AS
ACADEMIC STUDIO

PRACTICE EXAM

General Chemistry 1

15 problems · one per page · show all your work

Name _____ Date _____ Score / 15

Constants and molar masses

R = 0.08206 L·atm/(mol·K) = 8.314 J/(mol·K) · Water: c = 4.184 J/(g·°C)
H 1.008 · C 12.01 · N 14.01 · O 16.00 · Na 22.99 · Al 26.98 · Cl 35.45 · Ca 40.08 · Fe 55.85

How to use this exam

Give yourself about 2 hours with a calculator and a periodic table. Work each problem on its own page, then check your answers with the separate answer key.

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PROBLEM 1 OF 15

Percent composition

What is the percent nitrogen by mass in ammonium nitrate, NH_4NO_3?

PROBLEM 2 OF 15

Empirical and molecular formula

A compound is 40.00% C, 6.71% H and 53.29% O by mass. Its molar mass is 180.16 g/mol. Find the empirical and molecular formulas.

PROBLEM 3 OF 15

Limiting reagent and percent yield

$2\ Al + 3\ Cl_2 \rightarrow 2\ AlCl_3$. You react 10.0 g Al with 30.0 g Cl_2 and collect 30.1 g $AlCl_3$. Which reactant is limiting, and what is the percent yield?

PROBLEM 4 OF 15

Dilution

How many mL of 6.0 M HCl do you need to make 250. mL of 0.50 M HCl?

PROBLEM 5 OF 15

Titration with a diprotic acid

25.00 mL of H_2SO_4 is neutralized by 32.40 mL of 0.1000 M NaOH. What is the H_2SO_4 concentration?

PROBLEM 6 OF 15

Net ionic equation

Write the net ionic equation for mixing $Pb(NO_3)_2(aq)$ with $KI(aq)$. Name the spectator ions.

PROBLEM 7 OF 15

Oxidation numbers and redox

$Fe_2O_3 + 3\ CO \rightarrow 2\ Fe + 3\ CO_2$. What is oxidized, what is reduced, and which are the oxidizing and reducing agents?

PROBLEM 8 OF 15

Ideal gas law

What volume does 2.50 g of CO_2 occupy at 25.0 °C and 0.950 atm?

PROBLEM 9 OF 15

Calorimetry

A 45.0 g piece of metal at 95.0 °C is dropped into 100.0 g of water at 22.0 °C. The final temperature is 25.4 °C. Find the metal's specific heat.

PROBLEM 10 OF 15

Hess's law

Use these reactions to find ΔH for $C(s) + \frac{1}{2} O_2(g) \rightarrow CO(g)$.

$C(s) + O_2(g) \rightarrow CO_2(g)$, $\Delta H = -393.5$ kJ

$CO(g) + \frac{1}{2} O_2(g) \rightarrow CO_2(g)$, $\Delta H = -283.0$ kJ

PROBLEM 11 OF 15

Enthalpy of formation

Find ΔH° for $CH_4(g) + 2\ O_2(g) \rightarrow CO_2(g) + 2\ H_2O(l)$. $\Delta H^\circ f$: CH_4 −74.8, CO_2 −393.5, $H_2O(l)$ −285.8 kJ/mol.

PROBLEM 12 OF 15

Electron configurations and quantum numbers

(a) Write the configurations of Fe and Fe^{3+}. (b) Which set of quantum numbers is not allowed: (2, 1, 0, +½), (3, 2, −2, −½), (2, 2, 0, +½)?

PROBLEM 13 OF 15

Periodic trends

(a) Rank Na, Mg, S and Cl by atomic radius. (b) Rank Na, Mg and Al by first ionization energy.

PROBLEM 14 OF 15

Lewis structures, resonance and formal charge

Draw the nitrate ion, NO_3^-. How many resonance structures are there, what are the formal charges, and what is the N–O bond order?

PROBLEM 15 OF 15

VSEPR, polarity, hybridization and intermolecular forces

(a) Give the electron geometry, shape, polarity and hybridization of NH_3 and BF_3. (b) Rank by boiling point: Ne, CH_4, H_2S, H_2O.