

# Example Items

## Chemistry

**Chemistry Example Items** are a **representative set** of items for the ACP. Teachers may use this set of items along with the test blueprint as guides to prepare students for the ACP. On the last page, the correct answer, content SE and SE justification are listed for each item.

*The specific part of an SE that an Example Item measures is **NOT** necessarily the only part of the SE that is assessed on the ACP.* None of these Example Items will appear on the ACP.

Teachers may provide feedback regarding Example Items.

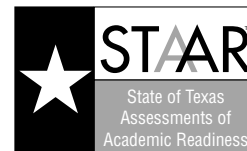
(1) Download the [Example Feedback Form](#) and email it. The form is located on the homepage of [Assessment.dallasisd.org](http://Assessment.dallasisd.org).

OR

(2) To submit directly, click “Example Feedback” **after** you login to the [Assessment website](#).

First Semester  
2018–2019  
Code #: 3101

# STAAR CHEMISTRY REFERENCE MATERIALS



## ATOMIC STRUCTURE

Speed of light = (frequency)(wavelength)

$$c = f\lambda$$

Energy = (Planck's constant)(frequency)

$$E_{\text{photon}} = hf$$

Energy =  $\frac{(\text{Planck's constant})(\text{speed of light})}{(\text{wavelength})}$

$$E_{\text{photon}} = \frac{hc}{\lambda}$$

## BEHAVIOR OF GASES

Total pressure of a gas =  $\left( \begin{array}{l} \text{sum of the partial pressures} \\ \text{of the component gases} \end{array} \right)$

$$P_T = P_1 + P_2 + P_3 + \dots$$

(Pressure)(volume) = (moles)(ideal gas constant)(temperature)

$$PV = nRT$$

$\frac{(\text{Initial pressure})(\text{initial volume})}{(\text{Initial moles})(\text{initial temperature})} = \frac{(\text{final pressure})(\text{final volume})}{(\text{final moles})(\text{final temperature})}$

$$\frac{P_1V_1}{n_1T_1} = \frac{P_2V_2}{n_2T_2}$$

(Initial pressure)(initial volume) = (final pressure)(final volume)

$$P_1V_1 = P_2V_2$$

$\frac{(\text{Initial volume})}{(\text{Initial temperature})} = \frac{(\text{final volume})}{(\text{final temperature})}$

$$\frac{V_1}{T_1} = \frac{V_2}{T_2}$$

$\frac{(\text{Initial volume})}{(\text{Initial moles})} = \frac{(\text{final volume})}{(\text{final moles})}$

$$\frac{V_1}{n_1} = \frac{V_2}{n_2}$$

## SOLUTIONS

Molarity =  $\frac{\text{moles of solute}}{\text{liter of solution}}$

$$M = \frac{\text{mol}}{\text{L}}$$

Ionization constant of water =  $\left( \begin{array}{l} \text{hydrogen ion} \\ \text{concentration} \end{array} \right) \left( \begin{array}{l} \text{hydroxide ion} \\ \text{concentration} \end{array} \right)$

$$K_w = [\text{H}^+][\text{OH}^-]$$

$\left( \begin{array}{l} \text{Volume of} \\ \text{solution 1} \end{array} \right) \left( \begin{array}{l} \text{molarity of} \\ \text{solution 1} \end{array} \right) = \left( \begin{array}{l} \text{volume of} \\ \text{solution 2} \end{array} \right) \left( \begin{array}{l} \text{molarity of} \\ \text{solution 2} \end{array} \right)$

$$V_1M_1 = V_2M_2$$

pH = -logarithm (hydrogen ion concentration)

$$\text{pH} = -\log[\text{H}^+]$$

## THERMOCHEMISTRY

Heat gained or lost = (mass)  $\left( \begin{array}{l} \text{specific} \\ \text{heat} \end{array} \right) \left( \begin{array}{l} \text{change in} \\ \text{temperature} \end{array} \right)$

$$Q = mc_p\Delta T$$

Enthalpy of reaction =  $\left( \begin{array}{l} \text{enthalpy} \\ \text{of products} \end{array} \right) - \left( \begin{array}{l} \text{enthalpy} \\ \text{of reactants} \end{array} \right)$

$$\Delta H = \Delta H_f^\circ(\text{products}) - \Delta H_f^\circ(\text{reactants})$$

# STAAR CHEMISTRY REFERENCE MATERIALS

## OTHER FORMULAS

$$\text{Density} = \frac{\text{mass}}{\text{volume}}$$

$$D = \frac{m}{V}$$

$$\text{Percent error} = \left( \frac{\text{accepted value} - \text{experimental value}}{\text{accepted value}} \right) (100)$$

$$\text{Percent yield} = \left( \frac{\text{actual yield}}{\text{theoretical yield}} \right) (100)$$

## CONSTANTS AND CONVERSIONS

$$\text{Avogadro's number} = 6.02 \times 10^{23} \text{ particles per mole}$$

$$h = \text{Planck's constant} = 6.63 \times 10^{-34} \text{ J} \cdot \text{s}$$

$$c = \text{speed of light} = 3.00 \times 10^8 \frac{\text{m}}{\text{s}}$$

$$K_w = \text{ionization constant of water} = 1.00 \times 10^{-14} \left( \frac{\text{mol}}{\text{L}} \right)^2$$

$$\text{alpha particle } (\alpha) = {}_2^4\text{He} \quad \text{beta particle } (\beta) = {}_{-1}^0\text{e} \quad \text{neutron} = {}_0^1\text{n}$$

$$\text{standard temperature and pressure (STP)} = 0^\circ\text{C and 1 atm}$$

$$0^\circ\text{C} = 273 \text{ K}$$

$$\text{volume of ideal gas at STP} = 22.4 \frac{\text{L}}{\text{mol}}$$

$$1 \text{ cm}^3 = 1 \text{ mL} = 1 \text{ cc}$$

$$1 \text{ atm} = 760 \text{ mm Hg} = 101.3 \text{ kPa}$$

$$R = \text{ideal gas constant} = 0.0821 \frac{\text{L} \cdot \text{atm}}{\text{mol} \cdot \text{K}} = 8.31 \frac{\text{L} \cdot \text{kPa}}{\text{mol} \cdot \text{K}} = 62.4 \frac{\text{L} \cdot \text{mm Hg}}{\text{mol} \cdot \text{K}}$$

$$1 \text{ calorie (cal)} = 4.18 \text{ joules (J)}$$

$$1000 \text{ calories (cal)} = 1 \text{ Calorie (Cal)} = 1 \text{ kilocalorie (kcal)}$$

## RULES FOR SIGNIFICANT FIGURES

1. Non-zero digits and zeros between non-zero digits are always significant.
2. Leading zeros are not significant.
3. Zeros to the right of all non-zero digits are only significant if a decimal point is shown.
4. For values written in scientific notation, the digits in the coefficient are significant.
5. In a common logarithm, there are as many digits after the decimal point as there are significant figures in the original number.

# STAAR CHEMISTRY REFERENCE MATERIALS

POLYATOMIC IONS		SOLUBILITY OF COMMON IONIC COMPOUNDS IN WATER		ACTIVITY SERIES
Acetate	$C_2H_3O_2^-$ , $CH_3COO^-$	<b><u>Soluble</u></b> <b><u>compounds contain</u></b> $C_2H_3O_2^-$ , $CH_3COO^-$	<b><u>Common exceptions</u></b> None	<b><u>Metal</u></b> Lithium
Ammonium	$NH_4^+$	$NH_4^+$	None	Potassium
Carbonate	$CO_3^{2-}$	$CO_3^{2-}$	None	Barium
Chlorate	$ClO_3^-$	$ClO_3^-$	None	Calcium
Chlorite	$ClO_2^-$	$ClO_2^-$	None	Sodium
Chromate	$CrO_4^{2-}$	$CrO_4^{2-}$	None	Magnesium
Cyanide	$CN^-$	$CN^-$	None	Aluminum
Dichromate	$Cr_2O_7^{2-}$	$Cr_2O_7^{2-}$	Compounds of $Ag^+$ , $Pb^{2+}$ , and $Hg_2^{2+}$	Manganese
Hydrogen carbonate	$HCO_3^-$	$HCO_3^-$	Compounds of $Ag^+$ , $Pb^{2+}$ , and $Hg_2^{2+}$	Zinc
Hydroxide	$OH^-$	$OH^-$	Compounds of $Ag^+$ , $Pb^{2+}$ , and $Hg_2^{2+}$	Chromium
Hypochlorite	$ClO^-$	$ClO^-$	Compounds of $Sr^{2+}$ , $Ba^{2+}$ , $Pb^{2+}$ , and $Hg_2^{2+}$	Iron
Nitrate	$NO_3^-$	$NO_3^-$	<b><u>Common exceptions</u></b>	Cobalt
Nitrite	$NO_2^-$	$NO_2^-$	Compounds of $NH_4^+$ and the alkali metal cations	Nickel
Perchlorate	$ClO_4^-$	$ClO_4^-$	Compounds of $NH_4^+$ and the alkali metal cations	Tin
Permanganate	$MnO_4^-$	$Cr_2O_7^{2-}$	Compounds of $NH_4^+$ and the alkali metal cations	Lead
Phosphate	$PO_4^{3-}$	$OH^-$	Compounds of $NH_4^+$ and the alkali metal cations, $Ca^{2+}$ , $Sr^{2+}$ , and $Ba^{2+}$	(Hydrogen)
Sulfate	$SO_4^{2-}$	$S^{2-}$	Compounds of $NH_4^+$ , the alkali metal cations, $Ca^{2+}$ , $Sr^{2+}$ , and $Ba^{2+}$	Copper
Sulfite	$SO_3^{2-}$		Compounds of $NH_4^+$ , the alkali metal cations, $Ca^{2+}$ , $Sr^{2+}$ , and $Ba^{2+}$	Mercury
				Silver
				Platinum
				Gold



# STAAR CHEMISTRY REFERENCE MATERIALS

## PERIODIC TABLE OF THE ELEMENTS

1 1A	2 2A	3 3B	4 4B	5 5B	6 6B	7 7B	8 8B	9	10	11 1B	12 2B	13 3A	14 4A	15 5A	16 6A	17 7A	18 8A														
1 <b>H</b> 1.008 Hydrogen	2 <b>He</b> 4.003 Helium	3 <b>Li</b> 6.941 Lithium	4 <b>Be</b> 9.012 Beryllium	5 <b>B</b> 10.812 Boron	6 <b>C</b> 12.011 Carbon	7 <b>N</b> 14.007 Nitrogen	8 <b>O</b> 15.999 Oxygen	9 <b>F</b> 18.998 Fluorine	10 <b>Ne</b> 20.180 Neon	11 <b>Na</b> 22.990 Sodium	12 <b>Mg</b> 24.305 Magnesium	13 <b>Al</b> 26.982 Aluminum	14 <b>Si</b> 28.086 Silicon	15 <b>P</b> 30.974 Phosphorus	16 <b>S</b> 32.066 Sulfur	17 <b>Cl</b> 35.453 Chlorine	18 <b>Ar</b> 39.948 Argon														
19 <b>K</b> 39.098 Potassium	20 <b>Ca</b> 40.078 Calcium	21 <b>Sc</b> 44.956 Scandium	22 <b>Ti</b> 47.867 Titanium	23 <b>V</b> 50.942 Vanadium	24 <b>Cr</b> 51.996 Chromium	25 <b>Mn</b> 54.938 Manganese	26 <b>Fe</b> 55.845 Iron	27 <b>Co</b> 58.933 Cobalt	28 <b>Ni</b> 58.693 Nickel	29 <b>Cu</b> 63.546 Copper	30 <b>Zn</b> 65.38 Zinc	31 <b>Ga</b> 69.723 Gallium	32 <b>Ge</b> 72.64 Germanium	33 <b>As</b> 74.922 Arsenic	34 <b>Se</b> 78.96 Selenium	35 <b>Br</b> 79.904 Bromine	36 <b>Kr</b> 83.798 Krypton														
37 <b>Rb</b> 85.468 Rubidium	38 <b>Sr</b> 87.62 Strontium	39 <b>Y</b> 88.906 Yttrium	40 <b>Zr</b> 91.224 Zirconium	41 <b>Nb</b> 92.906 Niobium	42 <b>Mo</b> 95.96 Molybdenum	43 <b>Tc</b> (98) Technetium	44 <b>Ru</b> 101.07 Ruthenium	45 <b>Rh</b> 102.906 Rhodium	46 <b>Pd</b> 106.42 Palladium	47 <b>Ag</b> 107.868 Silver	48 <b>Cd</b> 112.412 Cadmium	49 <b>In</b> 114.818 Indium	50 <b>Sn</b> 118.711 Tin	51 <b>Sb</b> 121.760 Antimony	52 <b>Te</b> 127.60 Tellurium	53 <b>I</b> 126.904 Iodine	54 <b>Xe</b> 131.294 Xenon														
55 <b>Cs</b> 132.905 Cesium	56 <b>Ba</b> 137.328 Barium	57 <b>La</b> 138.905 Lanthanum	58 <b>Ce</b> 140.116 Cerium	59 <b>Pr</b> 140.908 Praseodymium	60 <b>Nd</b> 144.242 Neodymium	61 <b>Pm</b> (145) Promethium	62 <b>Sm</b> 150.36 Samarium	63 <b>Eu</b> 151.964 Europium	64 <b>Gd</b> 157.25 Gadolinium	65 <b>Tb</b> 158.925 Terbium	66 <b>Dy</b> 162.500 Dysprosium	67 <b>Ho</b> 164.930 Holmium	68 <b>Er</b> 167.259 Erbium	69 <b>Tm</b> 168.934 Thulium	70 <b>Yb</b> 173.055 Ytterbium	71 <b>Lu</b> 174.967 Lutetium	72 <b>Hf</b> 178.49 Hafnium	73 <b>Ta</b> 180.948 Tantalum	74 <b>W</b> 183.84 Tungsten	75 <b>Re</b> 186.207 Rhenium	76 <b>Os</b> 190.23 Osmium	77 <b>Ir</b> 192.217 Iridium	78 <b>Pt</b> 195.085 Platinum	79 <b>Au</b> 196.967 Gold	80 <b>Hg</b> 200.59 Mercury	81 <b>Tl</b> 204.383 Thallium	82 <b>Pb</b> 207.2 Lead	83 <b>Bi</b> 208.980 Bismuth	84 <b>Po</b> (209) Polonium	85 <b>At</b> (210) Astatine	86 <b>Rn</b> (222) Radon
87 <b>Fr</b> (223) Francium	88 <b>Ra</b> (226) Radium	89 <b>Ac</b> (227) Actinium	90 <b>Th</b> 232.038 Thorium	91 <b>Pa</b> 231.036 Protactinium	92 <b>U</b> 238.029 Uranium	93 <b>Np</b> (237) Neptunium	94 <b>Pu</b> (244) Plutonium	95 <b>Am</b> (243) Americium	96 <b>Cm</b> (247) Curium	97 <b>Bk</b> (247) Berkelium	98 <b>Cf</b> (251) Californium	99 <b>Es</b> (252) Einsteinium	100 <b>Fm</b> (257) Fermium	101 <b>Md</b> (258) Mendelevium	102 <b>No</b> (259) Nobelium	103 <b>Lr</b> (262) Lawrencium	104 <b>Rf</b> (267) Rutherfordium	105 <b>Db</b> (268) Dubnium	106 <b>Sg</b> (271) Seaborgium	107 <b>Bh</b> (272) Bohrium	108 <b>Hs</b> (270) Hassium	109 <b>Mt</b> (276) Meitnerium	110 <b>Ds</b> (281) Darmstadtium	111 <b>Rg</b> (280) Roentgenium							

Mass numbers in parentheses are those of the most stable or most common isotope.

Lanthanide Series

Actinide Series

## EXAMPLE ITEMS Chemistry, Sem 1

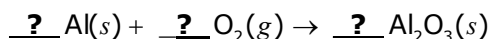
1 Which statement is a chemical property of copper?

- A It is a mineral.
- B It is a liquid at 1083 °C.
- C It reacts with nitric acid.
- D It is malleable and ductile.

2 What is the number of atoms in three grams of gold?

- A  $9.17 \times 10^{21}$
- B  $1.806 \times 10^{24}$
- C  $6.02 \times 10^{23}$
- D  $2.29 \times 10^{22}$

3 The unbalanced equation for the synthesis of aluminum oxide is shown.



Which list shows the order of coefficients needed to balance this equation?

- A 2, 3, 1
- B 2, 1, 2
- C 4, 1, 2
- D 4, 3, 2

4 Find the percent composition by mass of lithium in lithium chloride (LiCl).

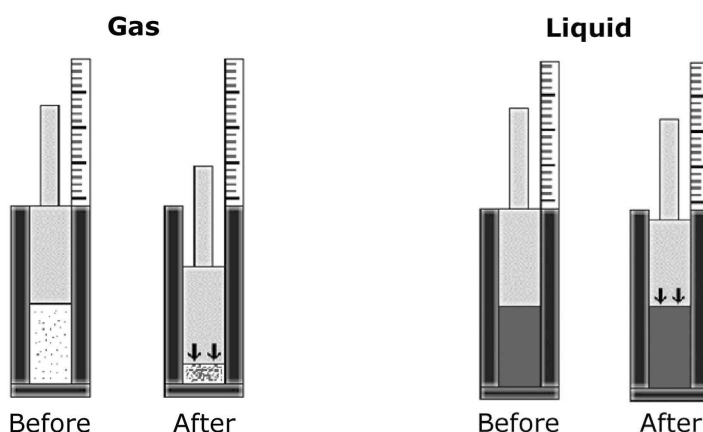
- A 16.4%
- B 15.0%
- C 19.6%
- D 83.6%

## EXAMPLE ITEMS Chemistry, Sem 1

- 5** Gold is classified as a pure substance. Which of its properties supports this classification?
- A** Gold occurs in nature as a solid.
  - B** Gold is resistant to rust and tarnish.
  - C** Gold has a high melting point.
  - D** Gold is made of one kind of atom.
- 6** What is the formula of calcium permanganate?
- A**  $\text{CaMnO}_4$
  - B**  $\text{Ca}_3\text{MnO}_4$
  - C**  $\text{Ca}(\text{MnO}_4)_2$
  - D**  $\text{Ca}_3(\text{MnO}_4)_3$
- 7** Which chemical family or group on the Periodic Table contains the least reactive elements?
- A** Group 1
  - B** Group 3
  - C** Group 17
  - D** Group 18
- 8** The Electron Sea Model explains why metals —
- A** accept electrons easily
  - B** are excellent conductors
  - C** are mostly brittle
  - D** form ionic compounds
- 9** What is the name of the molecular compound with the formula  $\text{P}_2\text{O}_5$ ?
- A** Pentaphosphorus dioxide
  - B** Decaphosphorus pentoxide
  - C** Diphosphorus pentoxide
  - D** Diphosphorus monoxide

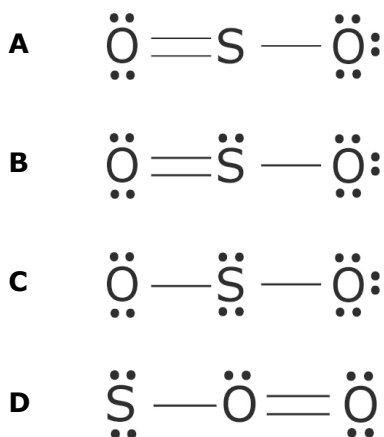
## EXAMPLE ITEMS Chemistry, Sem 1

- 10 Equal volumes of a liquid and a gas are placed in separate containers, and equal pressure is applied as shown in the illustration.

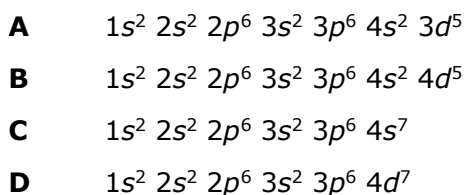


Which statement describes the result of this experiment?

- A The liquid has less mass than the gas.
  - B The liquid has more mass than the gas.
  - C The gas is less compressible than the liquid.
  - D The gas is more compressible than the liquid.
- 11 What is the Lewis electron dot structure for the covalent compound sulfur dioxide?



- 12 Which represents the ground state electron configuration for manganese?

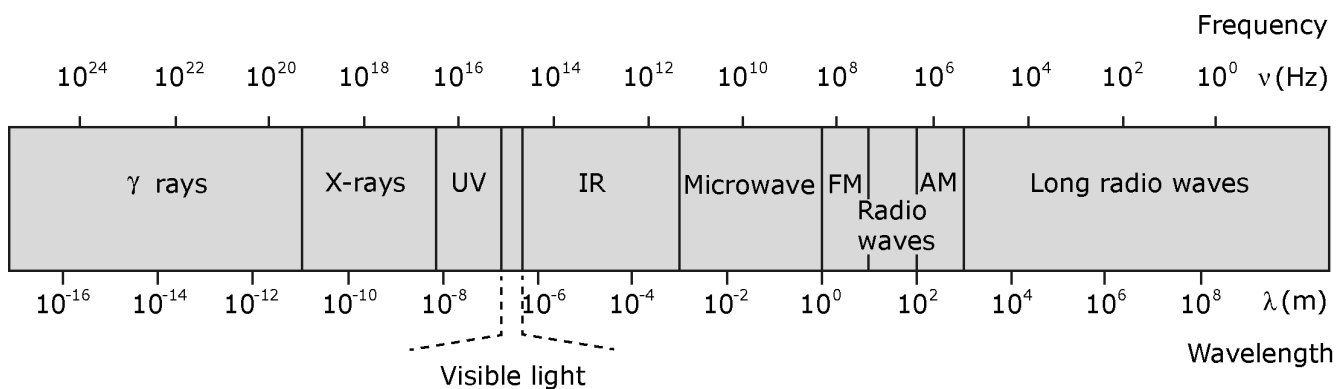




## EXAMPLE ITEMS Chemistry, Sem 1



Use the electromagnetic spectrum to answer the next question.



**13** Which type of electromagnetic waves have the greatest energy?

- A Gamma rays
- B Microwaves
- C Radio waves
- D Visible light

**14** Which is an example of an empirical formula?

- A  $\text{H}_2\text{O}_2$
- B  $\text{N}_2\text{O}_2$
- C  $\text{C}_3\text{H}_2$
- D  $\text{B}_2\text{H}_6$

## EXAMPLE ITEMS Chemistry, Sem 1

15

The table shows the two isotopes of an element.

Isotope	Mass (amu)	Percent Abundance	Average Mass
x	10.013	19.8%	
y	11.009	80.2%	
Average Atomic Mass			?

What is the average atomic mass of the element?

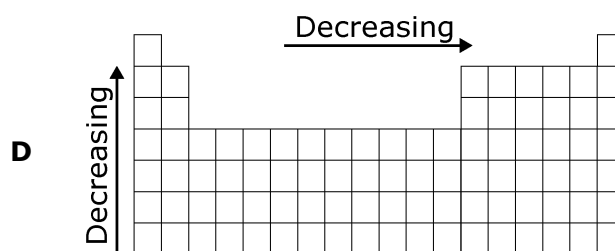
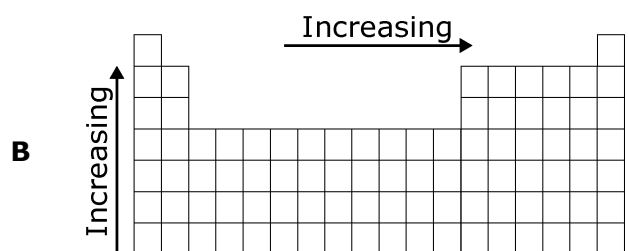
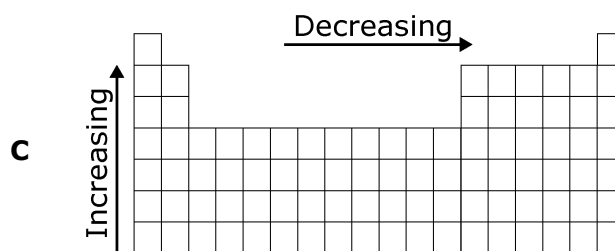
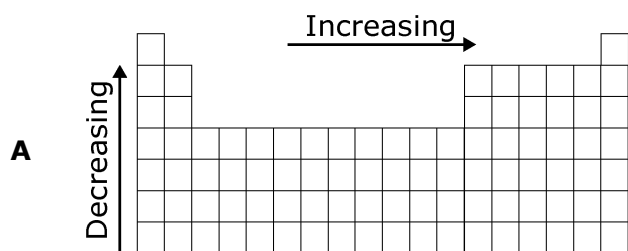
(Express the answer to three significant figures.)

Record the answer and fill in the bubbles on the grid provided. Be sure to use the correct place value.

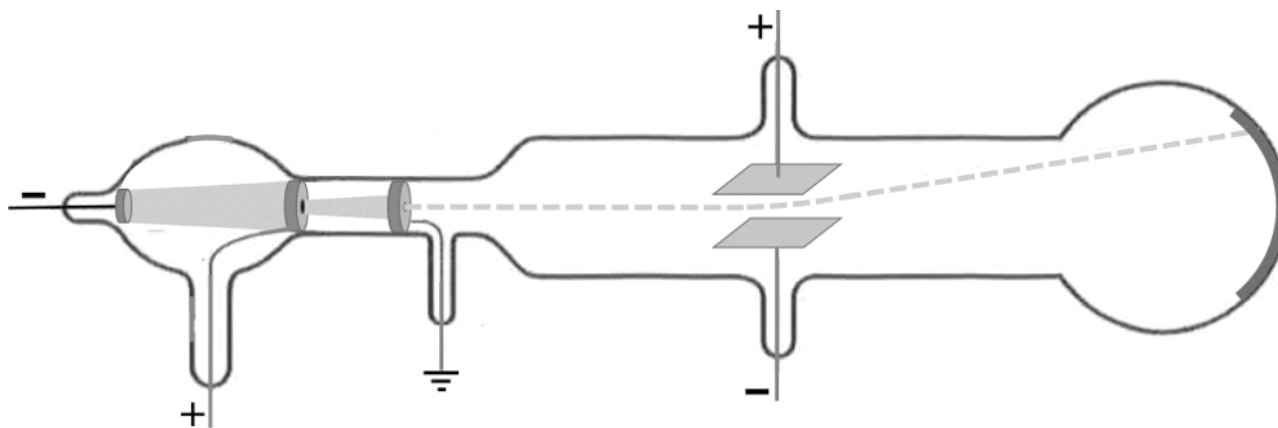
+	•	•	•	•	•	•	•
-	0	0	0	0	0	0	0
	1	1	1	1	1	1	1
	2	2	2	2	2	2	2
	3	3	3	3	3	3	3
	4	4	4	4	4	4	4
	5	5	5	5	5	5	5
	6	6	6	6	6	6	6
	7	7	7	7	7	7	7
	8	8	8	8	8	8	8
	9	9	9	9	9	9	9

## EXAMPLE ITEMS Chemistry, Sem 1

- 16 Electronegativity measures the ability of atoms to attract a bonding pair of electrons. Which diagram correctly identifies both the period and group trends for electronegativity in the Periodic Table?



- 17 The figure shows a cathode ray tube.



In 1897, J.J. Thomson used a device like the one shown to discover that cathode rays were streams of —

- A** photons
- B** electrons
- C** protons
- D** ions

**EXAMPLE ITEMS Chemistry Key, Sem 1**

<b>Item#</b>	<b>Key</b>	<b>SE</b>	<b>Process Skills</b>	<b>SE Justification</b>
<b>1</b>	C	C.4A	--	Differentiate between physical and chemical properties.
<b>2</b>	A	C.8B	2G	Calculate the number of atoms in a sample of material using Avogadro's number.
<b>3</b>	D	C.8E	2G	Balance chemical equations using the law of conservation of mass.
<b>4</b>	A	C.8C	2G	Calculate the percent composition of compounds.
<b>5</b>	D	C.4D	--	Classify matter as pure substances or mixtures through investigation of their properties.
<b>6</b>	C	C.7B	--	Write the chemical formulas of ionic compounds.
<b>7</b>	D	C.5B	2H	Identify the properties of chemical families using the Periodic Table.
<b>8</b>	B	C.7D	--	Describe metallic bonding and explain the electrical conductivity.
<b>9</b>	C	C.7A	--	Name covalent compounds using International Union of Pure and Applied Chemistry (IUPAC) nomenclature rules.
<b>10</b>	D	C.4C	2H, 2I	Compare liquids, and gases in terms of compressibility.
<b>11</b>	B	C.7C	2I	Construct electron dot formulas to illustrate covalent bonds.
<b>12</b>	A	C.6D	--	Express the arrangement of electrons in atoms using electron configurations.
<b>13</b>	A	C.6B	2H, 2I	Describe the mathematical relationships between energy, frequency, and wavelength of light using the electromagnetic spectrum.
<b>14</b>	C	C.8D	--	Differentiate between empirical and molecular formulas.
<b>15</b>	10.8	C.6C	2H, 2G	Calculate average atomic mass of an element using isotopic composition.
<b>16</b>	B	C.5C	2H	Interpret periodic trends, including electronegativity using the Periodic Table.
<b>17</b>	B	C.6A	3F	Describe the experimental design and conclusions used in the development of modern atomic theory, including Thomson's discovery of electron properties.