Chemistry 1250 - Sp22
Practice Midterm 1

1. Which of the following statements is **INCORRECT**?

A. Pure substances must be uniform throughout.
B. Some pure substances can be decomposed into simpler pure substances.
C. Heterogeneous mixtures can contain elements.
D. Every compound is a homogeneous mixture.
E. A heterogeneous mixture must contain at least two different substances.

2. Examine the following group of elements. _____ (a number) of them are **nonmetals** and _____ of them are **transition** **metals**.

$$_{20}Ca \qquad\qquad _{15}P \qquad\qquad _{36}Kr$$

$$_{32}Ge \qquad\qquad _{29}Cu \qquad\qquad _{49}In$$

$$_{34}Se \qquad\qquad _{24}Cr \qquad\qquad _{52}Te$$

A. 3, 4
B. 3, 3
C. 3, 2
D. 2, 3
E. 4, 2

3. Do the indicated arithmetic and give the answer to the correct number of significant figures.

$$(14.9 \times 0.049) - (3.53 \div 0.0840) + 101.600$$

A. 60.306
B. 60.31
C. 6.0×10^1
D. 6×10^1
E. 60.3

4. A crucible is known to weigh 24.3162 g. Three students in the class determine the weight of the crucible by repeated weighings on a simple balance. Which of the conclusions summarizes the data?

	trial 1	trial 2	trial 3	trial 4	trial 5
Student A	24.8	24.9	24.7	24.9	24.8
Student B	24.6	24.0	24.2	24.1	24.3
Student C	24.5	24.1	24.5	24.1	24.3

A. student B has done the most precise work and student C the most accurate
B. student B has done the most precise work and student A the most accurate
C. student C has done the most precise work and student B the most accurate
D. student C has done the most precise work and student A the most accurate
E. student A has done the most precise work and student C the most accurate

5. The displacement of an auto engine is 160 in^3. What is the displacement in **liters**?

A. 2.6
B. 2.9
C. 3.2
D. 2.1
E. 2.3

6. The heart rate of an individual is 62 beats/min and 55 mL of blood pass through the aorta with each beat. How many **liters** are pumped in 1.00 hour?

A. 205
B. 3.41
C. 3410
D. 2.05 x 10^3
E. 2.05 x 10^5

7. The calcium content of blood is 96 µg/mL. How many **grams** of calcium are in 1.00 dL of blood?

A. 9.6 x 10^{-2}
B. 9.6 x 10^{-3}
C. 0.96
D. 9.6
E. 96

8. A graduated cylinder contains 30.0 mL of liquid carbon tetrachloride, CCl_4, (density 1.589 g/mL) at 25°C. You have the metals listed below, along with their densities. None of the metals react with carbon tetrachloride nor are they soluble in carbon tetrachloride. When 1.0 g of metal is each individually placed in the cylinder, which would result in the greatest **total** **volume** (in **mL**) of the resulting heterogeneous mixture?

A. Cr (7.90 g/cm³)
B. Ni (8.90 g/cm³)
C. W (19.35 g/cm³)
D. Pt (21.45 g/cm³)
E. Os (22.50 g/cm³)

9. In a hypothermia case, the body temperature dropped to 85°F. What is the temperature equivalent in kelvin, K?

A. 288
B. 303
C. 352
D. 369
E. 394

10. Select the combination of statements which are **CORRECT**.

    1) The number of neutrons in an atom is its mass number.
    2) Atoms are indivisible.
    3) Isotopes of an element differ in the number of protons but have the same
       number of neutrons and electrons.
    4) A proton and neutron have approximately the same mass.
    5) A neutron has a charge of zero.

A. 1, 3
B. 1, 2, 5
C. 4, 5
D. 1, 3, 4
E. 3, 4, 5

11. Copper (atomic weight 63.5460) has two naturally-occurring isotopes, the predominant one being ^{63}Cu with an isotopic weight of 62.9298 and an abundance of 69.09%. Which of the following isotopic weights is the most likely for the other isotope?

A. 61.8210
B. 63.5460
C. 63.9819
D. 64.5289
E. 64.9278

12. Which of the following pairs of names and formulas is **<u>INCORRECT</u>**?

A. iron (III) bisulfate, $Fe(HSO_4)_3$

B. chlorous acid, $HClO_2 \ (aq)$

C. trinitrogen pentoxide, N_3O_5

D. zinc dihydrogen phosphate, $Zn(H_2PO_4)_2$

E. zirconium (IV) hypobromite, $Zr_4(BrO)$

13. What are the formulas of two compounds, one composed of yttrium and carbonate and another composed of yttrium and arsenate, if the charge on the Y is the same as in $Y(NO_2)_3$? (Assume the charge on the yttrium is the same in all the compounds.)

A. $Y_3(CO_3)_2$, Y_3AsO_4

B. YCO_3, $YAsO_4$

C. $Y_2(CO_3)_3$, $YAsO_4$

D. $Y_2(CO_3)_3$, $Y_2(AsO_4)_3$

E. YCO_3, $Y_2(AsO_4)_3$

14. Dimethylhydrazine, $(CH_3)_2N_2H_2$, was used as a fuel in the Apollo lunar descent module, with N_2O_4 as the oxidizer. Balance the following equation and choose the quantity which is the <u>sum</u> of the <u>coefficients</u> of **REACTANTS** <u>**AND**</u> **PRODUCTS**. (If present, don't forget the coefficients of 1.)

$$\_\,(CH_3)_2N_2H_2 \ + \ \_\,N_2O_4 \ \longrightarrow \ \_\,CO_2 \ + \ \_\,H_2O \ + \ \_\,N_2$$
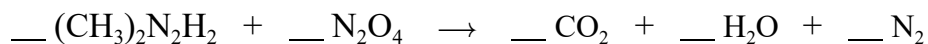
A. 6
B. 8
C. 10
D. 12
E. 14

15. Balance the following equation.   What is the <u>sum</u> of the <u>coefficients</u> of the **REACTANTS** <u>**AND**</u> **PRODUCTS** in the balanced equation? (If present, don't forget the coefficients of 1.)

$$\_\,BiCl_3 \ + \ \_\,NH_3 \ + \ \_\,H_2O \ \longrightarrow \ \_\,Bi(OH)_3 \ + \ \_\,NH_4Cl$$

A. 11
B. 10
C. 9
D. 7
E. 4

16. Balance the following equation. What is the <u>sum</u> of the <u>coefficients</u> of the **REACTANTS**? (If present, don't forget the coefficients of 1.)

$$\_\,C_{12}H_{22}O_6 \ + \ \_\,O_2 \ \longrightarrow \ \_\,CO_2 \ + \ \_\,H_2O$$
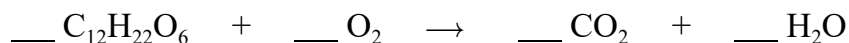
A. 15
B. 17
C. 23
D. 31
E. 39

17. Smelling salts contain $(NH_4)_2CO_3$. To three significant figures what is the **weight percent** of **nitrogen** in the compound? (Atomic weights: C = 12.01, O = 16.00, H = 1.008, N = 14.01)

A. 33.2
B. 29.2
C. 17.9
D. 14.6
E. 12.3

18. How **many** **moles** of **carbon** atoms are in 0.0195 g of the amino acid glycine $(NH_2CH_2CO_2H)$?
　　　(At. wts.: C = 12.01, O = 16.00, H = 1.008, N = 14.01; Mol. Wt: $NH_2CH_2CO_2H$ = 75.07)

A. 2.60×10^{-4}
B. 5.20×10^{-4}
C. 1.04×10^{-4}
D. 1.04×10^{-3}
E. 2.60×10^{-3}

19. A solution contains 1.63×10^{-3} g of iron(III) chloride, $FeCl_3$. How **many** **chloride** **ions** are in this quantity? (Atomic weights: Fe = 55.85, Cl = 35.45; Fol. wts.: $FeCl_3$ = 162.2)

A. 2.94×10^{21}
B. 6.05×10^{18}
C. 6.05×10^{21}
D. 1.81×10^{22}
E. 1.81×10^{19}

20. Vanillin is the primary component of the extract of the vanilla bean. It contains only carbon, hydrogen and oxygen. When a 0.8946 g sample is burned completely in oxygen, 2.0700 g of CO_2 and 0.4237 g of H_2O are formed. What is the empirical formula? (At. Wts.: H = 1.008, C = 12.01, O = 16.00)

A. C_3H_3O
B. C_4H_7O
C. $C_6H_5O_2$
D. $C_8H_8O_3$
E. $C_9H_7O_2$

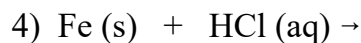21. Which of the following samples contains the highest total concentration of ions?
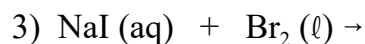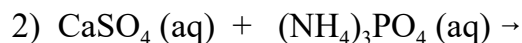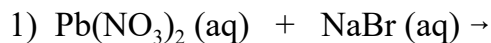
A. 0.040 M CsBr

B. 0.030 M $Cu(BrO_3)_2$

C. 0.020 M $ScBr_3$

D. 0.050 M $CaBr_2$

E. 0.070 M $HBrO_2$

22. Calcium hydroxide reacts with phosphoric acid according to the following equation. Which substance is the limiting reagent when 1.00 mol of $Ca(OH)_2$ reacts with 0.50 mol of H_3PO_4? How many moles of the excess reagent remain after completion of the reaction?

$$3\ Ca(OH)_2\ (s)\ +\ 2\ H_3PO_4\ (aq)\ \rightarrow\ Ca_3(PO_4)_2\ (aq)\ +\ 6\ H_2O\ (\ell)$$
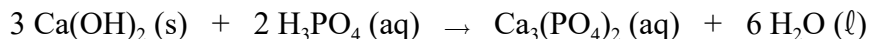
A. H_3PO_4 ; 0.75
B. H_3PO_4 ; 0.25
C. H_3PO_4 ; 0.33
D. $Ca(OH)_2$; 0.25
E. $Ca(OH)_2$; 0.50

23. Which of the following is (are) an example(s) of a **exchange** (double-replacement) reaction (assume all reactions occur to give products)?

   1) $Pb(NO_3)_2\ (aq)\ +\ NaBr\ (aq)\ \rightarrow$

   2) $CaSO_4\ (aq)\ +\ (NH_4)_3PO_4\ (aq)\ \rightarrow$

   3) $NaI\ (aq)\ +\ Br_2\ (\ell)\ \rightarrow$

   4) $Fe\ (s)\ +\ HCl\ (aq)\ \rightarrow$

   5) $Ba\ (s)\ +\ O_2\ (g)\ \rightarrow$
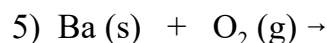
A. 3 only
B. 4 only
C. 5 only
D. 1 and 2
E. 3 and 4

24. Which of the following is (are) an example(s) of a **displacement (single-replacement)** reaction (assume all reactions occur to give products)? (Same reactions as in question 23.)

      1) $Pb(NO_3)_2$ (aq) + $NaBr$ (aq) →

      2) $CaSO_4$ (aq) + $(NH_4)_3PO_4$ (aq) →

      3) NaI (aq) + Br_2 (ℓ) →

      4) Fe (s) + HCl (aq) →

      5) Ba (s) + O_2 (g) →
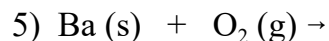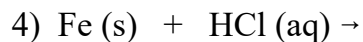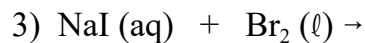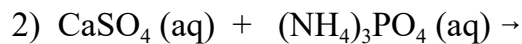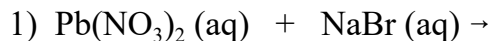
A. 3, 4
B. 1, 2
C. 4, 5
D. 2, 3, 4
E. 3, 4, 5

25. Select the correct **NET IONIC** reaction from those given below to represent what happens when solutions of silver chlorate and sodium bromide are mixed.

A. $AgClO_3$ + $NaBr$ → N.R.

B. Ag^+ + ClO_3^- → $AgClO_3$

C. Ag^+ + Br^- → $AgBr$

D. $AgClO_3$ → Ag^+ + ClO_3^-

E. Ag^+ + ClO_3^- + Na^+ + Br^- → Ag^+ + Br^- + Na^+ + ClO_3^-
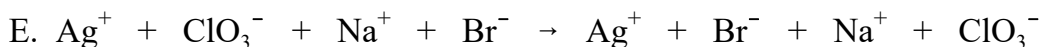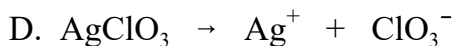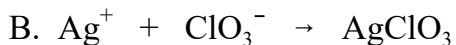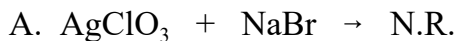
26. A solution is prepared by dissolving 516.5 mg of oxalic acid ($C_2H_2O_4$) to make 100.0 mL of solution. A 10.00 mL portion is then diluted to 250.0 mL. What is the molarity of the final solution?
(At. Wts.: H = 1.008, C = 12.01, O = 16.00; Mol. Wts.: $C_2H_2O_4$ = 90.04)

A. 5.737×10^{-2}
B. 5.737
C. 2.295×10^{-3}
D. 2.295
E. 5.738×10^{-2}

27. A 5.0 g sample of blood is titrated with 3.68 mL of 0.05295 M $K_2Cr_2O_7$ to determine the percent of alcohol. What is the mass percent? (At. Wts.: C = 12.01, H = 1.008, O = 16.00, Cr = 52.00, K = 39.10; Form. Wts.: $K_2Cr_2O_7$ = 294.20, C_2H_5OH = 46.068)

$$16\,H^+ + 2\,Cr_2O_7^{2-} + C_2H_5OH \longrightarrow 4\,Cr^{3+} + 11\,H_2O + 2\,CO_2$$
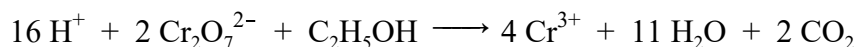
A. 0.090
B. 0.18
C. 0.27
D. 0.45
E. 0.018

28. Arrange the following phosphorus containing species in order of **increasing** oxidation number of the **phosphorus** atom. What compound occupies the **intermediate** (middle) position?

A. P_4
B. PH_2^-
C. HPO_3^{2-}
D. P_2H_4
E. PO_4^{3-}

29. Which of the following reactions will **NOT** occur as written?

A. $2 \text{ Cr(s)} + 6 \text{ HBr(aq)} \rightarrow 3 \text{ H}_2\text{(g)} + 2 \text{ CrBr}_3\text{(aq)}$

B. $\text{Al(OH)}_3\text{(s)} + 3 \text{ HNO}_3 \text{ (aq)} \rightarrow \text{Al(NO}_3)_3 \text{ (aq)} + 3 \text{ H}_2\text{O}(\ell)$

C. $\text{F}_2\text{(aq)} + 2 \text{ NaBr (aq)} \rightarrow \text{Br}_2 \text{ (aq)} + 2 \text{ NaF(aq)}$

D. $3 \text{ Fe(NO}_3)_2\text{(aq)} + 2 \text{ Al(s)} \rightarrow 3 \text{ Fe(s)} + 2 \text{ Al(NO}_3)_3 \text{ (aq)}$

E. $2 \text{ Au(s)} + 3 \text{ Zn(NO}_3)_2\text{(aq)} \rightarrow 3 \text{ Zn(s)} + 2 \text{ Au(NO}_3)_3 \text{ (aq)}$

30. Examine the reaction below and the statements concerning the reaction. Select an answer which includes **ALL** of the **CORRECT** statements given below.

$$\text{Te} + 4 \text{ HNO}_3 \rightarrow \text{TeO}_2 + 2 \text{ H}_2\text{O} + 4 \text{ NO}_2$$

1) Te has been oxidized.
2) The oxidation number of N changed from +5 to +4.
3) Both Te and N have been oxidized.
4) N has been oxidized.
5) The oxidizing agent is HNO_3.

A. 1
B. 2, 4
C. 2, 5
D. 2, 3, 4
E. 1, 2, 5

USEFUL INFORMATION

1 in = 2.54 cm

1 mile = 5280 ft

1 lb = 453.59 g

1 qt = 946.35 mL   1 gal = 4 qt

1 lb = 16 oz

1 amu = 1.66×10^{-24} g

Avogadro's number = 6.02×10^{23} particles/mole

$1 \text{ Å} = 1 \times 10^{-10} \text{ m} = 1 \times 10^{-8} \text{ cm}$

IA	IIA	IIIB	IVB	VB	VIB	VIIB		VIIIB		IB	IIB	IIIA	IVA	VA	VIA	VIIA	VIIIA
1.008 **H** 1																	4.003 **He** 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
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
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
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
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
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						

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)

EMPIRICAL RULES FOR THE SOLUBILITY OF IONIC SOLIDS IN H_2O

COMPOUNDS CONTAINING	SOLUBILITY	IMPORTANT EXCEPTIONS
alkali metal (grp 1A) ammonium	Soluble	None
nitrates, acetates, chlorates, perchlorates, permanganates	Soluble	None
chlorides, bromides, iodides	Soluble	Cmpds of Ag^+, Hg_2^{2+}, Pb^{2+}, Hg^{2+} iodide and Hg^{2+} bromide
sulfates	Soluble	Cmpds of Sr^{2+}, Ba^{2+}, Hg_2^{2+}, Pb^{2+}
hydroxides, oxides, sulfides	Insoluble	Cmpds of alkali metals (grp 1A), ammonium, Ca^{2+}, Sr^{2+}, Ba^{2+}
sulfites, carbonates, phosphates, chromates	Insoluble	Cmpds of alkali metals (grp 1A), ammonium

TABLE 4.5 • Activity Series of Metals in Aqueous Solution

Metal	Oxidation Reaction	
Lithium	$Li(s) \longrightarrow Li^+(aq) + e^-$	
Potassium	$K(s) \longrightarrow K^+(aq) + e^-$	
Barium	$Ba(s) \longrightarrow Ba^{2+}(aq) + 2e^-$	
Calcium	$Ca(s) \longrightarrow Ca^{2+}(aq) + 2e^-$	
Sodium	$Na(s) \longrightarrow Na^+(aq) + e^-$	
Magnesium	$Mg(s) \longrightarrow Mg^{2+}(aq) + 2e^-$	
Aluminum	$Al(s) \longrightarrow Al^{3+}(aq) + 3e^-$	
Manganese	$Mn(s) \longrightarrow Mn^{2+}(aq) + 2e^-$	
Zinc	$Zn(s) \longrightarrow Zn^{2+}(aq) + 2e^-$	
Chromium	$Cr(s) \longrightarrow Cr^{3+}(aq) + 3e^-$	Ease of oxidation increases
Iron	$Fe(s) \longrightarrow Fe^{2+}(aq) + 2e^-$	
Cobalt	$Co(s) \longrightarrow Co^{2+}(aq) + 2e^-$	
Nickel	$Ni(s) \longrightarrow Ni^{2+}(aq) + 2e^-$	
Tin	$Sn(s) \longrightarrow Sn^{2+}(aq) + 2e^-$	
Lead	$Pb(s) \longrightarrow Pb^{2+}(aq) + 2e^-$	
Hydrogen	$H_2(g) \longrightarrow 2H^+(aq) + 2e^-$	
Copper	$Cu(s) \longrightarrow Cu^{2+}(aq) + 2e^-$	
Silver	$Ag(s) \longrightarrow Ag^+(aq) + e^-$	
Mercury	$Hg(l) \longrightarrow Hg^{2+}(aq) + 2e^-$	
Platinum	$Pt(s) \longrightarrow Pt^{2+}(aq) + 2e^-$	
Gold	$Au(s) \longrightarrow Au^{3+}(aq) + 3e^-$	

Chemistry 1250
Answers to Practice Midterm 1

1) D	11) E	21) D
2) C	12) E	22) B
3) E	13) C	23) D
4) E	14) D	24) A
5) A	15) A	25) C
6) A	16) D	26) C
7) B	17) B	27) A
8) A	18) B	28) A
9) B	19) E	29) E
10) C	20) D	30) E