Example Items

Chemistry
Pre-AP

Chemistry Pre-AP 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 the Assessment website (assessment.dallasisd.org).

OR

(2) To submit directly: Login to the Assessment website. Under "News" in the left-hand column, click on "Sem 2 Example Items Download." Above the subjects, click on "Example Feedback Form."

Second Semester
2017–2018
Code #: 3201

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

BEHAVIOR OF GASES

Total pressure of a gas = (sum of the partial pressures of the component gases)	$P_T = P_1 + P_2 + P_3 + \ \ldots$
(Pressure)(volume) = (moles)(ideal gas constant)(temperature)	$PV = nRT$
$\dfrac{\text{(Initial pressure)(initial volume)}}{\text{(Initial moles)(initial temperature)}} = \dfrac{\text{(final pressure)(final volume)}}{\text{(final moles)(final temperature)}}$	$\dfrac{P_1V_1}{n_1T_1} = \dfrac{P_2V_2}{n_2T_2}$
(Initial pressure)(initial volume) = (final pressure)(final volume)	$P_1V_1 = P_2V_2$
$\dfrac{\text{(Initial volume)}}{\text{(Initial temperature)}} = \dfrac{\text{(final volume)}}{\text{(final temperature)}}$	$\dfrac{V_1}{T_1} = \dfrac{V_2}{T_2}$
$\dfrac{\text{(Initial volume)}}{\text{(Initial moles)}} = \dfrac{\text{(final volume)}}{\text{(final moles)}}$	$\dfrac{V_1}{n_1} = \dfrac{V_2}{n_2}$

SOLUTIONS

Molarity = $\dfrac{\text{moles of solute}}{\text{liter of solution}}$	$M = \dfrac{\text{mol}}{\text{L}}$
Ionization constant of water = (hydrogen ion concentration)(hydroxide ion concentration)	$K_w = [H^+][OH^-]$
(Volume of solution 1)(molarity of solution 1) = (volume of solution 2)(molarity of solution 2)	$V_1M_1 = V_2M_2$
pH = –logarithm (hydrogen ion concentration)	$\text{pH} = -\log[H^+]$

THERMOCHEMISTRY

Heat gained or lost = (mass)(specific heat)(change in temperature)	$Q = mc_p\Delta T$
Enthalpy of reaction = (enthalpy of products) – (enthalpy of reactants)	$\Delta H = \Delta H_f^o(\text{products}) - \Delta H_f^o(\text{reactants})$

STAAR CHEMISTRY REFERENCE MATERIALS

OTHER FORMULAS

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

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

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

CONSTANTS AND CONVERSIONS

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

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

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

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

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

standard temperature and pressure (STP) = 0°C and 1 atm

0°C = 273 K

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

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

1 atm = 760 mm Hg = 101.3 kPa

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

1 calorie (cal) = 4.18 joules (J)

1000 calories (cal) = 1 Calorie (Cal) = 1 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

Increasing Activity (↑)

STAAR CHEMISTRY
REFERENCE MATERIALS

PERIODIC TABLE OF THE ELEMENTS

Key:
- Atomic number — 14
- Symbol — **Si**
- Atomic mass — 28.086
- Name — Silicon

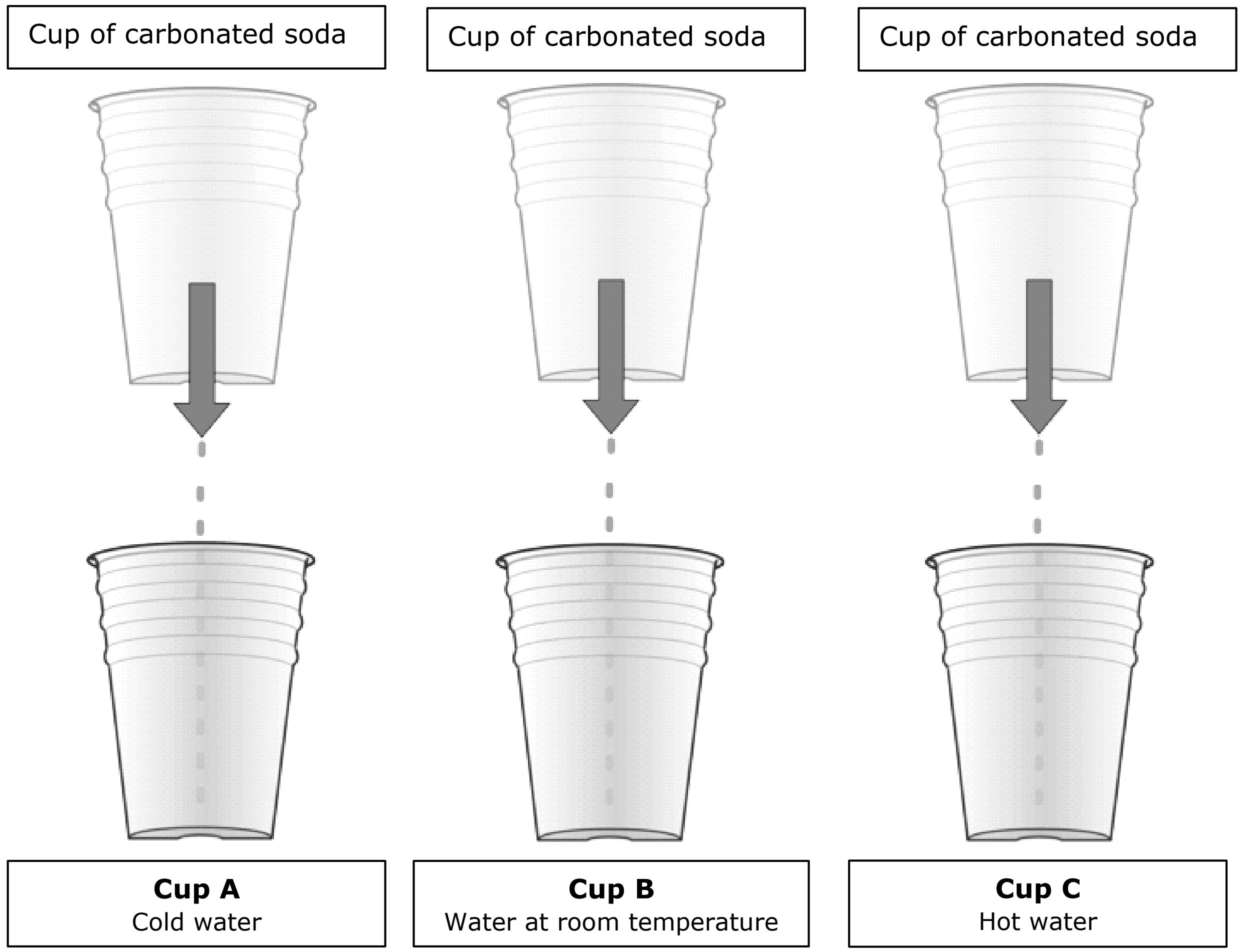
Period	1 1A	2 2A	3 3B	4 4B	5 5B	6 6B	7 7B	8	9 8B	10	11 1B	12 2B	13 3A	14 4A	15 5A	16 6A	17 7A	18 8A
1	1 **H** 1.008 Hydrogen																	2 **He** 4.003 Helium
2	3 **Li** 6.941 Lithium	4 **Be** 9.012 Beryllium											5 **B** 10.812 Boron	6 **C** 12.011 Carbon	7 **N** 14.007 Nitrogen	8 **O** 15.999 Oxygen	9 **F** 18.998 Fluorine	10 **Ne** 20.180 Neon
3	11 **Na** 22.990 Sodium	12 **Mg** 24.305 Magnesium											13 **Al** 26.982 Aluminum	14 **Si** 28.086 Silicon	15 **P** 30.974 Phosphorus	16 **S** 32.066 Sulfur	17 **Cl** 35.453 Chlorine	18 **Ar** 39.948 Argon
4	19 **K** 39.098 Potassium	20 **Ca** 40.078 Calcium	21 **Sc** 44.956 Scandium	22 **Ti** 47.867 Titanium	23 **V** 50.942 Vanadium	24 **Cr** 51.996 Chromium	25 **Mn** 54.938 Manganese	26 **Fe** 55.845 Iron	27 **Co** 58.933 Cobalt	28 **Ni** 58.693 Nickel	29 **Cu** 63.546 Copper	30 **Zn** 65.38 Zinc	31 **Ga** 69.723 Gallium	32 **Ge** 72.64 Germanium	33 **As** 74.922 Arsenic	34 **Se** 78.96 Selenium	35 **Br** 79.904 Bromine	36 **Kr** 83.798 Krypton
5	37 **Rb** 85.468 Rubidium	38 **Sr** 87.62 Strontium	39 **Y** 88.906 Yttrium	40 **Zr** 91.224 Zirconium	41 **Nb** 92.906 Niobium	42 **Mo** 95.96 Molybdenum	43 **Tc** (98) Technetium	44 **Ru** 101.07 Ruthenium	45 **Rh** 102.906 Rhodium	46 **Pd** 106.42 Palladium	47 **Ag** 107.868 Silver	48 **Cd** 112.412 Cadmium	49 **In** 114.818 Indium	50 **Sn** 118.711 Tin	51 **Sb** 121.760 Antimony	52 **Te** 127.60 Tellurium	53 **I** 126.904 Iodine	54 **Xe** 131.294 Xenon
6	55 **Cs** 132.905 Cesium	56 **Ba** 137.328 Barium	71 **Lu** 174.967 Lutetium	72 **Hf** 178.49 Hafnium	73 **Ta** 180.948 Tantalum	74 **W** 183.84 Tungsten	75 **Re** 186.207 Rhenium	76 **Os** 190.23 Osmium	77 **Ir** 192.217 Iridium	78 **Pt** 195.085 Platinum	79 **Au** 196.967 Gold	80 **Hg** 200.59 Mercury	81 **Tl** 204.383 Thallium	82 **Pb** 207.2 Lead	83 **Bi** 208.980 Bismuth	84 **Po** (209) Polonium	85 **At** (210) Astatine	86 **Rn** (222) Radon
7	87 **Fr** (223) Francium	88 **Ra** (226) Radium	103 **Lr** (262) Lawrencium	104 **Rf** (267) Rutherfordium	105 **Db** (268) Dubnium	106 **Sg** (271) Seaborgium	107 **Bh** (272) Bohrium	108 **Hs** (270) Hassium	109 **Mt** (276) Meitnerium	110 **Ds** (281) Darmstadtium	111 **Rg** (280) Roentgenium							

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

Series														
Lanthanide Series	57 **La** 138.905 Lanthanum	58 **Ce** 140.116 Cerium	59 **Pr** 140.908 Praseodymium	60 **Nd** 144.242 Neodymium	61 **Pm** (145) Promethium	62 **Sm** 150.36 Samarium	63 **Eu** 151.964 Europium	64 **Gd** 157.25 Gadolinium	65 **Tb** 158.925 Terbium	66 **Dy** 162.500 Dysprosium	67 **Ho** 164.930 Holmium	68 **Er** 167.259 Erbium	69 **Tm** 168.934 Thulium	70 **Yb** 173.055 Ytterbium
Actinide Series	89 **Ac** (227) Actinium	90 **Th** 232.038 Thorium	91 **Pa** 231.036 Protactinium	92 **U** 238.029 Uranium	93 **Np** (237) Neptunium	94 **Pu** (244) Plutonium	95 **Am** (243) Americium	96 **Cm** (247) Curium	97 **Bk** (247) Berkelium	98 **Cf** (251) Californium	99 **Es** (252) Einsteinium	100 **Fm** (257) Fermium	101 **Md** (258) Mendelevium	102 **No** (259) Nobelium

Updated Spring 2011

1 Three cups of carbonated soda are lowered into cups of water at varying temperatures.



All other factors being equal, in which cup does the greatest release of dissolved gas occur?

A Cup A

B Cup B

C Cup C

D All cups will release an equal amount of gas, because temperature is not a factor.

2 Which reaction is an example of a precipitation reaction?

A $2Mg(s) + O_2(g) \rightarrow 2MgO(s)$

B $Pb(NO_3)_2(aq) + 2KI(aq) \rightarrow PbI_2(s) + 2KNO_3(aq)$

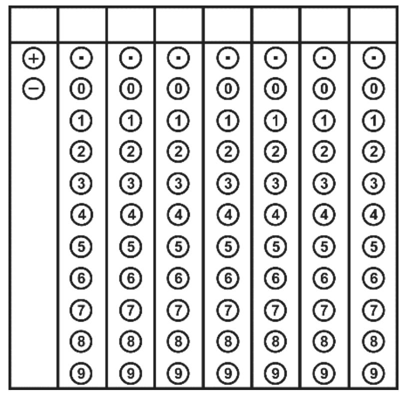
C $4Fe(s) + 3O_2(g) \rightarrow 2Fe_2O_3(s)$

D $NaOH(aq) + HCl(aq) \rightarrow NaCl(aq) + H_2O(aq)$

3 What is the pH of a borax solution with a hydroxide ion concentration, $[OH^-]$, of 1.25×10^{-5} M?

(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.



4 The Sun is powered by a series of nuclear fusion reactions. Which process is an example of nuclear fusion?

A ${}^{209}_{82}\text{Bi} + {}^{4}_{2}\text{He} \rightarrow {}^{211}_{84}\text{Po} + 2\,{}^{1}_{0}\text{n}$

B ${}^{2}_{1}\text{H} + {}^{2}_{1}\text{H} \rightarrow {}^{3}_{2}\text{He} + {}^{1}_{0}\text{n} + \text{Energy}$

C ${}^{239}_{94}\text{Pu} + {}^{1}_{0}\text{n} \rightarrow {}^{240}_{95}\text{Am} + {}^{0}_{-1}\text{e}$

D ${}^{239}_{92}\text{U} \rightarrow {}^{239}_{93}\text{Np} + {}^{0}_{-1}\text{e} + \text{Energy}$

5 Oxygen gas in a 15.0 L container exerts a pressure of 0.48 atm at 21 ºC. How many moles of oxygen are in this container?

A 3.4 moles

B 8.7×10^{-3} moles

C 4.2 moles

D 3.0×10^{-1} moles

6 Students performed a lab where they measured hydrogen ion concentration after pouring four different acids into separate beakers containing 200 mL of water. The table shows $[H^+]$ for each of the resulting solutions.

Solution	$[H^+]$
Solution A	5.9×10^{-5}
Solution B	2.2×10^{-8}
Solution C	3.3×10^{-10}
Solution D	1.5×10^{-4}

Based on the information in the table, which is the strongest acid?

A Solution A

B Solution B

C Solution C

D Solution D

7 Precipitates are insoluble substances that result from reactions between aqueous solutions. Two solubility rules are shown.

Solubility Rules
1. All nitrates, NO_3^-, are soluble.
2. All halides are soluble, except those of Ag^+, Pb^{2+}, and Hg_2^{2+}.

Which compound forms a yellow precipitate from the reaction $Pb(NO_3)_2 + 2KI \rightarrow PbI_2 + 2KNO_3$?

A KNO_3

B $Pb(NO_3)_2$

C KI

D PbI_2

8 Ethyne, a fuel used in oxyacetylene torches, is produced from the reaction shown.

$$2C + H_2 + 228.2\text{ kJ} \rightarrow C_2H_2$$

Based on the equation, what type of reaction is used to produce ethyne?

A Endothermic, because heat is absorbed.

B Exothermic, because heat is released.

C Endothermic, because heat is released.

D Exothermic, because heat is absorbed.

9 The table shows data collected on an experiment where a cold piece of steel was placed in warm water.

Mass of water	125.0 g
Initial temperature of water	22.00 ºC
Initial temperature of steel	2.000 ºC
Final temperature of both steel and water	21.10 ºC
Heat lost by water	470.3 J

If the specific heat capacity of steel is 0.452 J/(g•°C), what mass of steel was used in the investigation?

A 54.5 grams

B 125.0 grams

C 49.3 grams

D 43.32 grams

10 A student uses calorimetry to determine the amount of heat energy stored in a piece of candy. The table shows the data collected.

Mass of beaker and water	125 g
Mass of beaker empty	25 g
Mass of candy used	2.5 g
Initial temperature of water	25 °C
Final highest temperature reached by the water	62 °C

Based on the data in the table, what is the amount of heat stored in the candy?

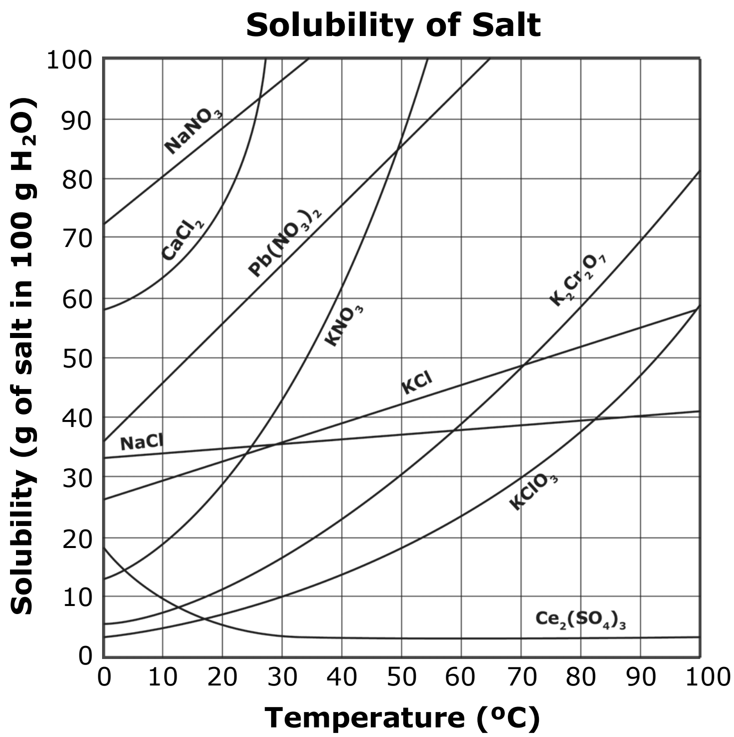
A 25,916 Joules

B 15,466 Joules

C 6,186 Joules

D 3,700 Joules

Use the solubility curves to answer the next question.



11 Seventy grams of four substances are added to 100 grams of water in four separate beakers. The water in all four beakers is held at 50 °C. Which substance makes an unsaturated solution?

A KNO_3

B NaCl

C $KClO_3$

D $K_2Cr_2O_7$

12 The complete combustion of 1 mole of propane (C_3H_8) is represented by the reaction shown.

$$C_3H_8 + 5O_2 \rightarrow 3CO_2 + 4H_2O$$

How many grams of water are produced in this reaction?

A 7.0

B 8.0

C 22

D 72

Use the table to answer the next question.

Properties of Radiation Rays
1. Low penetrating, blocked by paper, positively charged particles
2. Low penetrating, blocked by aluminum foil, typical speed is less than speed of β particles
3. Low penetrating, blocked by lead, identical to helium nucleus
4. Low penetrating, blocked by concrete, more massive than β and γ particles
5. Low penetrating, no charge, identical to helium atom

13 Which properties describe alpha radiation rays?

A 1, 2, 3, and 4 only

B 1, 3, and 5 only

C 1 and 3 only

D 1 and 5 only

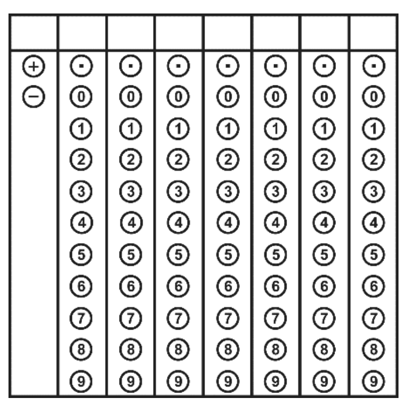
14 A balanced chemical equation is shown.

$$2Na + H_2O \rightarrow H_2 + Na_2O$$

Based on this equation, how many grams of sodium are used to produce 3.20 L of hydrogen gas at STP?

(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.



15 An isotope of an element decayed and formed lead-208 when a beta particle was emitted.

$$\_\_\_\_\_ \rightarrow {}^{207}_{82}\text{Pb} + {}^{0}_{-1}\text{e}$$

What is the nuclear symbol of the original parent nuclide?

A ${}^{207}_{81}\text{Tl}$

B ${}^{207}_{83}\text{Bi}$

C ${}^{207}_{82}\text{Pb}$

D ${}^{207}_{80}\text{Hg}$

EXAMPLE ITEMS Chemistry Pre-AP Key, Sem 2

Item#	Key	SE	Process Skills	SE Justification
1	C	C.10F	2H	Investigate factors that influence solubilities, such as temperature.
2	B	C.10H	2G	Understand and differentiate among acid-base reactions, precipitation reactions, and oxidation-reduction reactions.
3	9.10	C.10I	2G	Define pH and use the hydroxide ion concentrations to calculate the pH of a solution.
4	B	C.12C	--	Compare fission and fusion reactions.
5	D	C.9A	2G	Describe and calculate the relationship between volume, pressure, number of moles, and temperature for an ideal gas as described by the ideal gas law.
6	D	C.10J	2H	Distinguish between degrees of dissociation for strong and weak acids.
7	D	C.10B	3A	Develop and use general rules regarding solubility through investigations with aqueous solutions.
8	A	C.11C	--	Classify reactions as exothermic or endothermic.
9	A	C.11D	2G	Perform calculations involving heat, mass, temperature change, and specific heat.
10	B	C.11E	2G	Use calorimetry to calculate the heat of a chemical process.
11	A	C.10E	2H	Distinguish between unsaturated and saturated solutions.
12	D	C.8E	2G	Perform stoichiometric calculations, including determination of mass relationships between reactants and products.
13	A	C.12A	3A	Describe the characteristics of alpha radiation.
14	6.57	C.9B	2G	Perform stochiometric calculations.
15	A	C.12B	2G	Describe radioactive decay process in terms of balanced nuclear equations.