Name: KEY Class: _____ Date: _____ ID: E

Exam 1

Multiple Choice
Identify the choice that best completes the statement or answers the question.
Record your name on the top of this exam and on the scantron form.
Record the test ID letter in the top right box of the scantron form.
Record all of your answers on the scantron form.

1. An electrically charged atom or group of atoms is a(n)
   a. element.
   (b.) ion.
   c. chemical compound.
   d. heterogeneous mixture.
   e. homogeneous mixture.

2. What is the balanced chemical equation for the complete combustion of methanol, CH_3OH?
   a. $CH_3OH(\ell) \rightarrow CO(g) + 2\ H_2(g)$
   b. $CH_3OH(\ell) \rightarrow CH_2(g) + H_2O(g)$
   c. $CH_3OH(\ell) + O_2(g) \rightarrow CO_2(g) + H_2O(g)$
   (d.) $2\ CH_3OH(\ell) + 3\ O_2(g) \rightarrow 2\ CO_2(g) + 4\ H_2O(g)$
   e. $2\ CH_3OH(\ell) + 4\ O_2(g) \rightarrow 2\ CO_2(g) + 4\ H_2O(g)$

   First carbon → 2 on each side
   then hydrogen → 8 on each side
   then oxygen → 8 on each side

3. What is the **net ionic equation** for the reaction of aqueous perchloric acid and aqueous potassium hydroxide?
   a. $HClO_4(aq) + OH^-(aq) \rightarrow H_2O(\ell) + ClO_4^-(aq)$
   b. $ClO_4^-(aq) + K^+(aq) \rightarrow KClO_4(s)$
   c. $HClO_4(aq) + KOH(aq) \rightarrow KClO_4(aq) + H_2O(\ell)$
   d. $ClO_4^-(aq) + K^+(aq) \rightarrow KClO_4(aq)$
   (e.) $H^+(aq) + OH^-(aq) \rightarrow H_2O(\ell)$

   strong acid + strong base

4. What halogen is in the second period?
   a. N
   b. O
   (c.) F ← the only halogen
   d. Ne
   e. Ar

5. The formula for acetic acid, CH_3CO_2H, is an example of a(n)
   (a.) condensed formula.
   b. empirical formula.
   c. structural formula.
   d. ionic compound formula.
   e. mass spectrum.

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6. Which of the following formulas is not correct?
   a. $Al_3(CO_3)_2$
   b. $KClO_4$
   c. BaO
   d. $Ca(NO_3)_2$
   e. Na_2HPO_4

$Al^{3+} \times 3 = 9+$
$CO_3^{2-} \times 2 = 4-$
charge is not balanced

7. Which one of the following is most likely to be a **homogeneous** mixture?
   a. blood
   b. ground beef
   c. the air trapped inside an inflated balloon
   d. chocolate chip cookies
   e. mortar (a mixture of calcium carbonate and sand)

8. Which of the following compounds is a weak acid?
   a. HCl
   b. CH_3CO_2H
   c. HNO_3
   d. $HClO_4$
   e. H_2SO_4

9. Which one of the following substances is classified as an element?
   a. P_4
   b. NO
   c. KCl
   d. $C_6H_{12}O_6$
   e. NO_2

only made of 1 type of atom

10. What is the correct name for N_2O_3?
    a. nitrogen oxide
    b. oxygen nitride
    c. dinitrogen trioxide
    d. nitrogen trioxide
    e. trioxygen dinitride

11. An element consists of two isotopes. The abundance of one isotope is 60.1% and its atomic mass is 68.9256 u. The atomic mass of the second isotope is 70.9247 u. What is the average atomic mass of the element?
    a. 69.7 u
    b. 69.9 u
    c. 70.1 u
    d. 84.1 u
    e. 139.9 u

$68.9256(0.601) + 70.9247(1-0.601) = 69.723$

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12. Iron rusts according to the following equation:

__ $Fe(s)$ + __ $O_2(g) \rightarrow$ __ $Fe_2O_3(s)$

What are the respective coefficients when the equation is balanced with the smallest integer values?

a. 1, 1, 1
b. 1, 3, 1
c. 2, 3, 1
d. 3, 3, 2
(e.) 4, 3, 2

first oxygen → 6 on each side
then iron → 4 on each side

13. All of the following compounds are **insoluble** in water **EXCEPT** ____.

a. $BaSO_4$
b. AgI
c. CuS
(d.) $Ca(ClO_4)_2$
e. $PbCrO_4$

Check table

14. Light with a wavelength of 25 nm is in the x-ray region of the electromagnetic spectrum. What is the wavelength of this light in meters?

a. 2.5×10^{-11} m
b. 2.5×10^{-10} m
(c.) 2.5×10^{-8} m
d. 2.5×10^{-7} m
e. 2.5×10^{10} m

$25\ nm = 25 \times 10^{-9}\ m = 2.5 \times 10^{-8}\ m$

15. Two isotopes of a given element will have the same number of ____, but a different number of ____ in their nucleus.

a. protons, electrons
b. electrons, protons
(c.) protons, neutrons
d. neutrons, protons
e. electrons, neutrons

16. How many **hydrogen atoms** are in 1.0 g of CH_4?

a. 6.2×10^{-2} atoms
b. 2.5×10^{-1} atoms
c. 3.8×10^{22} atoms
(d.) 1.5×10^{23} atoms
e. 3.9×10^{25} atoms

formula wieght of CH_4 = 16

$$\frac{1\ g}{} \times \frac{1\ mol\ CH_4}{16\ g} \times \frac{4\ mol\ H}{1\ mol\ CH_4} \times \frac{6.022 \times 10^{23}\ atoms}{1\ mol} = 1.5 \times 10\ H\ atoms$$

17. Ethanol boils at 351.7 K. What is this temperature in Celsius?

a. 1.29 °C
b. 53.5 °C
(c.) 78.5 °C
d. 227.4 °C
e. 624.9 °C

$K = °C + 273.15$

$351.7 = °C + 273.2$

$78.5 = °C$

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18. Write a balanced net ionic equation for the reaction of barium carbonate and aqueous hydrochloric acid.
    a. $BaCO_3(s) + 2\ H^+(aq) \rightarrow Ba^{2+}(aq) + CO_3^{2-}(aq) + H_2(g)$
    b. $BaCO_3(s) + 2\ H^+(aq) \rightarrow Ba^{2+}(aq) + CO_2(g) + H_2O(\ell)$
    c. $BaCO_3(s) + 2\ HCl(aq) \rightarrow BaCl_2(aq) + H_2CO_3(aq)$ gas formation
    d. $BaCO_3(s) + 2\ H^+(aq) \rightarrow Ba^{2+}(aq) + H_2CO_3(s)$
    e. $BaCO_3(s) + 2\ H^+(aq) \rightarrow BaO(s) + CO_2(g) + H_2(g)$

19. Which of the following statements is/are correct?
    1. A solute is a mixture of a solvent and a soluble compound.
    2. A solution is a homogeneous mixture of a solvent and a solute.
    3. Water is a solvent that is commonly used by chemists.

    a. 1 only
    b. 2 only
    c. 3 only
    d. 1 and 2
    e. 2 and 3

20. Round 0.000680483 to 4 significant figures.
    a. 0.000
    b. 0.0007
    c. 0.0006805
    d. 0.00068048
    e. 0.000680483

21. What is the net ionic equation for the reaction of aqueous sodium hydroxide and aqueous iron(II) chloride?
    a. $Na^+(aq) + OH^-(aq) \rightarrow NaOH(s)$
    b. $Na^+(aq) + Cl^-(aq) \rightarrow NaCl(s)$
    c. $Fe^{2+}(aq) + 2\ OH^-(aq) \rightarrow Fe(OH)_2(s)$
    d. $Fe^{2+}(aq) + OH^-(aq) \rightarrow FeOH^+(s)$
    e. $Fe^{2+}(aq) + 2\ Cl^-(aq) \rightarrow FeCl_2(s)$

22. The SI unit of temperature is the ____.
    a. kelvin
    b. calorie
    c. fahrenheit
    d. absolute zero scale
    e. kilocalorie

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23. A 3.592 g sample of hydrated magnesium bromide, $MgBr_2 \cdot xH_2O$, is dried in an oven. When the anhydrous salt is removed from the oven, its mass is 2.263 g. What is the value of x?
    a. 1
    b. 3
    (c.) 6
    d. 8
    e. 12

$MgBr_2 \cdot xH_2O \xrightarrow{\Delta} MgBr_2 + xH_2O$

fw: $MgBr_2 = (24.3 + 79.9 \times 2) = 184.1$

fw: $H_2O = (1.01 \times 2 + 15.99) = 18.0$

mol $MgBr_2$: $2.263 \div 184.1 = 0.0123$

mol H_2O : $(3.592 - 2.263) \div 18 = 0.0738$

↑ conservation of mass

$\frac{\text{mol } H_2O}{\text{mol } MgBr_2} = \frac{0.0738}{0.0123} = 6.00$

24. What is the atomic symbol for an element that has 24 neutrons and a mass number of 45?
    a. Tm
    b. Cr
    c. Rh
    (d.) Sc
    e. Dy

$45 - 24 = 21$ protons

25. All of the following are examples of **chemical** change **EXCEPT**
    (a.) the condensation of steam.
    b. the rusting of iron.
    c. the combustion of gasoline.
    d. the tarnishing of silver.
    e. the decomposition of cinnabar (HgS) to mercury metal upon heating.

26. The density of liquid mercury is 13.5 g/cm^3. What mass of mercury will fill a 12.0 ounce soda can? (1.00 oz = 29.6 mL, 1.00 g = 1.00 cm^3)
    a. 0.0380 g
    b. 26.3 g
    c. 162 g
    d. 369 g
    (e.) 4.80×10^3 g

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

$\frac{12 \text{ oz}}{1} \times \frac{29.6 \text{ mL}}{1 \text{ oz}} \times \frac{1 \text{ cm}^3}{1 \text{ mL}} \times \frac{13.5 \text{ g}}{\text{cm}^3} = 4795.2 \text{ g}$