, the molecules of an ideal gas
 - (1) have a strong attraction for each other
 - (2) have significant volume
 - (3) move in random, constant, straight-line motion
 - (4) are closely packed in a regular repeating pattern

- 5.) According to the kinetic molecular theory, which statement describes the particles in a sample of an ideal gas?
 - (1) The force of attraction between the gas particles is strong.
 - (2) The motion of the gas particles is random and straight-line.
 - (3) The collisions between the gas particles cannot result in a transfer of energy between the particles.
 - (4) The separation between the gas particles is smaller than the size of the gas particles themselves.

- 6.) Which gas sample at STP has the same total number of molecules as 2.0 liters of $\text{CO}_2(\text{g})$ at STP?
 - (1) 5.0 L of $\text{CO}_2(\text{g})$
 - (2) 2.0 L of $\text{Cl}_2(\text{g})$
 - (3) 3.0 L of $\text{H}_2\text{S}(\text{g})$
 - (4) 6.0 L of $\text{He}(\text{g})$

- 7.) At 25°C , gas in a rigid cylinder with a movable piston has a volume of 145 mL and a pressure of 125 kPa. Then the gas is compressed to a volume of 80. mL. What is the new pressure of the gas if the temperature is held at 25°C ?
 - (1) 69 kPa
 - (2) 93 kPa
 - (3) 160 kPa
 - (4) 230 kPa

8.) Which graph best represents the pressure-volume relationship for an ideal gas at constant temperature?



Base your answers to question 9 on the diagram below, which shows a piston confining a gas in a cylinder.



9.) Using the set of axes provided *below*, sketch the general relationship between the pressure and the volume of an ideal gas at constant temperature.

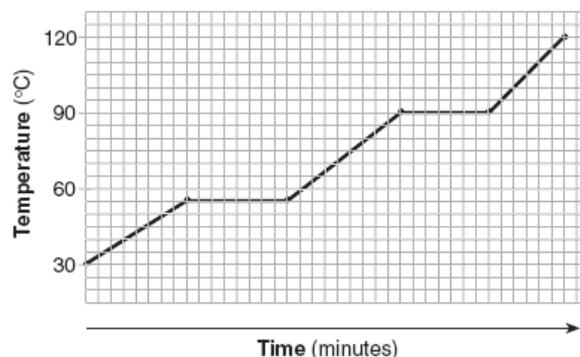


Regents Chemistry: Temperature, Heat, & Heating/Cooling Curves Name: _____

- 1.) The temperature of a sample of matter is a measure of the
 (1) average potential energy of the particles of the sample
 (2) average kinetic energy of the particles of the sample
 (3) total nuclear energy of the sample
 (4) total thermal energy of the sample
- 2.) Which sample of ethanol has particles with the highest average kinetic energy?
 (1) 10.0 mL of ethanol at 25°C
 (2) 10.0 mL of ethanol at 55°C
 (3) 100.0 mL of ethanol at 35°C
 (4) 100.0 mL of ethanol at 45°C
- 3.) The graph below represents the heating curve of a substance that starts as a solid below its freezing point.

What is the melting point of this substance?

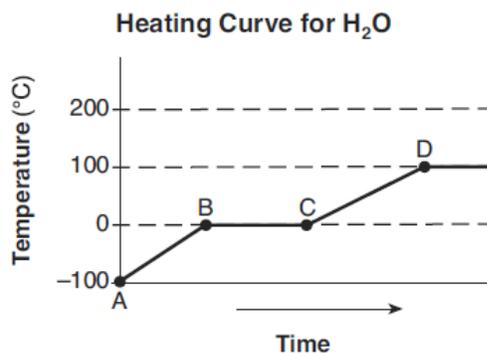
- (1) 30°C
 (2) 55°C
 (3) 90°C
 (4) 120°C



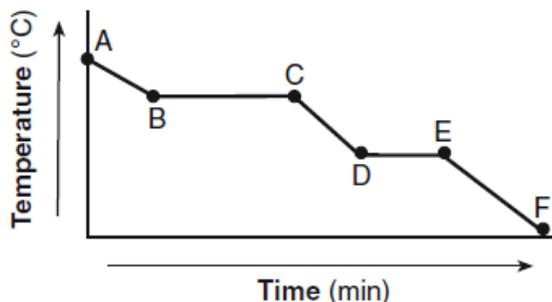
- 4.) The graph represents the relationship between temperature and time as heat is added to a sample of H₂O.

Which statement correctly describes the energy of the particles of the sample during interval BC?

- (1) Potential energy decreases and average kinetic energy increases.
 (2) Potential energy increases and average kinetic energy increases.
 (3) Potential energy increases and average kinetic energy remains the same.
 (4) Potential energy remains the same and average kinetic energy increases.



- 5.) Given the cooling curve of a substance:



During which intervals is potential energy decreasing and average kinetic energy remaining constant?

- (1) AB and BC
 (2) AB and CD
 (3) DE and BC
 (4) DE and EF

- 6.) What is the amount of heat energy released when 50.0 grams of water is cooled from 20.0°C to 10.0°C?
 (1) 5.00×10^2 J
 (2) 2.09×10^3 J
 (3) 1.67×10^5 J
 (4) 1.13×10^6 J

- 7.) A 36-gram sample of water has an initial temperature of 22°C . After the sample absorbs 1200 joules of heat energy, the final temperature of the sample is
(1) 8.0°C (2) 14°C (3) 30.0°C (4) 55°C
- 8.) What is the total amount of heat required to vaporize 1.00 gram of $\text{H}_2\text{O}(\ell)$ at 100.0°C and 1 atmosphere?
(1) 4.18 J (2) 334 J (3) 373 J (4) 2260 J
- 9.) What is the minimum amount of heat required to completely melt 20.0 grams of ice at its melting point?
(1) 20.0 J (2) 83.6 J (3) 6680 J (4) 45 200 J
- 10.) At standard pressure, the total amount of heat required to completely vaporize a 100.-gram sample of water at its boiling point is
(1) $2.26 \times 10 \text{ J}$ (2) $2.26 \times 10^2 \text{ J}$ (3) $2.26 \times 10^3 \text{ J}$ (4) $2.26 \times 10^5 \text{ J}$
-

Base your answers to questions 11 through 13 on the information below.

Heat is added to a 200.-gram sample of $\text{H}_2\text{O}(\text{s})$ to melt the sample at 0°C . Then the resulting $\text{H}_2\text{O}(\ell)$ is heated to a final temperature of 65°C .

- 11.) Determine the total amount of heat required to completely melt the sample.

_____ J

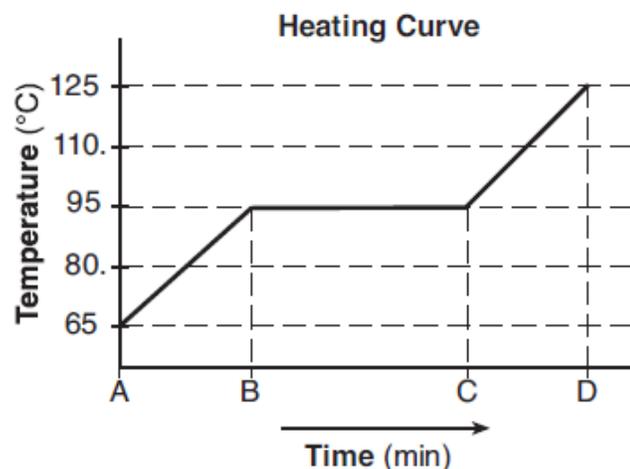
- 12.) Show a numerical setup for calculating the total amount of heat required to raise the temperature of the $\text{H}_2\text{O}(\ell)$ from 0°C to its final temperature.

- 13.) Compare the amount of heat required to vaporize a 200.-gram sample of $\text{H}_2\text{O}(\ell)$ at its boiling point to the amount of heat required to melt a 200.-gram sample of $\text{H}_2\text{O}(\text{s})$ at its melting point.

Base your answers to questions 14 and 15 on the information below and on your knowledge of chemistry.

A sample of a substance is a liquid at 65°C. The sample is heated uniformly to 125°C.

The heating curve for the sample at standard pressure is shown to the right.



14.) Determine the boiling point of the sample at standard pressure.

_____ °C

15.) State what happens to the potential energy of the particles of the sample during time interval BC.

Base your answers to questions 16 through 18 on the information below.

A student investigated heat transfer using a bottle of water. The student placed the bottle in a room at 20.5°C. The student measured the temperature of the water in the bottle at 7 a.m. and again at 3 p.m. The data from the investigation are shown in the table to the right.

Water Bottle Investigation Data

7 a.m.		3 p.m.	
Mass of Water (g)	Temperature (°C)	Mass of Water (g)	Temperature (°C)
800.	12.5	800.	20.5

16.) Compare the average kinetic energy of the water molecules in the bottle at 7 a.m. to the average kinetic energy of the water molecules in the bottle at 3 p.m.

17.) State the direction of heat transfer between the surroundings and the water in the bottle from 7 a.m. to 3 p.m.

18.) Show a numerical setup for calculating the change in the thermal energy of the water in the bottle from 7 a.m. to 3 p.m.

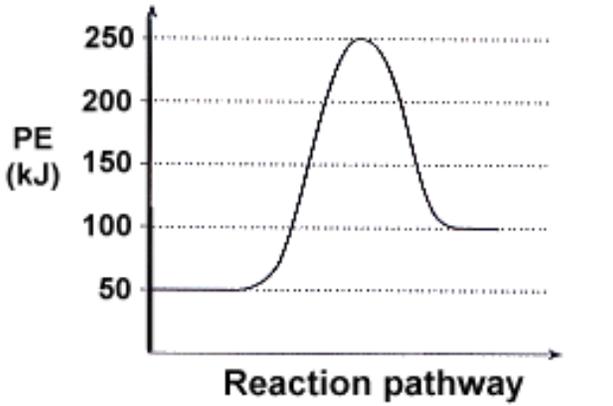
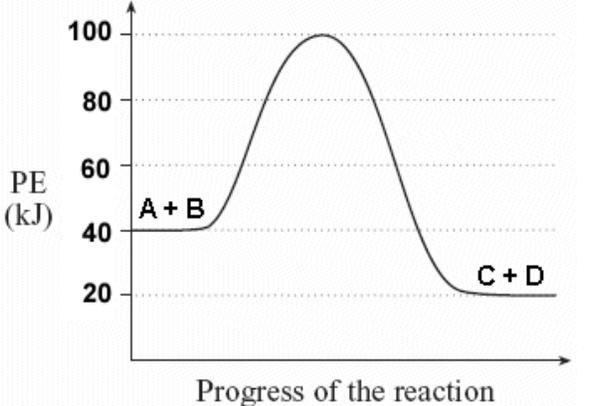
Base your answers to questions 19 and 20 on the information below.

The boiling point of a liquid is the temperature at which the vapor pressure of the liquid is equal to the pressure on the surface of the liquid. The heat of vaporization of ethanol is 838 joules per gram. A sample of ethanol has a mass of 65.0 grams and is boiling at 1.00 atmosphere.

19.) Based on Table H, what is the temperature of this sample of ethanol? _____ °C

20.) Calculate the minimum amount of heat required to completely vaporize this sample of ethanol. Your response must include *both* a correct numerical setup and the calculated result.

_____ J

		
Does the diagram represent an exothermic or endothermic process?		
Determine the potential energy of the reactants		
Determine the potential energy of the products		
Determine the heat of reaction, including the sign and magnitude		
Determine the activation energy of the forward reaction		
Are the reactants or products more stable?		
Describe heat flow, in terms of the system and surroundings.		
If this reaction could go backwards, what would be the activation energy of the reverse reaction?		

How does the information on Reference Table I relate to the information in a PE diagram?

How does the addition of a catalyst affect ...a potential energy diagram? ...the reaction rate?

Name: _____

Properties, Polarity, and IMF Station

- Which of these formulas contains the most polar bond?
(1) H-Br
(2) H-Cl
(3) H-F
(4) H-I
- The bonds between hydrogen and oxygen in a water molecule are classified as
(1) polar covalent
(2) nonpolar covalent
(3) ionic
(4) metallic
- Hexane (C₆H₁₄) and water do *not* form a solution. Which statement explains this phenomenon?
(1) Hexane is polar and water is nonpolar.
(2) Hexane is ionic and water is polar.
(3) Hexane is nonpolar and water is polar.
(4) Hexane is nonpolar and water is ionic.
- Which molecule is nonpolar?
(1) H₂O
(2) NH₃
(3) CO
(4) CO₂
- As a result of the gold foil experiment, it was concluded that an atom
(1) contains protons, neutrons, and electrons
(2) contains a small, dense nucleus
(3) has positrons and orbitals
(4) is a hard, indivisible sphere
- Which atom in the ground state has an outermost electron with the most energy?
(1) Cs
(2) K
(3) Li
(4) Na
- Which pair represents two forms of an element in the same phase at STP but with different structures and different properties?
(1) I₂(s) and I₂(g)
(2) O₂(g) and O₃(g)
(3) H₂(g) and Hg(g)
(4) H₂O(s) and H₂O(l)
- Which sample of CO₂ has a definite shape and a definite volume?
(1) CO₂(aq)
(2) CO₂(g)
(3) CO₂(l)
(4) CO₂(s)
- What occurs in order to break the bond in a Cl₂ molecule?
(1) Energy is absorbed.
(2) Energy is released.
(3) The molecule creates energy.
(4) The molecule destroys energy.
- Which statement describes a chemical change?
(1) Alcohol evaporates.
(2) Water vapor forms snowflakes.
(3) Table salt (NaCl) is crushed into powder.
(4) Glucose (C₆H₁₂O₆) and oxygen produce CO₂ and H₂O.
- At standard pressure, CH₄ boils at 112 K and H₂O boils at 373 K. What accounts for the higher boiling point of H₂O at standard pressure?
(1) covalent bonding
(2) ionic bonding
(3) hydrogen bonding
(4) metallic bonding
- A mixture of sand and table salt can be separated by filtration because the substances in the mixture differ in
(1) boiling point
(2) density at STP
(3) freezing point
(4) solubility in water

- 13.) Which sample of matter is classified as a substance?
 (1) air (3) milk
 (2) ammonia (4) seawater
- 14.) A solution consists of 0.50 mole of CaCl_2 dissolved in 100. grams of H_2O at 25°C . Compared to the boiling point and freezing point of 100. grams of H_2O at standard pressure, the solution at standard pressure has
 (1) a lower boiling point and a lower freezing point
 (2) a lower boiling point and a higher freezing point
 (3) a higher boiling point and a lower freezing point
 (4) a higher boiling point and a higher freezing point
- 15.) Which element is a liquid at 305 K and 1.0 atmosphere?
 (1) magnesium (3) gallium
 (2) fluorine (4) iodine
- 16.) At STP, which physical property of aluminum always remains the same from sample to sample?
 (1) mass (3) length
 (2) density (4) volume
- 17.) Which sample of matter sublimates at room temperature and standard pressure?
 (1) $\text{Br}_2(\ell)$ (3) $\text{CO}_2(\text{s})$
 (2) $\text{Cl}_2(\text{g})$ (4) $\text{SO}_2(\text{aq})$
- 18.) At $50.^\circ\text{C}$ and standard pressure, intermolecular forces of attraction are strongest in a sample of
 (1) ethanoic acid (3) propanone
 (2) ethanol (4) water
- 19.) Which statement explains why neon is a Group 18 element?
 (1) Neon is a gas at STP. (3) Neon atoms have a stable valence electron configuration.
 (2) Neon has a low melting point. (4) Neon atoms have two electrons in the first shell.
- 20.) Which element has chemical properties that are most similar to the chemical properties of fluorine?
 (1) boron (3) neon
 (2) chlorine (4) oxygen
- 21.) A solid element that is malleable, a good conductor of electricity, and reacts with oxygen is classified as a
 (1) metal (3) noble gas
 (2) metalloid (4) nonmetal
- 22.) The phase of a sample of a molecular substance at STP is *not* determined by its
 (1) arrangement of molecules (3) number of molecules
 (2) intermolecular forces (4) molecular structure
- 23.) Which substance in the table below has the strongest intermolecular forces?

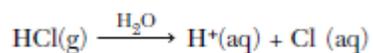
Substance	Molar Mass (g/mol)	Boiling Point (kelvins)
HF	20.01	293
HCl	36.46	188
HBr	80.91	207
HI	127.91	237

- (1) HF (3) HBr
 (2) HCl (4) HI

24.) Explain, in terms of electronegativity difference, why the bond in H–Cl is more polar than the bond in H–I.

25.) Explain why CCl₄ is classified as a nonpolar molecule.

A scientist makes a solution that contains 44.0 grams of hydrogen chloride gas, HCl(g), in 200. grams of water, H₂O(l), at 20.°C. This process is represented by the balanced equation below.



26.) Explain, in terms of the distribution of particles, why the solution is a homogeneous mixture.

_____ 1.) Which statement is true for any electrochemical cell?

- (1) Oxidation occurs at the anode, only.
- (2) Reduction occurs at the anode, only.
- (3) Oxidation occurs at both the anode and the cathode.
- (4) Reduction occurs at both the anode and the cathode.

_____ 2.) Given the equation: $2 \text{Al} + 3 \text{Cu}^{2+} \rightarrow 2 \text{Al}^{3+} + 3 \text{Cu}$

The reduction half-reaction is

- (1) $\text{Al} \rightarrow \text{Al}^{3+} + 3\text{e}^-$
- (2) $\text{Cu}^{2+} + 2\text{e}^- \rightarrow \text{Cu}$
- (3) $\text{Al} + 3\text{e}^- \rightarrow \text{Al}^{3+}$
- (4) $\text{Cu}^{2+} \rightarrow \text{Cu} + 2\text{e}^-$

_____ 3.) Which type of reaction occurs when nonmetal atoms become negative nonmetal ions?

- (1) oxidation
- (2) reduction
- (3) substitution
- (4) condensation

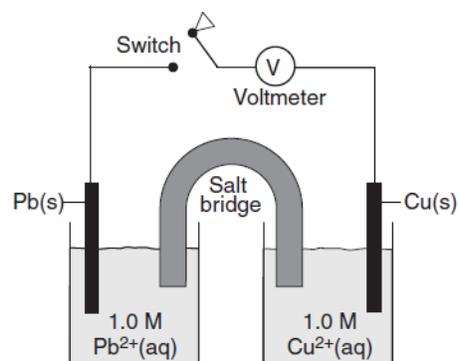
_____ 4.) In which compound does chlorine have the highest oxidation number?

- (1) NaClO
- (2) NaClO_2
- (3) NaClO_3
- (4) NaClO_4

_____ 5.) A diagram of a chemical cell and an equation are shown to the right.

When the switch is closed, electrons will flow from

- (1) the Pb(s) to the Cu(s)
- (2) the Cu(s) to the Pb(s)
- (3) the $\text{Pb}^{2+}(\text{aq})$ to the Pb(s)
- (4) the $\text{Cu}^{2+}(\text{aq})$ to the Cu(s)

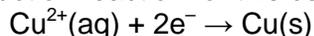


_____ 6.) What is the purpose of the salt bridge in a voltaic cell?

- (1) It blocks the flow of electrons.
- (2) It blocks the flow of positive and negative ions.
- (3) It is a path for the flow of electrons.
- (4) It is a path for the flow of positive and negative ions.

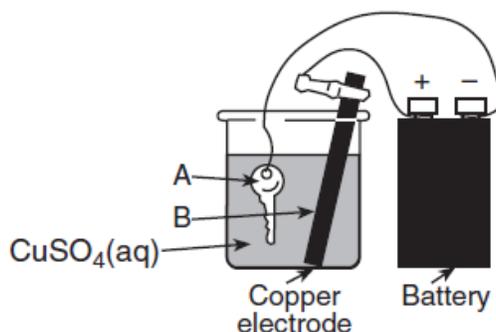
_____ 7.) The diagram to the right shows a key being plated with copper in an electrolytic cell.

Given the reduction reaction for this cell:



This reduction occurs at

- (1) A, which is the anode
- (2) A, which is the cathode
- (3) B, which is the anode
- (4) B, which is the cathode



_____ 8.) A voltaic cell spontaneously converts

- (1) electrical energy to chemical energy
- (2) chemical energy to electrical energy
- (3) electrical energy to nuclear energy
- (4) nuclear energy to electrical energy

_____ 9.) Given the reaction for the corrosion of aluminum: $4 \text{Al} + 3 \text{O}_2 \rightarrow 2 \text{Al}_2\text{O}_3$

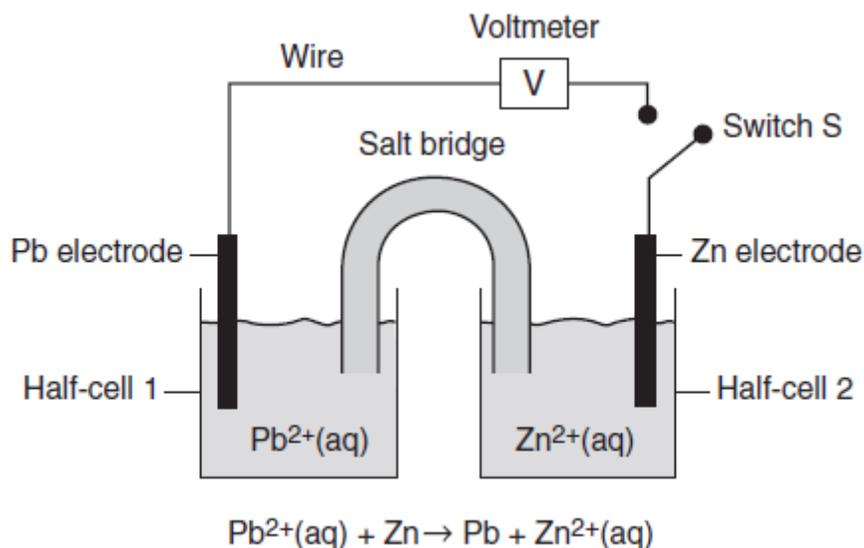
Which half-reaction correctly represents the oxidation that occurs?

- (1) $\text{Al} + 3\text{e}^- \rightarrow \text{Al}^{3+}$
- (2) $\text{Al} \rightarrow \text{Al}^{3+} + 3\text{e}^-$
- (3) $\text{O}_2 + 4\text{e}^- \rightarrow 2 \text{O}^{2-}$
- (4) $\text{O}_2 \rightarrow 2 \text{O}^{2-} + 4\text{e}^-$

- _____ 10.) Which change in oxidation number indicates oxidation?
(1) -1 to $+2$ (2) -1 to -2 (3) $+2$ to -3 (4) $+3$ to $+2$
-

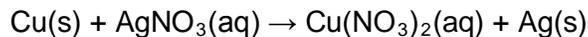
11.) State one difference between voltaic cells and electrolytic cells. Include information about *both* types of cells in your answer. [1]

Base your answers to questions 12 through 14 on the diagram below, which represents a voltaic cell at 298 K and 1 atm.

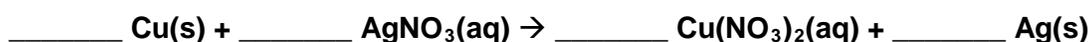


- 12.) In which half-cell will oxidation occur when switch S is closed? [1] _____
- 13.) Write the balanced half-reaction equation that will occur in half-cell 1 when switch S is closed. [1]
- 14.) Describe the direction of electron flow between the electrodes when switch S is closed. [1]

Base your answers to questions 15 and 16 on the unbalanced redox reaction below.



- 15.) Write the oxidation half-reaction. [1]
- 16.) Balance the redox equation below, using the smallest whole-number coefficients. [1]



Name: _____

Calculations- Equations Table T

1. Which kelvin temperature is equivalent to -24°C ?

→ Which equation do you need to use? _____

(1) 226 K

(2) 273 K

(3) 249 K

(4) 297 K

2. If 0.025 gram of $\text{Pb}(\text{NO}_3)_2$ is dissolved in 100. grams of H_2O , what is the concentration of the resulting solution, in parts per million?

→ Which equation do you need to use? _____

(1) 2.5×10^{-4} ppm

(2) 2.5 ppm

(3) 250 ppm

(4) 4.0×10^3 ppm

3. Based on data collected during a laboratory investigation, a student determined an experimental value of 322 joules per gram for the heat of fusion of H_2O . Calculate the student's percent error. Your response must include a correct numerical setup and the calculated result.

→ Which equation do you need to use? _____

_____ %

4. In a titration, a few drops of an indicator are added to a flask containing 35.0 milliliters of $\text{HNO}_3(\text{aq})$ of unknown concentration. After 30.0 milliliters of 0.15 M $\text{NaOH}(\text{aq})$ solution is slowly added to the flask, the indicator changes color, showing the acid is neutralized.

a) The volume of the $\text{NaOH}(\text{aq})$ solution is expressed to what number of significant figures? _____

b) Show a numerical setup below for calculating the concentration of the $\text{HNO}_3(\text{aq})$ solution.

→ Which equation do you need to use? _____

5. A student prepared two mixtures, each in a labeled beaker. Enough water at $20.^{\circ}\text{C}$ was used to make 100 milliliters of each mixture.

Information about Two Mixtures at $20.^{\circ}\text{C}$

	Mixture 1	Mixture 2
Composition	NaCl in H_2O	Fe filings in H_2O
Student Observations	<ul style="list-style-type: none">colorless liquidno visible solid on bottom of beaker	<ul style="list-style-type: none">colorless liquidblack solid on bottom of beaker
Other Data	<ul style="list-style-type: none">mass of NaCl(s) dissolved = 2.9 g	<ul style="list-style-type: none">mass of Fe(s) = 15.9 gdensity of Fe(s) = 7.87 g/cm^3

→

Determine the volume of the Fe filings used to produce mixture 2.

→ Which equation do you need to use? _____

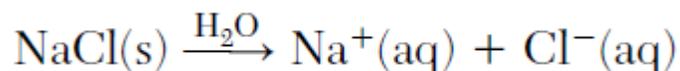
_____ cm³

6. One sample of a green vegetable contains 0.0035 gram of boron. Determine the total number of moles of boron in this sample.

→ Which equation do you need to use? _____

_____ moles

7. A 2.50-liter aqueous solution contains 1.25 moles of dissolved sodium chloride. The dissolving of NaCl(s) in water is represented by the equation below.



a) Determine the molarity of this solution.

→ Which equation do you need to use? _____

_____ M

8. Gypsum is a mineral that is used in the construction industry to make drywall (sheetrock). The chemical formula for this hydrated compound is CaSO₄ • 2 H₂O. A hydrated compound contains water molecules within its crystalline structure. Gypsum contains 2 moles of water for each 1 mole of calcium sulfate.

a) What is the gram formula mass of CaSO₄ • 2 H₂O?

_____ g/mol

b) In the space provided, show a correct numerical setup and calculate the percent composition by mass of water in this compound.

→ Which equation do you need to use? _____

_____ %

Name: _____

Vocabulary Review Station

- 1.) Which term represents the attraction one atom has for the electrons in a bond with another atom?
 - (1) electronegativity
 - (2) electrical conductivity
 - (3) first ionization energy
 - (4) mechanical energy

- 2.) The coefficients in a balanced chemical equation represent
 - (1) the mass ratios of the substances in the reaction
 - (2) the mole ratios of the substances in the reaction
 - (3) the total number of electrons in the reaction
 - (4) the total number of elements in the reaction

- 3.) Which type of formula represents the simplest whole-number ratio of atoms of the elements in a compound?
 - (1) molecular formula
 - (2) condensed formula
 - (3) empirical formula
 - (4) structural formula

- 4.) In the wave-mechanical model of the atom, an orbital is defined as
 - (1) a region of the most probable proton location
 - (2) a region of the most probable electron location
 - (3) a circular path traveled by a proton around the nucleus
 - (4) a circular path traveled by an electron around the nucleus

- 5.) The atomic mass of magnesium is the weighted average of the atomic masses of
 - (1) all of the artificially produced isotopes of Mg
 - (2) all of the naturally occurring isotopes of Mg
 - (3) the two most abundant artificially produced isotopes of Mg
 - (4) the two most abundant naturally occurring isotopes of Mg

- 6.) Which element has atoms with the strongest attraction for electrons in a chemical bond?
 - (1) chlorine
 - (2) nitrogen
 - (3) fluorine
 - (4) oxygen

- 7.) Which statement describes a reversible reaction at equilibrium?
 - (1) The activation energy of the forward reaction must equal the activation energy of the reverse reaction.
 - (2) The rate of the forward reaction must equal the rate of the reverse reaction.
 - (3) The concentration of the reactants must equal the concentration of the products.
 - (4) The potential energy of the reactants must equal the potential energy of the products.

- 8.) Which substance can *not* be broken down by a chemical change?
 - (1) ammonia
 - (2) ethanol
 - (3) propanal
 - (4) zirconium

- 9.) Which term is defined as the difference between the potential energy of the products and the potential energy of the reactants in a chemical reaction?
 - (1) activation energy
 - (2) thermal energy
 - (3) heat of fusion
 - (4) heat of reaction

- 10.) Which statement describes one acid-base theory?
 - (1) An acid is an H^+ acceptor, and a base is an H^+ donor.
 - (2) An acid is an H^+ donor, and a base is an H^+ acceptor.
 - (3) An acid is an H^- acceptor, and a base is an H^- donor.
 - (4) An acid is an H^- donor, and a base is an H^- acceptor.

- 11.) Which notations represent different isotopes of the element sodium?
 (1) ^{32}S and ^{34}S (3) Na^+ and Na^0
 (2) S^{2-} and S^{6+} (4) ^{22}Na and ^{23}Na
- 12.) What can be explained by the Arrhenius theory?
 (1) the behavior of many acids and bases (3) the operation of an electrochemical cell
 (2) the effect of stress on a phase equilibrium (4) the spontaneous decay of some nuclei
- 13.) Any substance composed of two or more elements that are chemically combined in a fixed proportion is
 (1) an isomer (3) a solution
 (2) an isotope (4) a compound
- 14.) All atoms of uranium have the same
 (1) mass number (3) number of neutrons plus protons
 (2) atomic number (4) number of neutrons plus electrons
- 15.) Hydrocarbons are composed of the elements
 (1) carbon and hydrogen, only (3) carbon, hydrogen, and oxygen
 (2) carbon and oxygen, only (4) carbon, nitrogen, and oxygen
- 16.) Which compounds are classified as electrolytes?
 (1) KNO_3 and H_2SO_4 (3) CH_3OCH_3 and H_2SO_4
 (2) KNO_3 and CH_3OH (4) CH_3OCH_3 and CH_3OH
- 17.) The isomers butane and methylpropane have
 (1) the same molecular formula and the same properties
 (2) the same molecular formula and different properties
 (3) different molecular formulas and the same properties
 (4) different molecular formulas and different properties
- 18.) The laboratory process in which the volume of a solution of known concentration is used to determine the concentration of another solution is called
 (1) distillation (3) titration
 (2) fermentation (4) transmutation
- 19.) All elements on the modern Periodic Table are arranged in order of increasing
 (1) atomic mass (3) number of neutrons per atom
 (2) molar mass (4) number of protons per atom
- 20.) The temperature of a sample of matter is a measure of the
 (1) average potential energy of the particles of the sample
 (2) average kinetic energy of the particles of the sample
 (3) total nuclear energy of the sample
 (4) total thermal energy of the sample
- 21.) Samples of four Group 15 elements, antimony, arsenic, bismuth, and phosphorus, are in the gaseous phase. An atom in the ground state of which element requires the *least* amount of energy to remove its most loosely held electron?
 (1) As (3) P
 (2) Bi (4) Sb