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.

OR

(2) To submit directly, click "Example Feedback" **after** you login to the Assessment website.

First Semester
2017–2018
Code #: 3101

STAAR CHEMISTRY REFERENCE MATERIALS

STAAR™ State of Texas Assessments of Academic Readiness

ATOMIC STRUCTURE

Speed of light = (frequency)(wavelength) $c = f\lambda$

Energy = (Planck's constant)(frequency) $E_{photon} = hf$

$$\text{Energy} = \frac{(\text{Planck's constant})(\text{speed of light})}{(\text{wavelength})} \qquad E_{photon} = \frac{hc}{\lambda}$$

BEHAVIOR OF GASES

$$\text{Total pressure of a gas} = \begin{pmatrix}\text{sum of the partial pressures}\\ \text{of the component gases}\end{pmatrix} \qquad P_T = P_1 + P_2 + P_3 + \ \ldots$$

(Pressure)(volume) = (moles)(ideal gas constant)(temperature) $PV = nRT$

$$\frac{(\text{Initial pressure})(\text{initial volume})}{(\text{Initial moles})(\text{initial temperature})} = \frac{(\text{final pressure})(\text{final volume})}{(\text{final moles})(\text{final temperature})} \qquad \frac{P_1V_1}{n_1T_1} = \frac{P_2V_2}{n_2T_2}$$

(Initial pressure)(initial volume) = (final pressure)(final volume) $P_1V_1 = P_2V_2$

$$\frac{(\text{Initial volume})}{(\text{Initial temperature})} = \frac{(\text{final volume})}{(\text{final temperature})} \qquad \frac{V_1}{T_1} = \frac{V_2}{T_2}$$

$$\frac{(\text{Initial volume})}{(\text{Initial moles})} = \frac{(\text{final volume})}{(\text{final moles})} \qquad \frac{V_1}{n_1} = \frac{V_2}{n_2}$$

SOLUTIONS

$$\text{Molarity} = \frac{\text{moles of solute}}{\text{liter of solution}} \qquad M = \frac{\text{mol}}{\text{L}}$$

$$\text{Ionization constant of water} = \begin{pmatrix}\text{hydrogen ion}\\ \text{concentration}\end{pmatrix}\begin{pmatrix}\text{hydroxide ion}\\ \text{concentration}\end{pmatrix} \qquad K_w = [H^+][OH^-]$$

$$\begin{pmatrix}\text{Volume of}\\ \text{solution 1}\end{pmatrix}\begin{pmatrix}\text{molarity of}\\ \text{solution 1}\end{pmatrix} = \begin{pmatrix}\text{volume of}\\ \text{solution 2}\end{pmatrix}\begin{pmatrix}\text{molarity of}\\ \text{solution 2}\end{pmatrix} \qquad V_1M_1 = V_2M_2$$

pH = –logarithm (hydrogen ion concentration) $pH = -\log[H^+]$

THERMOCHEMISTRY

$$\text{Heat gained or lost} = (\text{mass})\begin{pmatrix}\text{specific}\\ \text{heat}\end{pmatrix}\begin{pmatrix}\text{change in}\\ \text{temperature}\end{pmatrix} \qquad Q = mc_p\Delta T$$

$$\begin{matrix}\text{Enthalpy of}\\ \text{reaction}\end{matrix} = \begin{pmatrix}\text{enthalpy}\\ \text{of products}\end{pmatrix} - \begin{pmatrix}\text{enthalpy}\\ \text{of reactants}\end{pmatrix} \qquad \Delta H = \Delta H_f^o(\text{products}) - \Delta H_f^o(\text{reactants})$$

STAAR CHEMISTRY REFERENCE MATERIALS

OTHER FORMULAS

$$\text{Density} = \frac{\text{mass}}{\text{volume}} \qquad D = \frac{m}{V}$$

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

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

CONSTANTS AND CONVERSIONS

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

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

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

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

$$\text{alpha particle } (\alpha) = {}^{4}_{2}\text{He} \qquad \text{beta particle } (\beta) = {}^{0}_{-1}\text{e} \qquad \text{neutron} = {}^{1}_{0}\text{n}$$

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

$$0°\text{C} = 273 \text{ K}$$

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

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

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

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

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

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

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

Acetate	$C_2H_3O_2^-$, CH_3COO^-
Ammonium	NH_4^+
Carbonate	CO_3^{2-}
Chlorate	ClO_3^-
Chlorite	ClO_2^-
Chromate	CrO_4^{2-}
Cyanide	CN^-
Dichromate	$Cr_2O_7^{2-}$
Hydrogen carbonate	HCO_3^-
Hydroxide	OH^-
Hypochlorite	ClO^-
Nitrate	NO_3^-
Nitrite	NO_2^-
Perchlorate	ClO_4^-
Permanganate	MnO_4^-
Phosphate	PO_4^{3-}
Sulfate	SO_4^{2-}
Sulfite	SO_3^{2-}

SOLUBILITY OF COMMON IONIC COMPOUNDS IN WATER

Soluble compounds contain	**Common exceptions**
$C_2H_3O_2^-$, CH_3COO^-	None
NH_4^+	None
NO_3^-	None
CN^-	None
ClO^-	None
ClO_2^-	None
ClO_3^-	None
ClO_4^-	None
Br^-	Compounds of Ag^+, Pb^{2+}, and Hg_2^{2+}
Cl^-	Compounds of Ag^+, Pb^{2+}, and Hg_2^{2+}
I^-	Compounds of Ag^+, Pb^{2+}, and Hg_2^{2+}
SO_4^{2-}	Compounds of Sr^{2+}, Ba^{2+}, Pb^{2+}, and Hg_2^{2+}

Insoluble compounds contain	**Common exceptions**
CO_3^{2-}	Compounds of NH_4^+ and the alkali metal cations
PO_4^{3-}	Compounds of NH_4^+ and the alkali metal cations
CrO_4^{2-}	Compounds of NH_4^+ and the alkali metal cations
$Cr_2O_7^{2-}$	Compounds of NH_4^+ and the alkali metal cations
OH^-	Compounds of NH_4^+, the alkali metal cations, Ca^{2+}, Sr^{2+}, and Ba^{2+}
S^{2-}	Compounds of NH_4^+, the alkali metal cations, Ca^{2+}, Sr^{2+}, and Ba^{2+}

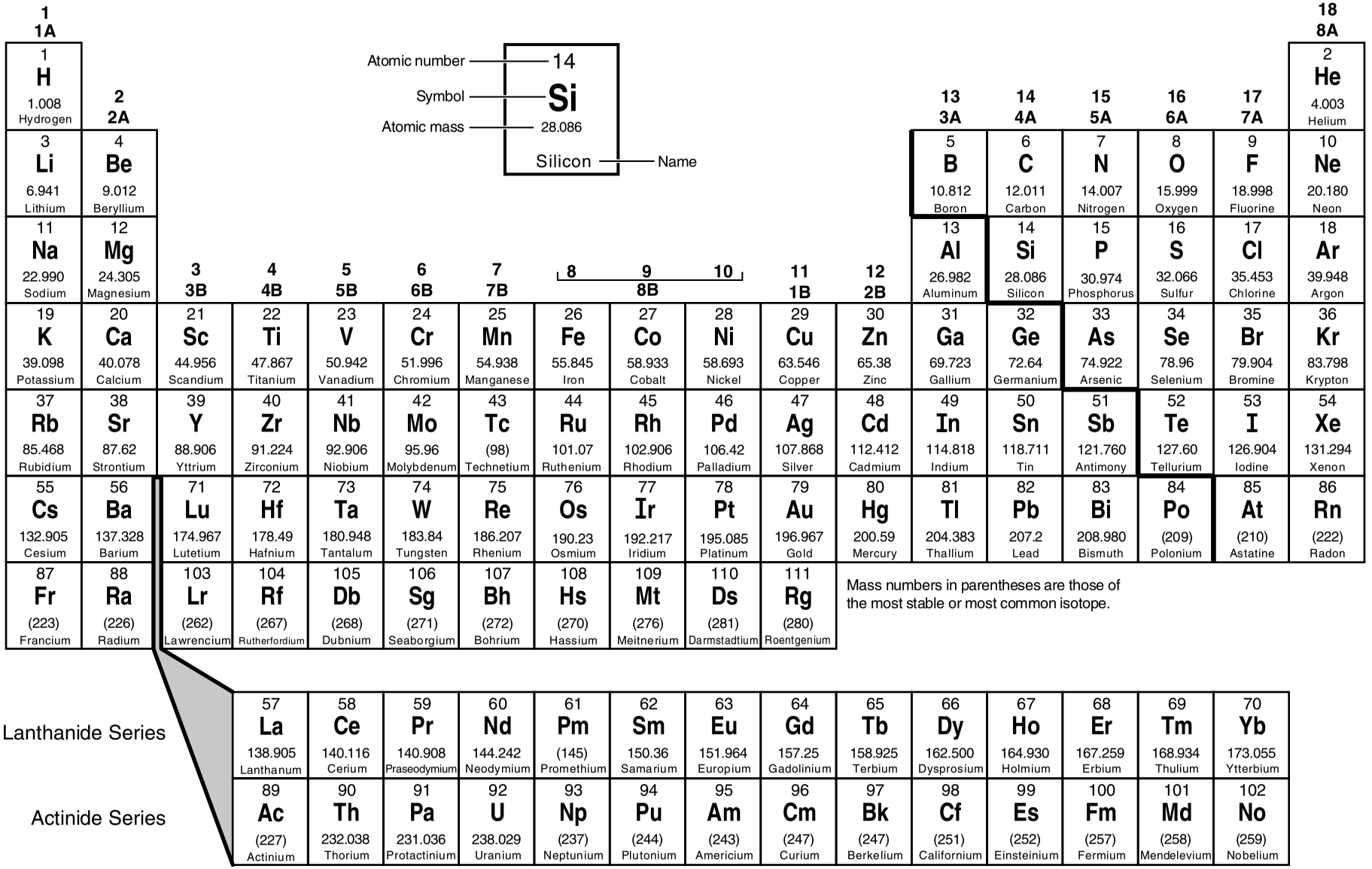
ACTIVITY SERIES

Metal

Lithium
Potassium
Barium
Calcium
Sodium
Magnesium
Aluminum
Manganese
Zinc
Chromium
Iron
Cobalt
Nickel
Tin
Lead
(Hydrogen)
Copper
Mercury
Silver
Platinum
Gold

STAAR CHEMISTRY REFERENCE MATERIALS

PERIODIC TABLE OF THE ELEMENTS



Updated Spring 2011

EXAMPLE ITEMS Chemistry, Sem 1

1 Which is a chemical property of copper?

A It is a mineral.

B It reacts with nitric acid.

C It is a liquid at 1083 °C.

D It is malleable and ductile.

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

A 9.17×10^{21}

B 1.806×10^{24}

C 6.02×10^{23}

D 2.29×10^{22}

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

$$\_\underline{?}\_\ Al(s) + \_\underline{?}\_\ O_2(g) \rightarrow \_\underline{?}\_\ Al_2O_3(s)$$

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 The table shows the percent composition of a compound containing hydrogen and oxygen.

Element	Percent Composition
Hydrogen	11.19%
Oxygen	88.81%

What is the empirical formula for this compound?

A H_2O

B H_2O_2

C $H_{11}O_6$

D $H_{11}O_{89}$

EXAMPLE ITEMS Chemistry, Sem 1

5 How many grams are there in one mole of Aluminum?

A 3.01×10^{23}

B 6.02×10^{25}

C 13.0

D 26.982

6 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.

7 What is the formula of calcium permanganate?

A $CaMnO_4$

B $Ca(MnO_4)_2$

C Ca_3MnO_4

D $Ca_3(MnO_4)_3$

8 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

9 The Electron Sea Model explains why metals —

A accept electrons easily

B are excellent conductors

C are mostly brittle

D form ionic compounds

Dallas ISD - Example Items

EXAMPLE ITEMS Chemistry, Sem 1

10 What is the name of the molecular compound with the formula P_2O_5?

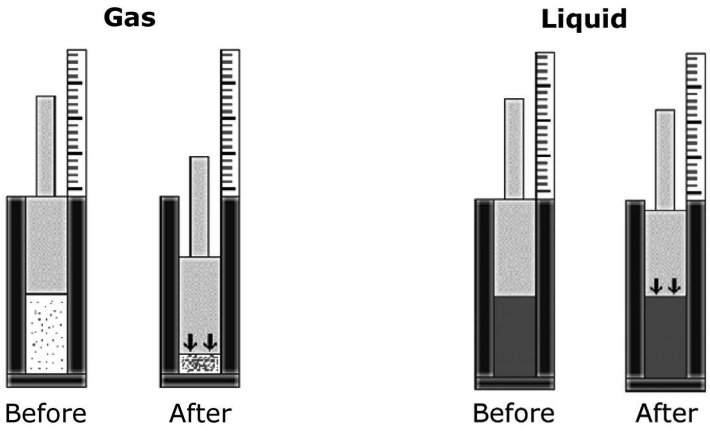
A Pentaphosphorus dioxide

B Decaphosphorus pentoxide

C Diphosphorus pentoxide

D Diphosphorus monoxide

11 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.

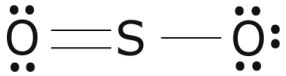
B The liquid has more mass than the gas.

C The gas is less compressible than the liquid.

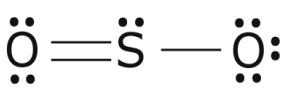
D The gas is more compressible than the liquid.

12 What is the Lewis electron dot structure for the covalent compound sulfur dioxide?

A



B



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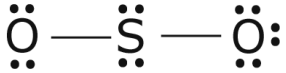
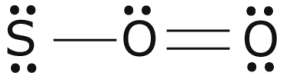


D



Dallas ISD - Example Items

13 Which represents the ground state electron configuration for manganese?

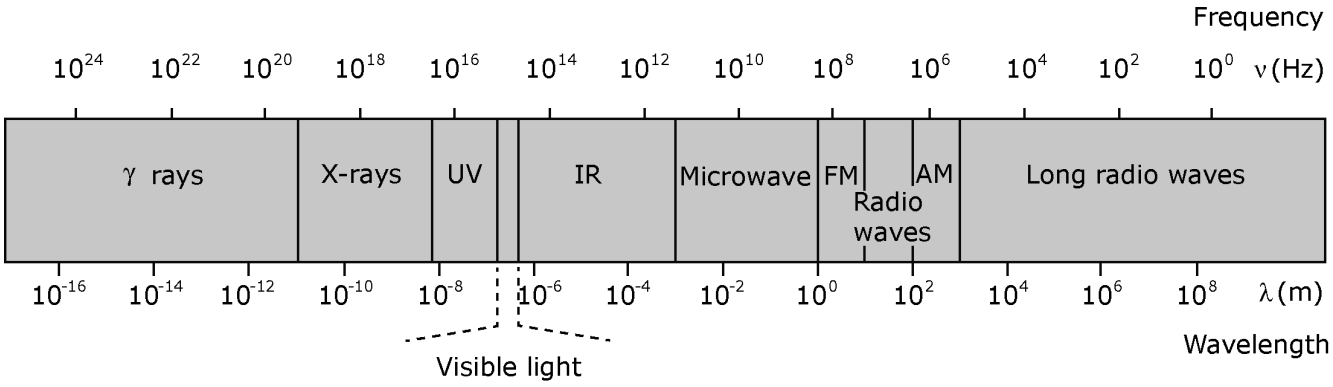
A $1s^2\ 2s^2\ 2p^6\ 3s^2\ 3p^6\ 4s^2\ 3d^5$

B $1s^2\ 2s^2\ 2p^6\ 3s^2\ 3p^6\ 4s^2\ 4d^5$

C $1s^2\ 2s^2\ 2p^6\ 3s^2\ 3p^6\ 4s^7$

D $1s^2\ 2s^2\ 2p^6\ 3s^2\ 3p^6\ 4d^7$

⇨ **Use the electromagnetic spectrum to answer the next question.**



14 Which type of electromagnetic waves have the greatest energy?

A Gamma rays

B Microwaves

C Radio waves

D Visible light

15 If a beam of blue light has a frequency of 6.67×10^{14} Hz, its wavelength is —

A 4.50×10^{-7} m

B 4.50×10^{-6} m

C 3.00×10^{8} m

D 2.22×10^{6} m

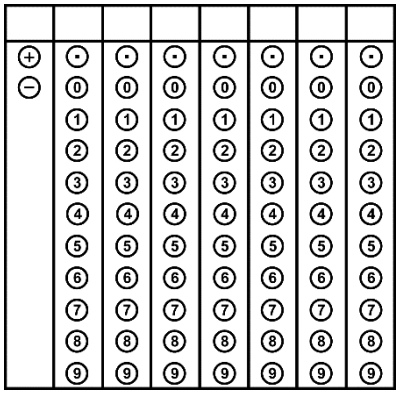
16 The table shows the two isotopes of an element.

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?

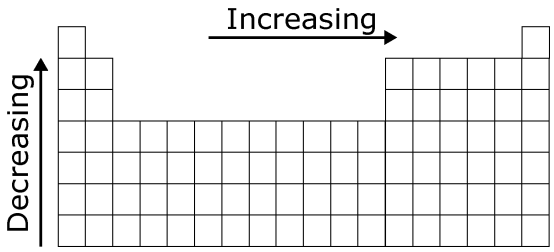
(Express the answer to three significant figures.)

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

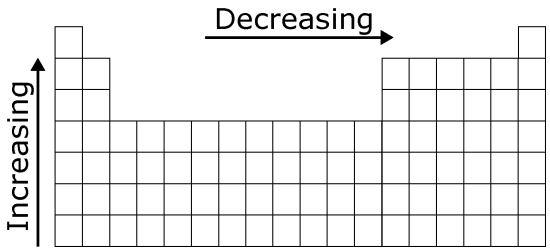


17 Electronegativity measures the ability of atoms to attract a bonding pair of electrons. Which diagram correctly identifies both the period and group trends for electronegativity in the Periodic Table?

A



C



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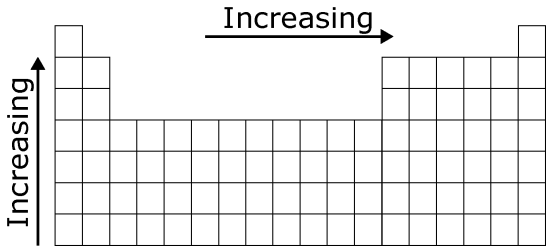
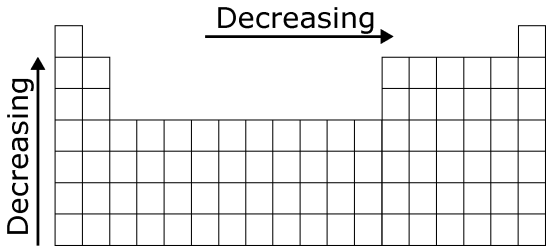


D



EXAMPLE ITEMS Chemistry Key, Sem 1

Item#	Key	SE	Process Skills	SE Justification
1	B	CHEM.4A	--	Differentiate between physical and chemical changes and properties.
2	A	CHEM.8B	2G	Use the mole concept to calculate the number of atoms, in a sample of material.
3	D	CHEM.8D	2G	Use the law of conservation of mass to chemical equations.
4	A	CHEM.8C	2H	Calculate molecular formulas.
5	D	CHEM.8A	2G	Use the concept of a mole.
6	D	CHEM.4D	--	Classify matter as pure substances or mixtures through investigation of their properties.
7	B	CHEM.7B	--	Write the chemical formulas of common polyatomic ionic compounds containing main group or transition metals.
8	D	CHEM.5B	2H	Use the Periodic Table to identify and explain the properties of chemical families, including noble gases.
9	B	CHEM.7D	--	Apply the theory of metallic bonding to explain the electrical conductivity of metals.
10	C	CHEM.7A	--	Name covalent compounds using International Union of Pure and Applied Chemistry (IUPAC) nomenclature rules.
11	D	CHEM.4C	2H, 2I	Compare liquids, and gases in terms of compressibility.
12	B	CHEM.7C	2I	Construct electron dot formulas to illustrate covalent bonds.
13	A	CHEM.6E	--	Express the arrangement of electrons in atoms through electron configurations.
14	A	CHEM.6B	2H, 2I	Understand the electromagnetic spectrum and the mathematical relationships between energy, frequency, and wavelength of light.
15	A	CHEM.6C	2G	Calculate the wavelength of light using its frequency and the speed of light.
16	10.8	CHEM.6D	2H, 2G	Use isotopic composition to calculate average atomic mass of an element.
17	B	CHEM.5C	2H	Use the Periodic Table to identify and explain periodic trends, including electronegativity.