

## SHORT ANSWER REFERENCE GUIDE

Type of Short Answer Question	How to Approach	Example
IN TERMS OF...	<p>Restate question, <b>because</b> * in terms of word...</p>	<p>Explain, in terms of <u>atomic structure</u>, why the radius of a cesium ion in cesium chloride is smaller than the radius of a cesium atom when both are in the ground state.</p> <p>The Cs ion is smaller than the atom B/C the ion has lost an e<sup>-</sup></p>
COMPARE...	<p>More or less Higher or lower Stronger or weaker RTS</p>	<p>Compare the energy of an electron in the first electron shell to the energy of an electron in the second electron shell in an atom of isotope E.</p> <p>The e<sup>-</sup> in the 2nd shell will have higher energy!</p>
EXPLAIN...	<p>Need to tell why a certain phenomena occurs--sometimes with an <u>in terms of!</u></p>	<p>Explain, in terms of <u>electron configuration</u>, why sulfur atoms and oxygen atoms form compounds with similar molecular structures.</p> <p>S atoms and O atoms form similar compounds B/C the e<sup>-</sup> configuration shows the same # of valence e<sup>-</sup></p>

<p>SHOW NUMERICAL SETUP...</p>	<p>DO NOT SOLVE!!!! FORMULA (IF NECESSARY) AND PLUG IN! STOP!</p>	<p>Show a numerical setup for calculating the percent composition by mass of oxygen in <math>Al_2O_3</math> (gram-formula mass 102 g/mol).</p> $\% \text{ comp} = \frac{P}{W} \times 100$ <div style="border: 1px solid black; padding: 5px; width: fit-content; margin: 10px auto;"> <math display="block">\frac{3(16)}{102} \times 100</math> </div>
<p>STATE EVIDENCE...</p>	<p>MUST reference the provided or indicated chart or diagram!</p>	<p>Based on Table G, state evidence that all of the <math>NaCl(s)</math> in the flask would dissolve in the distilled water at <math>20.^{\circ}C</math>.</p> <p>The <math>NaCl</math> must be unsaturated and "under" the <math>NaCl</math> line on table G.</p>
<p>STATE THE RELATIONSHIP...</p>	<p>As _____ (increase/ decreases), _____ (increase/ decreases). RTS RTS</p>	<p>State the relationship between <span style="border: 1px solid black; padding: 2px;">atomic number</span> and <span style="border: 1px solid black; padding: 2px;">electronegativity</span> in period 2.</p> <p>As atomic # <math>\uparrow</math>, the electroneg. will <u>increase</u>.</p>

Name Key

1. Base your answer to the following question on the information below.

A student was studying the pH differences in samples from two Adirondack streams. The student measured a pH of 4 in stream A and a pH of 6 in stream B.

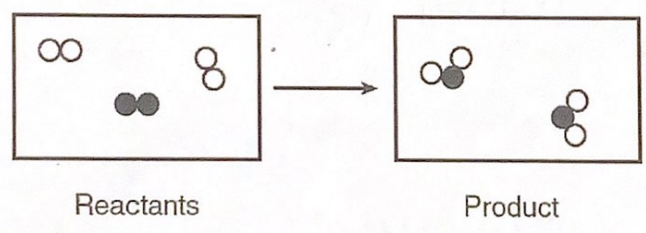
Compare the hydronium ion concentration in stream A to the hydronium ion concentration in stream B.

The  $[H^+]$  in A is higher.

2. Base your answer to the following question on the information below.

The particle diagrams below represent the reaction between two nonmetals,  $A_2$  and  $Q_2$ .

Key	
●	= Atom of element A
○	= Atom of element Q



Compare the total mass of the reactants to the total mass of the product.

The mass is =

3. Base your answer to the following question on the information below.

In a laboratory, a student makes a solution by completely dissolving 80.0 grams of  $KNO_3(s)$  in 100.0 grams of hot water. The resulting solution has a temperature of  $60.^{\circ}C$ . The room temperature in the laboratory is  $22.^{\circ}C$ .

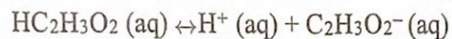
Compare the boiling point of the solution at standard pressure to the boiling point of water at standard pressure.

The solution has a higher boiling point.

## Regents Chemistry

4. Base your answer to the following question on the information below.

A beaker contains 100.0 milliliters of a dilute aqueous solution of ethanoic acid at equilibrium. The equation below represents this system.



Compare the rate of the forward reaction to the rate of the reverse reaction for this system.

The rates are equal.

5. Base your answer to the following question on the information below.

A sample of helium gas is in a closed system with a movable piston. The volume of the gas sample is changed when both the temperature and the pressure of the sample are increased. The table below shows the initial temperature, pressure, and volume of the gas sample, as well as the final temperature and pressure of the sample.

Helium Gas in a Closed System

Condition	Temperature (K)	Pressure (atm)	Volume (mL)
initial	200.	2.0	500.
final	300.	7.0	?

Compare the total number of gas particles in the sample under the initial conditions to the total number of gas particles in the sample under the final conditions.

The # of particles is the same

6. Base your answer to the following question on the information below.

Nuclear radiation is harmful to living cells, particularly to fast-growing cells, such as cancer cells and blood cells. An external beam of the radiation emitted from a radioisotope can be directed on a small area of a person to destroy cancer cells within the body.

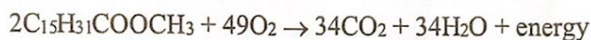
Cobalt-60 is an artificially produced radioisotope that emits gamma rays and beta particles. One hospital keeps a 100.0-gram sample of cobalt-60 in an appropriate, secure storage container for future cancer treatment.

Compare the penetrating power of the two emissions from the Co-60.

gamma is more highly penetrating

1. Base your answer to the following question on the information below.

Biodiesel is an alternative fuel for vehicles that use petroleum diesel. Biodiesel is produced by reacting vegetable oil with  $\text{CH}_3\text{OH}$ . Methyl palmitate,  $\text{C}_{15}\text{H}_{31}\text{COOCH}_3$ , a compound found in biodiesel, is made from soybean oil. One reaction of methyl palmitate with oxygen is represented by the balanced equation below.

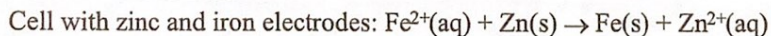
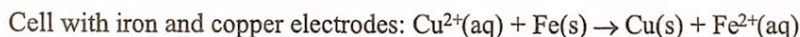


State evidence from the balanced equation that indicates the reaction is exothermic.

Energy is on the products side

2. Base your answer to the following question on the information below.

In a laboratory investigation, a student constructs a voltaic cell with iron and copper electrodes. Another student constructs a voltaic cell with zinc and iron electrodes. Testing the cells during operation enables the students to write the balanced ionic equations below.

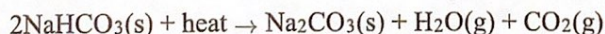


State evidence from the balanced equation for the cell with iron and copper electrodes that indicates the reaction in the cell is an oxidation-reduction reaction.

There is a change in oxidation #

3. Base your answer to the following question on the information below.

The Solvay process is a multistep industrial process used to produce washing soda,  $\text{Na}_2\text{CO}_3(\text{s})$ . In the last step of the Solvay process,  $\text{NaHCO}_3(\text{s})$  is heated to  $300^\circ\text{C}$ , producing washing soda, water, and carbon dioxide. This reaction is represented by the balanced equation below.



State evidence that indicates the entropy of the products is greater than the entropy of the reactant.

(s)  $\rightarrow$  (g) phase change

OR

More moles on products side

## Regents Chemistry

4. Base your answer to the following question on the information below.

Physical Properties of  $\text{CF}_4$  and  $\text{NH}_3$   
at Standard Pressure

Compound	Melting Point (°C)	Boiling Point (°C)	Solubility in Water at 20.0°C
$\text{CF}_4$	-183.6	-127.8	insoluble
$\text{NH}_3$	-77.7	-33.3	soluble

State evidence that indicates  $\text{NH}_3$  has stronger intermolecular forces than  $\text{CF}_4$ .

$\text{NH}_3$  has a higher BP/MP

5. Base your answer to the following question on the information below.

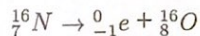
In the early 1800s, John Dalton proposed an atomic theory that was based on experimental observations made by several scientists. Three concepts of Dalton's atomic theory are stated below.

Statement A: Atoms are indivisible and cannot be destroyed or broken down into smaller parts.

Statement B: Atoms of one element cannot be changed into atoms of another element.

Statement C: All atoms of one element have the same mass.

The decay of N-16 is represented by the balanced equation below.



State evidence that indicates statement B is *not* always true.

Atoms of N-16 are changed to O-16

6. Base your answer to the following question on the information below and on your knowledge of chemistry.

Rubbing alcohol sold in stores is aqueous 2-propanol,  $\text{CH}_3\text{CHOHCH}_3(\text{aq})$ . Rubbing alcohol is available in concentrations of 70% and 91% 2-propanol by volume.

To make 100. mL of 70.% aqueous 2-propanol, 70. mL of 2-propanol is diluted with enough water to produce a total volume of 100. mL. In a laboratory investigation, a student is given a 132-mL sample of 91% aqueous 2-propanol to separate using the process of distillation.

State evidence that indicates the proportions of the components in rubbing alcohol can vary.

The solution can have 70% or 91% propanol

Name Key

Regents Chemistry

Numerical Setup S.A. Review

1. Base your answer to the following question on the information below.

Gypsum is a mineral that is used in the construction industry to make drywall (sheetrock). The chemical formula for this hydrated compound is  $\text{CaSO}_4 \cdot 2\text{H}_2\text{O}$ . A hydrated compound contains water molecules within its crystalline structure. Gypsum contains 2 moles of water for each 1 mole of calcium sulfate.

Show a correct numerical setup for calculating the percent composition by mass of water in this compound and record your answer.

$$\frac{P}{W} \times 100 \quad \frac{2(18)}{136.14} \times 100$$

2. Base your answer to the following question on the information below.

A student titrates 60.0 mL of  $\text{HNO}_3(\text{aq})$  with 0.30 M  $\text{NaOH}(\text{aq})$ . Phenolphthalein is used as the indicator. After adding 42.2 mL of  $\text{NaOH}(\text{aq})$ , a color change remains for 25 seconds, and the student stops the titration.

Show a correct numerical setup for calculating the molarity of the  $\text{HNO}_3(\text{aq})$ .

$$M_A V_A = M_B V_B$$

$$M_A (60) = (0.3) (42.2)$$

3. Base your answer to the following question on the data table below, which shows three isotopes of neon.

Isotope	Atomic Mass (atomic mass units)	Percent Natural Abundance
$^{20}\text{Ne}$	19.99	90.9%
$^{21}\text{Ne}$	20.99	0.3%
$^{22}\text{Ne}$	21.99	8.8%

$$\frac{M(\%) + M(\%) \dots}{100}$$

Based on the atomic masses and the natural abundances shown in the data table show a correct numerical setup for calculating the average atomic mass of neon.

$$\frac{19.99(90.9)}{100} + \frac{20.99(0.3)}{100} + \frac{21.99(8.8)}{100}$$

4. Show a correct numerical setup for calculating the formula mass of glucose,  $\text{C}_6\text{H}_{12}\text{O}_6$ .

$$+ \frac{6(12)}{+ 12(1)} + \frac{6(16)}{\underline{\hspace{2cm}}}$$

## Regents Chemistry

5. Base your answer to the following question on the information below

An unsaturated solution is made by completely dissolving 20.0 grams of  $\text{NaNO}_3$  in 100.0 grams of water at  $20.0^\circ\text{C}$

Show a correct numerical setup for calculating the number of moles of  $\text{NaNO}_3$  (gram-formula mass = 85.0 grams per mole) used to make this unsaturated solution.

$$20\text{g} \cdot \frac{1}{85} = \text{--- mol OR} = \frac{20}{85}$$

6. Base your answer to the following question on the information below.

A sample of helium gas is in a closed system with a movable piston. The volume of the gas sample is changed when both the temperature and the pressure of the sample are increased. The table below shows the initial temperature, pressure, and volume of the gas sample, as well as the final temperature and pressure of the sample.

Helium Gas in a Closed System

Condition	Temperature (K)	Pressure (atm)	Volume (mL)
initial	200.	2.0	500.
final	300.	7.0	?

In the space below show a correct numerical setup for calculating the final volume of the helium gas sample.

$$\frac{P_1 V_1}{T_1} = \frac{P_2 V_2}{T_2} \quad \frac{2(500)}{200} = \frac{7(V_2)}{300}$$

7. Base your answer to the following question on the information below and on your knowledge of chemistry.

- A test tube contains a sample of solid stearic acid, an organic acid.
- Both the sample and the test tube have a temperature of  $22.0^\circ\text{C}$ .
- The stearic acid melts after the test tube is placed in a beaker with 320 grams of water at  $98.0^\circ\text{C}$
- The temperature of the liquid stearic acid and water in the beaker reaches  $74.0^\circ\text{C}$ .

Show a numerical setup for calculating the amount of thermal energy change for the water in the beaker.

$$Q = mc\Delta T$$
$$Q = 320(4.18)(74 - 98)$$



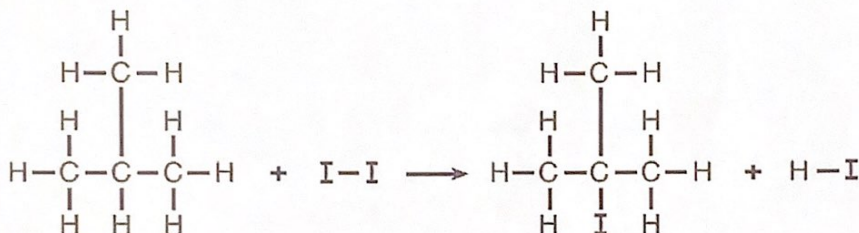
Name Key

Regents Chemistry

In Terms of Review

1. Base your answer to the following question on the information below

The hydrocarbon 2-methylpropane reacts with iodine as represented by the balanced equation below. At standard pressure, the boiling point of 2-methylpropane is lower than the boiling point of 2-iodo-2-methylpropane.



2-methylpropane

2-iodo-2-methylpropane

Explain, in terms of bonding, why the hydrocarbon 2-methylpropane is saturated.

The molecules are saturated B/C, bonding is single

2. Base your answer to the following question on the information below

An atom in an excited state has an electron configuration of 2-7-2.

Explain, in terms of subatomic particles, why this excited atom is electrically neutral.

The atom is neutral B/C protons = ~~neutrons~~ electrons

3. Base your answer to the following question on the information below and on your knowledge of chemistry.

The balanced equation below represents a reaction.  
 $\text{O}_2(\text{g}) + \text{energy} \rightarrow \text{O}(\text{g}) + \text{O}(\text{g})$

Explain, in terms of bonds, why energy is absorbed during this reaction.

Energy is absorbed B/C bonds are broken

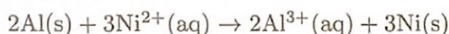
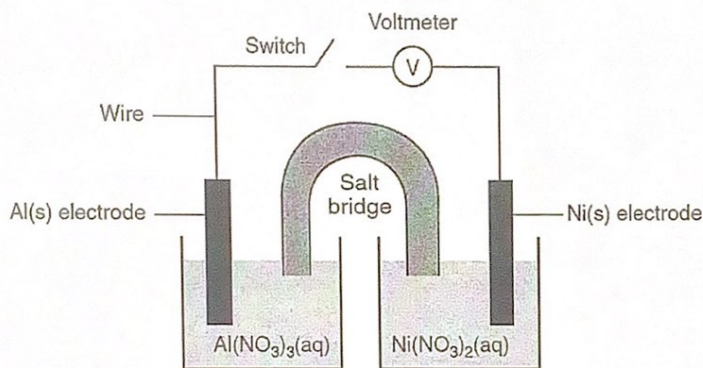
4. Explain, in terms of element classification, why  $\text{K}_2\text{O}$  is an ionic compound.

$\text{K}_2\text{O}$  is ionic B/C K is a metal and O is non.

## Regents Chemistry

5. Base your answer to the following question on the information below.

A student constructs an electrochemical cell during a laboratory investigation. When the switch is closed, electrons flow through the external circuit. The diagram and equation below represent this cell and the reaction that occurs.



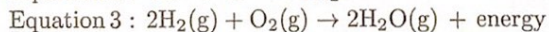
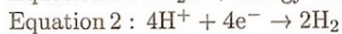
State, in terms of energy, why this cell is a voltaic cell.

This is voltaic b/c <sup>Electrical</sup> energy is produced.

6. Base your answer to the following question on the information below and on your knowledge of chemistry.

Fossil fuels produce air pollution and may eventually be depleted. Scientists are researching ways to use hydrogen as an alternate fuel.

A device called an artificial leaf was invented to produce hydrogen and oxygen using sunlight and water. The artificial leaf is an electrochemical cell. Equation 1 and 2 below represent the reactions taking place in the leaf. Equation 3 represents a reaction of hydrogen when used as fuel.



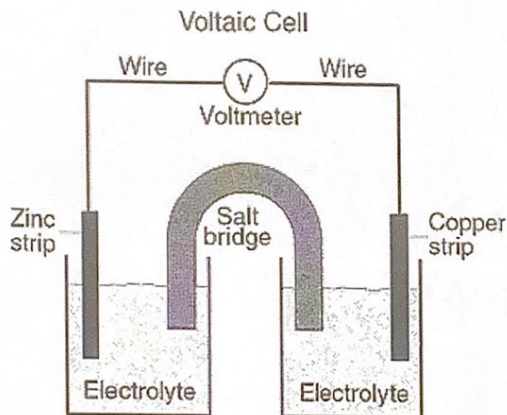
Explain, in terms of energy, why the artificial leaf is an electrolytic cell.

This is electrolytic b/c energy is required.

7. Explain, in terms of electron configuration, why arsenic and antimony are chemically similar.

Arsenic and Antimony are similar b/c  $\text{e}^-$  configurations have same # of valence  $\text{e}^-$

1. Base your answer to the following question on the diagram of a voltaic cell provided below.

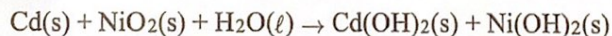


Explain the function of the salt bridge.

to allow ions to travel

2. Base your answer to the following question on the following information.

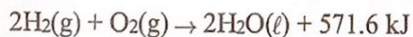
A flashlight can be powered by a rechargeable nickel-cadmium battery. In the battery, the anode is  $\text{Cd}(s)$  and the cathode is  $\text{NiO}_2(s)$ . The unbalanced equation below represents the reaction that occurs as the battery produces electricity. When a nickel-cadmium battery is recharged, the reverse reaction occurs.



Explain why Cd would be above Ni if placed on Table J.

more active, the anode

3. Base your answer to the following question on the equation below.



Explain why the entropy of the system decreases as the reaction proceeds.

gas is changed into a liquid.

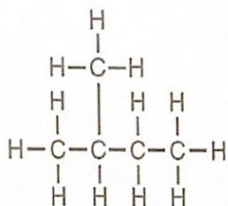
OR

fewer # of moles on products side

## Regents Chemistry

4. Base your answer to the following question on the information below.

The formula below represents a hydrocarbon.



Explain, in terms of carbon-carbon bonds, why this hydrocarbon is saturated.

All single C-C bonds

5. Base your answer to the following question on the information below

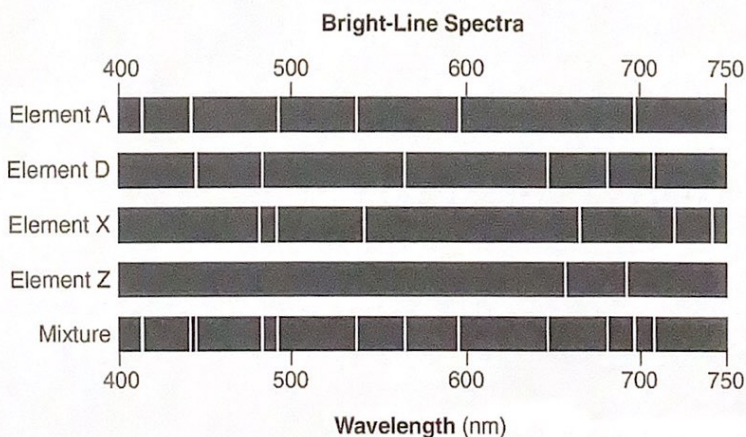
An atom in an excited state has an electron configuration of 2-7-2.

Explain, in terms of subatomic particles, why this excited atom is electrically neutral.

This is neutral B/C protons = electrons.

6. Base your answer to the following question on the information below and on your knowledge of chemistry.

The bright-line spectra for four elements and a mixture of elements are shown in the diagram below.



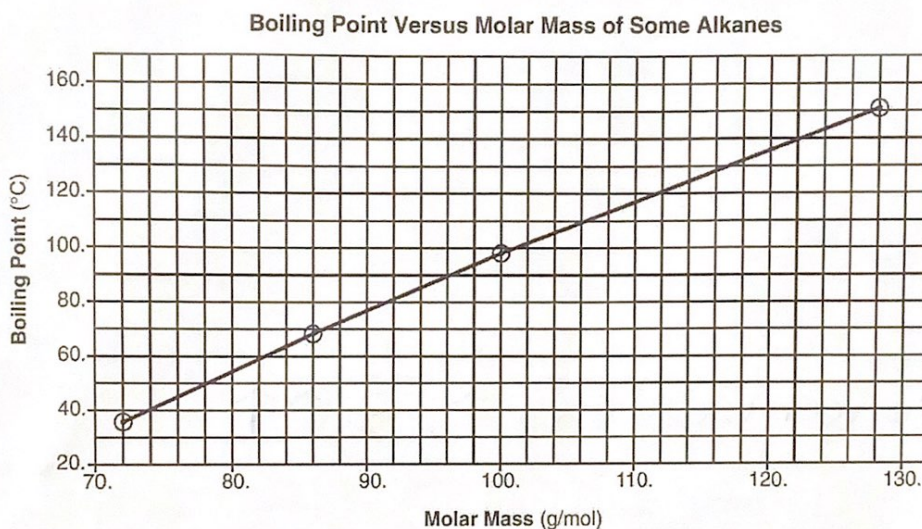
Explain, in terms of electrons and energy states, how the light emitted by excited atoms is produced.

Light is produced when electrons fall from high energy levels to low energy levels

Name Key

1. Base your answer to the following question on one the information below.

The graph below shows the relationship between boiling point and molar mass at standard pressure for pentane, hexane, heptane, and nonane.



State the relationship between molar mass and the strength of intermolecular forces for the selected alkanes.

*As mass increases, IMF ↑*

2. Base your answer to the following question on the information below.

**Molar Mass and Boiling Point of Four Substances**

Substance	Molar Mass (g/mol)	Boiling Point at 1 atm (K)
methane	16	112
ethane	30	185
propane	44	231
butane	58	273

Based on the data in the table, state the relationship between the boiling point at 1 atmosphere and molar mass for these four substances.

*As mass ↑, B.P increases*

## Regents Chemistry

3. Base your answer to the following question on the information below and on your knowledge of chemistry.

In an investigation, aqueous solutions are prepared by completely dissolving a different amount of  $\text{NaCl}(s)$  in each of four beakers containing 100.00 grams of  $\text{H}_2\text{O}(\ell)$  at room temperature. Each solution is heated and the temperature at which boiling occurred is measured. The data are recorded in the table below.

Boiling Point Data for Four  $\text{NaCl}(aq)$  Solutions

Beaker Number	Mass of $\text{H}_2\text{O}(\ell)$ (g)	Mass of $\text{NaCl}(s)$ Dissolved (g)	Boiling Point of Solution ( $^{\circ}\text{C}$ )
1	100.00	8.76	101.5
2	100.00	17.52	103.1
3	100.00	26.28	104.6
4	100.00	35.04	106.1

State the relationship between the concentration of ions and the boiling point for these solutions.

As concent. of ions  $\uparrow$ , B.P  $\uparrow$

4. Base your answer to the following question on the information below.

The atomic radius and the ionic radius for some Group 1 and some Group 17 elements are given in the tables below.

Atomic and Ionic Radii of Some Elements

Group 1

Particle	Radius (pm)
Li atom	130.
$\text{Li}^+$ ion	78
Na atom	160.
$\text{Na}^+$ ion	98
K atom	200.
$\text{K}^+$ ion	133
Rb atom	215
$\text{Rb}^+$ ion	148

Group 17

Particle	Radius (pm)
F atom	60.
$\text{F}^-$ ion	133
Cl atom	100.
$\text{Cl}^-$ ion	181
Br atom	117
$\text{Br}^-$ ion	?
I atom	136
$\text{I}^-$ ion	220.

State the relationship between atomic number and first ionization energy as the elements in Group 1 are considered in order of increasing atomic number.

As atomic # increases, ionization decreases.