Record

Answer Key
10/20/25

Exam 2 Test Prep

Solutions are homogenous → even in composition mixtures

Determine if the following are a strong, weak, or nonelectrolyte:

NH_3 weak
↑ weak base

C_2H_5OH Non
↑ covalent

$CaCl_2$ strong
↑ Ionic

If salt is mixed with water, what is the solvent, and what is the solute?

Solute = salt salt dissolves in water

Solvent = water

Does the equation yield a precipitate? If so, what compound is the precipitate?

$Mg(NO_3)_2$ (aq) + 2NaOH (aq) ——— $Mg(OH)_2$ (s) + $2NaNO_3$ (aq)

↑ precipitate + insoluble

Write the net ionic equation for BaI_2 and Na_2SO_4 if it is a precipitation reaction. What are the spectator ions in this reaction?

Molecular: $BaI_2(aq) + Na_2SO_4(aq) \rightarrow BaSO_4(s) + 2\,NaI(aq)$

$Ba^{2+}I^-$ $Na^+SO_4^{2-}$

Net: $Ba^{2+}(aq) + SO_4^{2-}(aq) \rightarrow BaSO_4(s)$

Spectator ions: $2I^-(aq) + 2Na^+(aq)$

What is the net ionic equation for aqueous nitric acid and aqueous strontium hydroxide?

Molecular: $2\,HNO_3(aq) + Sr(OH)_2(aq) \rightarrow Sr(NO_3)_2(aq) + 2\,H_2O(l)$

Complete: $2H^+(aq) + 2NO_3^-(aq) + Sr^{2+}(aq) + 2OH^-(aq) \rightarrow Sr^{2+}(aq) + 2NO_3^-(aq) + 2H_2O(l)$

Net: $2H^+(aq) + 2OH^-(aq) \rightarrow 2H_2O(l)$

★ $H^+(aq) + OH^-(aq) \rightarrow H_2O(l)$

strong base = Group 1 or 2 + OH^-

Give one example of a strong acid and base. How do they dissociate in water?

strong acid: HCl, HBr, H_2SO_4, $HClO_3$, $HClO_4$, HNO_3, HI

strong base: $LiOH$, $Ca(OH)_2$

completely dissociate

Give an example of a weak acid and base. How do they dissociate in water?

weak acid: HF, CH_3COOH

partially dissociate

weak base: NH_3, $Mn(OH)_2$

What is oxidation and reduction?

oxidation = lose e⁻ LEO says GER

reduction = gain e⁻ OIL RIG

What is the one type of reaction that redox reactions are not?

Double Replacement

Determine the oxidation state of the boldfaced element: $\mathbf{H_2S}$, $\mathbf{Cr_2O_7^{2-}}$, $Na_2\mathbf{SO_3}$, and $\mathbf{O_2}$.

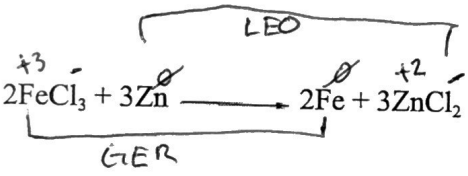
H_2S: $+2 - 2 = 0$, $H = +1$

Cr_2O_7: $+12 - 14 = -2$, $Cr = +6$

Na_2SO_3: $+2 + 4 - 6 = 0$, $S = +4$

O_2: $O_2 = 0$

What is oxidized and reduced? What is the oxidizing and reducing agent?



Oxidized = Zn

Reduced = Fe

Oxidizing agent = $FeCl_3$

Reducing agent = Zn

$Fe^{+3} \rightarrow Fe^0$ more − → gain e⁻ GER

$Zn^0 \rightarrow Zn^{+2}$ more + → lost e⁻ LEO

What is the concentration (M) of lead (II) nitrate by dissolving 12.2g of solute in 97.5mL of solution? $M = \frac{mol}{L}$

MW of $Pb(NO_3)_2$ = 331.208 g

$$12.2\,g\ Pb(NO_3)_2 \times \frac{1\ mol\ Pb(NO_3)_2}{331.208\,g\ Pb(NO_3)_2} = 0.0368\ mol\ Pb(NO_3)_2$$

$$\frac{0.0368\ mol}{0.0975\ L}$$

97.5mL → 0.0975L

$= 0.377\ M\ Pb(NO_3)_2$

$$0.0800\,\text{mol } CoI_2 \left| \frac{MW\ CoI_2}{1\ \text{mole}} \right.$$

How many ~~grams~~ moles of CoI_2 are present in 0.200L of a 0.400M solution of CoI_2?

$$\frac{0.400\,\text{mol}}{\text{L}} \times 0.200\,\text{L} = 0.0800\,\text{mol } CoI_2 \text{ or } 8.00\times10^{-2}\,\text{mol } CoI_2$$

What is the concentration of sodium sulfide in a solution by diluting 50.0mL of a 0.874M solution of sodium sulfide to a total volume of 50.0mL?

$M_1V_1 = M_2V_2$

$$\frac{(50.0\,\text{mL})(0.874\,\text{M})}{50.0\,\text{mL}} = \frac{(50.0\,\text{mL})(M_2)}{50.0\,\text{mL}}$$

$$= 0.874\,\text{M } Na_2S$$

$$\frac{M_1V_1}{V_1} = \frac{M_2V_2}{V_2}$$

$$M_2 = \frac{M_1V_1}{M_2}$$

If it takes 50 mL of 0.5 M KOH solution to completely neutralize 125 mL of sulfuric acid solution (H_2SO_4), what is the concentration of the H_2SO_4 solution?

$2\,KOH_{(aq)} + H_2SO_{4(aq)} \rightarrow K_2SO_{4(aq)} + 2\,H_2O_{(l)}$

$$\frac{0.5\,\text{mol KOH}}{\text{L}} \times 0.05\,\text{L} = 0.025\,\text{mol KOH} \left| \frac{1\ \text{mol } H_2SO_4}{2\ \text{mol KOH}} \right. = 0.0125\,\text{mol } H_2SO_4$$

$$\frac{0.0125\,\text{mol}}{0.125\,\text{L}} = 0.1\,\text{M } H_2SO_4$$

Can a reaction happen between potassium and ~~cobalt~~ copper(II) chloride? Hint: look at the activity series.

$K_{(s)} + CuCl_{2\,(aq)} \rightarrow 2\,KCl_{(aq)} + Cu$

Yes, K is higher than Cu

Energy is the capacity to do work

Heat and work are not state functions

work on system +

work on surroundings −

work by system −

work by surroundings +

↗ exo

What is the change in internal energy of a system that releases 2500J of heat and does 7655J of work on the surroundings? $\Delta E = q + w$

$\Delta E = ?$

$q = -2500\,J$

$w = -7655\,J$

$\Delta E = (-2500\,J) + (-7655\,J)$

$= \boxed{-10155\,J}$

What is the J of heat released in the combustion of 16.0g of C_6H_6?

Stoichiometry
- BCE
- ΔH
- ∫

$2C_6H_6 + 15O_2 \longrightarrow 12CO_2 + 6H_2O \qquad \Delta H^\circ = -6535\,kJ$

$$16.0\,g\ C_6H_6 \left| \frac{1\ mol\ C_6H_6}{78.114\,g\ C_6H_6} \right| \frac{-6535\,kJ}{2\ mol\ C_6H_6}$$

$$= \frac{-669.27\,kJ}{1\ kJ} \left| \frac{1000\ J}{} \right. = \boxed{-6.69 \times 10^5\,J}$$

Calculate the specific heat capacity of a metal if a 17.0 g sample requires 481 J to change the temperature of the metal from 25.0 °C to 67.0 °C?

$q = mc\Delta T$

$\frac{q}{m\Delta T} = \frac{mc\Delta T}{m\Delta T}$

$c = \frac{q}{m\Delta T}$

$q = 481\,J$

$m = 17.0\,g$

$c = ?$

$\Delta T = 67.0^\circ C - 25.0^\circ C = 42.0^\circ C$

$c = \frac{481\,J}{(17.0\,g)(42.0^\circ C)}$

$= \boxed{0.674\ J/g^\circ C}$

What is the enthalpy of reaction for

$2SO_2\,(g) + O_2\,(g) \longrightarrow 2SO_3\,(g)$

given

keep $2S\,(s) + 3O_2\,(g) \longrightarrow 2SO_3\,(g)$ $\Delta H^\circ = -790kJ$

flip $2\left(S\,(s) + O_2\,(g) \longrightarrow SO_2\,(g)\right)$ $\Delta H^\circ = -297kJ$ $\times 2$

$2S(s) + 3O_2(g) \rightarrow 2SO_3(g)$ $\Delta H = -790\,kJ$

$2SO_2(g) \rightarrow 2S(s) + 2O_2(g)$ $\Delta H = +594\,kJ$

$2SO_2(g) + O_2(g) \rightarrow 2SO_3(g)$ $\Delta H = -196\,kJ$

What is the ΔH°_{rxn} in kJ for the following reaction?

$4NH_3\,(g) + 5O_2\,(g) \longrightarrow 4NO\,(g) + 6H_2O\,(l)$

products − reactants

$\left[(4 \times 90kJ) + (6 \times -286\,kJ)\right] - \left[(4 \times -46kJ) + (0)\right]$

(NO) (H₂O) (NH₃) (O₂)

$-1356 - -184$

$= -1172$

$\Delta H^\circ_{rxn} = -1172\,kJ$

Substance	ΔH°_f (kJ/mol)
H_2O (l)	−286
NO (g)	90
NO_2 (g)	34
HNO_3 (aq)	−207
NH_3 (g)	−46

Enthalpy is the heat change of a reaction at a constant pressure and is an extensive property

Standard Enthalpy of Formation is measured under standard conditions (25°C and 1.00atm pressure)

What is the difference between endothermic and exothermic?

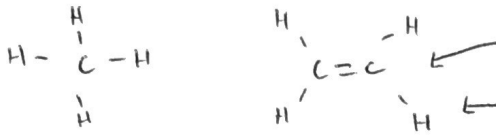
Endothermic = Absorbs energy; bond breaking

Exothermic = Releases energy; bond forms

Endo Exo

When considering bond enthalpy, is it harder to break a single bond or a double bond?

Harder to break double bonds than single bonds



more e⁻ being shared

harder to break C=C, so requires more energy

What is the frequency of electromagnetic radiation that has a wavelength of 2.3 x 10^9 nm?

$c = \lambda\nu$ $\quad c = 3.00 \times 10^8$ m/s

$$2.3 \times 10^9 \text{ nm} \left| \frac{1 \text{ m}}{10^9 \text{ nm}} \right. = 2.3 \text{ m}$$

$$\frac{c}{\lambda} = \frac{\lambda\nu}{\lambda} \qquad \nu = \frac{c}{\lambda}$$

$$\nu = \frac{(3.00 \times 10^8 \text{ m/s})}{2.3 \text{ m}} = \boxed{1.3 \times 10^8 \text{ s}^{-1}}$$

Calculate the energy of blue light that has a wavelength of 400.nm

$E = h\nu$ $\quad c = \lambda\nu$ $\quad E = \frac{hc}{\lambda}$

$$400 \text{ nm} \left| \frac{1 \text{ m}}{10^9 \text{ nm}} \right. = 4 \times 10^{-7} \text{ m}$$

$$E = \frac{(6.626 \times 10^{-34} \text{ J/s})(3.00 \times 10^8 \text{ m/s})}{4 \times 10^{-7} \text{ m}} = \boxed{4.97 \times 10^{-19} \text{ J}}$$

What shape are s orbitals? What shape are p orbitals?

s orbitals = spheres

○

p orbitals = dumbell / hourglass

8 ∞

If n = 1, then l can only be ∅

$n \neq l$

If n = 4, and l = 3, then m_l can be −3, −2, −1, 0, 1, 2, 3

−3 → +3

$l = m_l$

n = period #
ℓ = orbital

For ℓ →
s = ∅
p = 1
d = 2
f = 3

What would be the quantum numbers for n, l, m_l, m_s if you are given chlorine?

$1s^2 2s^2 2p^6 3s^2 3p^5$ $n=3$ $\ell=1$ $m_l=\emptyset$ $m_s=-1/2$

3p ↑↓ | ↑↓ | ↑

−1 0 1

Can a subshell have two up arrows? If not, what rule does this violate?
No, violates Pauli Exclusion
-Arrows must be in opposite directions

↑↑ wrong ↑↓ correct

Can a 2s subshell be filled before 1s subshell? If not, what rule does this violate?
No, violates Aufbau
-Must fill 1s before going to 2s

1s: ↑ ↓ 2s: ↑↓ =wrong
1s: ↑↓ 2s: ↑ =correct

Can 2 arrows fill the first orbital in a 2p subshell before having one arrow in each orbital first? If not, which rule does this violate?
NO, violates Hund's rule
-Need 1 arrow in each orbital before doubling up

2p ↑↓ | | =wrong
2p ↑ | ↑ | = correct

What is the electron configuration for nitrogen?

$1s^2 2s^2 2p^3$

What is the electron configuration for Mg^{2+}?

← lost 2e⁻

$1s^2 2s^2 2p^6$

← Add 1e⁻

What is the condensed electron configuration for S^-?

$[Ne]\ 3s^2 3p^5$

What is the condensed electron configuration for Bi?

$[Xe]\ 6s^2 4f^{14} 5d^{10} 6p^3$

What is the condensed electron configuration for copper, chromium, and silver?

Copper: $[Ar]\ 4s^1 3d^{10}$ silver: $[Kr]\ 5s^1 4d^{10}$

Chromium: $[Ar]\ 4s^1 3d^5$