Dr. Zellmer | Chemistry 1210 | All sections
Time: 7 PM Sun. | Autumn Semester 2022 | October 2, 2022
35 min | Quiz V

Name _____ Rec. TA/time _____

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Show **ALL** your work or **EXPLAIN** to receive full credit.

1. (3 pts) How many grams of $KClO_4$ are required to prepare 568.3 mL of a 0.685 M $KClO_4$ solution. (Atomic weights: K = 39.10, O = 16.00, Cl = 35.45)

2. (5 pts) What is the concentration of a NaOH solution if 45.0 mL is required to neutralize 50.0 mL of 0.141 M $H_3PO_4$?

$$3\ NaOH + H_3PO_4 \rightarrow Na_3PO_4 + 3\ H_2O$$

3. (4 pts) What volume (mL) of 0.0521 M $Ca(OH)_2$ is required to neutralize 12.0 mL of 0.141 M $H_3PO_4$ ?

$$3\ Ca(OH)_2 + 2\ H_3PO_4 \longrightarrow Ca_3(PO_4)_2 + 6\ H_2O$$

4. (5 pts) The titration of 25.0 mL of potassium dichromate solution with 0.0350 M $Fe^{2+}$ solution requires 27.5 mL of the iron solution. The iron and dichromate react according to the following equation. What is the molarity of the potassium dichromate? (Atomic weights: Fe = 55.85, Cr = 52.00, O = 16.000, H = 1.008)

$$14\ H^+ + 6\ Fe^{2+} + Cr_2O_7^{2-} \longrightarrow 6\ Fe^{3+} + 2\ Cr^{3+} + 7\ H_2O$$

5. (3 pts) Which of the following pairs of ions would be expected to have a greater electrostatic force of attraction between them when separated by 1 nm?

a) $Na^+$ and $Cl^-$

b) $Na^+$ and $O^{2-}$

c) $Ca^{2+}$ and $Cl^-$

d) $Mg^{2+}$ and $O^{2-}$

e) $Mg^{2+}$ and $Cl^-$

6. (4 pts) The work done when a gas is compressed in a cylinder is 580.7 J. A heat transfer of 85.68 kJ occurs from the gas to the surroundings. Calculate $\Delta E$ of the gas in kJ.

7. (3 pts) Which of the following statements is **FALSE**?

a) The change in enthalpy, $\Delta H$, does not depend on the path taken, only on the initial and final states.

b) $\Delta E = q_P - P\Delta V$

c) For an exothermic process the products are at higher energy than the reactants.

d) $\Delta H = q_P$ (heat at constant pressure)

e) Heat, q, depends on the path taken.

8. (4 pts) A piston is pushed down on a reaction vessel containing a gas phase reaction.

a) Does the system do work on the surroundings or is work done on the system by the surroundings?

b) What would be the sign of the work, w?

c) If the process is also endothermic is heat being added to or removed from the system?

d) What would be the sign of $\Delta E$ or can that not be determined based on the information given? Explain!

9. (4 pts) Given the following equation, how many **grams** of **acetylene** gas are required to produce 1208 kcal of heat energy by combustion with oxygen? (Atomic weights: C = 12.01, H = 1.008, O = 16.00; Mol. Wts.: $C_2H_2 = 26.04$, $O_2 = 32.00$, $CO_2 = 44.01$, $H_2O = 18.02$)

$$2\ C_2H_2\ (g) + 5\ O_2\ (g) \longrightarrow 4\ CO_2\ (g) + 2\ H_2O\ (g) \qquad \Delta H = -302\ \text{kcal}$$

# USEFUL INFORMATION

1 amu = $1.66 \times 10^{-24}$ g

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

| | IA | IIA | IIIB | IVB | VB | VIB | VIIB | VIIIB | | | IB | IIB | IIIA | IVA | VA | VIA | VIIA | VIIIA |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 1.008 **H** 1 | | | | | | | | | | | | | | | | | 4.003 **He** 2 |
| 2 | 6.941 **Li** 3 | 9.012 **Be** 4 | | | | | | | | | | | 10.811 **B** 5 | 12.011 **C** 6 | 14.007 **N** 7 | 15.999 **O** 8 | 18.998 **F** 9 | 20.179 **Ne** 10 |
| 3 | 22.990 **Na** 11 | 24.305 **Mg** 12 | | | | | | | | | | | 26.98 **Al** 13 | 28.09 **Si** 14 | 30.974 **P** 15 | 32.06 **S** 16 | 35.453 **Cl** 17 | 39.948 **Ar** 18 |
| 4 | 39.098 **K** 19 | 40.08 **Ca** 20 | 44.96 **Sc** 21 | 47.88 **Ti** 22 | 50.94 **V** 23 | 52.00 **Cr** 24 | 54.94 **Mn** 25 | 55.85 **Fe** 26 | 58.93 **Co** 27 | 58.69 **Ni** 28 | 63.546 **Cu** 29 | 65.38 **Zn** 30 | 69.72 **Ga** 31 | 72.59 **Ge** 32 | 74.92 **As** 33 | 78.96 **Se** 34 | 79.904 **Br** 35 | 83.80 **Kr** 36 |
| 5 | 85.47 **Rb** 37 | 87.62 **Sr** 38 | 88.91 **Y** 39 | 81.22 **Zr** 40 | 92.91 **Nb** 41 | 95.94 **Mo** 42 | 98 **Tc** 43 | 101.07 **Ru** 44 | 102.91 **Rh** 45 | 106.42 **Pd** 46 | 107.87 **Ag** 47 | 112.41 **Cd** 48 | 114.82 **In** 49 | 118.69 **Sn** 50 | 121.75 **Sb** 51 | 127.60 **Te** 52 | 126.90 **I** 53 | 131.39 **Xe** 54 |
| 6 | 132.91 **Cs** 55 | 137.33 **Ba** 56 | 138.91 **La** 57 | 178.39 **Hf** 72 | 180.95 **Ta** 73 | 183.85 **W** 74 | 186.21 **Re** 75 | 190.23 **Os** 76 | 192.22 **Ir** 77 | 195.08 **Pt** 78 | 196.97 **Au** 79 | 200.59 **Hg** 80 | 204.38 **Tl** 81 | 207.2 **Pb** 82 | 208.98 **Bi** 83 | 209 **Po** 84 | 210 **At** 85 | 222 **Rn** 86 |
| 7 | 223 **Fr** 87 | 226.03 **Ra** 88 | 227.03 **Ac** 89 | 261 **Rf** 104 | 262 **Ha** 105 | 263 **Sg** 106 | 262 **Ns** 107 | 265 **Hs** 108 | 266 **Mt** 109 | 269 110 | 272 111 | 277 112 | | | | | | |

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| Lanthanide Series | 140.12 **Ce** 58 | 140.91 **Pr** 59 | 144.24 **Nd** 60 | 145 **Pm** 61 | 150.36 **Sm** 62 | 151.96 **Eu** 63 | 157.25 **Gd** 64 | 158.93 **Tb** 65 | 162.50 **Dy** 66 | 164.93 **Ho** 67 | 167.26 **Er** 68 | 168.93 **Tm** 69 | 173.04 **Yb** 70 | 173.04 **Lu** 71 |
| Actinide Series | 232.04 **Th** 90 | 231.04 **Pa** 91 | 238.03 **U** 92 | 237.05 **Np** 93 | **Pu** 94 | **Am** 95 | **Cm** 96 | **Bk** 97 | **Cf** 98 | **Es** 99 | **Fm** 100 | **Md** 101 | **No** 102 | **Lr** 103 |

A PERIODIC CHART OF THE ELEMENTS
(Based on $^{12}C$)