

## Chemistry 1250 - Sp22 Practice Midterm 1

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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**.

$^{20}\text{Ca}$	$^{15}\text{P}$	$^{36}\text{Kr}$
$^{32}\text{Ge}$	$^{29}\text{Cu}$	$^{49}\text{In}$
$^{34}\text{Se}$	$^{24}\text{Cr}$	$^{52}\text{Te}$

- 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.  $6.0 \times 10^1$
- D.  $6 \times 10^1$
- 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<sup>3</sup>. 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.  $2.05 \times 10^3$
- E.  $2.05 \times 10^5$

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

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

8. A graduated cylinder contains 30.0 mL of liquid carbon tetrachloride, CCl<sub>4</sub>, (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/cm<sup>3</sup>)
- B. Ni (8.90 g/cm<sup>3</sup>)
- C. W (19.35 g/cm<sup>3</sup>)
- D. Pt (21.45 g/cm<sup>3</sup>)
- E. Os (22.50 g/cm<sup>3</sup>)

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  $^{63}\text{Cu}$  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

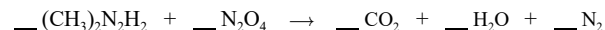
12. Which of the following pairs of names and formulas is **INCORRECT**?

- |                                |                                      |
|--------------------------------|--------------------------------------|
| A. iron (III) bisulfate,       | $\text{Fe}(\text{HSO}_4)_3$          |
| B. chlorous acid,              | $\text{HClO}_2(\text{aq})$           |
| C. trinitrogen pentoxide,      | $\text{N}_3\text{O}_5$               |
| D. zinc dihydrogen phosphate,  | $\text{Zn}(\text{H}_2\text{PO}_4)_2$ |
| E. zirconium (IV) hypobromite, | $\text{Zr}_4(\text{BrO})$            |

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  $\text{Y}(\text{NO}_2)_3$ ? (Assume the charge on the yttrium is the same in all the compounds.)

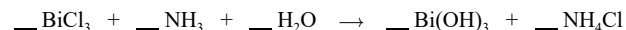
- A.  $\text{Y}_3(\text{CO}_3)_2$ ,  $\text{Y}_3\text{AsO}_4$
- B.  $\text{YCO}_3$ ,  $\text{YAsO}_4$
- C.  $\text{Y}_2(\text{CO}_3)_3$ ,  $\text{YAsO}_4$
- D.  $\text{Y}_2(\text{CO}_3)_3$ ,  $\text{Y}_2(\text{AsO}_4)_3$
- E.  $\text{YCO}_3$ ,  $\text{Y}_2(\text{AsO}_4)_3$

14. Dimethylhydrazine,  $(\text{CH}_3)_2\text{N}_2\text{H}_2$ , was used as a fuel in the Apollo lunar descent module, with  $\text{N}_2\text{O}_4$  as the oxidizer. Balance the following equation and choose the quantity which is the sum of the coefficients of **REACTANTS AND PRODUCTS**. (If present, don't forget the coefficients of 1.)



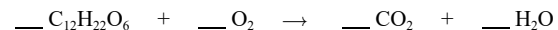
- A. 6
- B. 8
- C. 10
- D. 12
- E. 14

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



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

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



- A. 15
- B. 17
- C. 23
- D. 31
- E. 39

17. Smelling salts contain  $(\text{NH}_4)_2\text{CO}_3$ . 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 ( $\text{NH}_2\text{CH}_2\text{CO}_2\text{H}$ )? (At. wts.: C = 12.01, O = 16.00, H = 1.008, N = 14.01; Mol. Wt:  $\text{NH}_2\text{CH}_2\text{CO}_2\text{H}$  = 75.07)

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

19. A solution contains  $1.63 \times 10^{-3}$  g of iron(III) chloride,  $\text{FeCl}_3$ . How many chloride ions are in this quantity? (Atomic weights: Fe = 55.85, Cl = 35.45; Mol. wts.:  $\text{FeCl}_3$  = 162.2)

- A.  $2.94 \times 10^{21}$
- B.  $6.05 \times 10^{18}$
- C.  $6.05 \times 10^{21}$
- D.  $1.81 \times 10^{22}$
- E.  $1.81 \times 10^{19}$

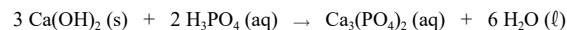
20. Vanillin is the primary component of the extract of the vanilla bean. It contains only carbon, hydrogen and oxygen. When a 0.8946 g sample is burned completely in oxygen, 2.0700 g of  $\text{CO}_2$  and 0.4237 g of  $\text{H}_2\text{O}$  are formed. What is the empirical formula? (At. Wts.: H = 1.008, C = 12.01, O = 16.00)

- A.  $\text{C}_3\text{H}_4\text{O}$
- B.  $\text{C}_4\text{H}_7\text{O}$
- C.  $\text{C}_6\text{H}_5\text{O}_2$
- D.  $\text{C}_8\text{H}_8\text{O}_3$
- E.  $\text{C}_9\text{H}_7\text{O}_2$

21. Which of the following samples contains the highest total concentration of ions?

- A. 0.040 M CsBr
- B. 0.030 M  $\text{Cu}(\text{BrO}_3)_2$
- C. 0.020 M  $\text{ScBr}_3$
- D. 0.050 M  $\text{CaBr}_2$
- E. 0.070 M  $\text{HBrO}_2$

22. Calcium hydroxide reacts with phosphoric acid according to the following equation. Which substance is the limiting reagent when 1.00 mol of  $\text{Ca(OH)}_2$  reacts with 0.50 mol of  $\text{H}_3\text{PO}_4$ ? How many moles of the excess reagent remain after completion of the reaction?



- A.  $\text{H}_3\text{PO}_4$  ; 0.75
- B.  $\text{H}_3\text{PO}_4$  ; 0.25
- C.  $\text{H}_3\text{PO}_4$  ; 0.33
- D.  $\text{Ca(OH)}_2$  ; 0.25
- E.  $\text{Ca(OH)}_2$  ; 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)  $\text{Pb(NO}_3)_2 (\text{aq}) + \text{NaBr} (\text{aq}) \rightarrow$
- 2)  $\text{CaSO}_4 (\text{aq}) + (\text{NH}_4)_3\text{PO}_4 (\text{aq}) \rightarrow$
- 3)  $\text{NaI} (\text{aq}) + \text{Br}_2 (\ell) \rightarrow$
- 4)  $\text{Fe} (\text{s}) + \text{HCl} (\text{aq}) \rightarrow$
- 5)  $\text{Ba} (\text{s}) + \text{O}_2 (\text{g}) \rightarrow$

- 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)  $\text{Pb(NO}_3)_2 (\text{aq}) + \text{NaBr} (\text{aq}) \rightarrow$
- 2)  $\text{CaSO}_4 (\text{aq}) + (\text{NH}_4)_3\text{PO}_4 (\text{aq}) \rightarrow$
- 3)  $\text{NaI} (\text{aq}) + \text{Br}_2 (\ell) \rightarrow$
- 4)  $\text{Fe} (\text{s}) + \text{HCl} (\text{aq}) \rightarrow$
- 5)  $\text{Ba} (\text{s}) + \text{O}_2 (\text{g}) \rightarrow$

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

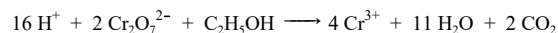
25. Select the correct **NET IONIC** reaction from those given below to represent what happens when solutions of silver chlorate and sodium bromide are mixed.

- A.  $\text{AgClO}_3 + \text{NaBr} \rightarrow \text{N.R.}$
- B.  $\text{Ag}^+ + \text{ClO}_3^- \rightarrow \text{AgClO}_3$
- C.  $\text{Ag}^+ + \text{Br}^- \rightarrow \text{AgBr}$
- D.  $\text{AgClO}_3 \rightarrow \text{Ag}^+ + \text{ClO}_3^-$
- E.  $\text{Ag}^+ + \text{ClO}_3^- + \text{Na}^+ + \text{Br}^- \rightarrow \text{Ag}^+ + \text{Br}^- + \text{Na}^+ + \text{ClO}_3^-$

26. A solution is prepared by dissolving 516.5 mg of oxalic acid ( $\text{C}_2\text{H}_2\text{O}_4$ ) 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.:  $\text{C}_2\text{H}_2\text{O}_4$  = 90.04)

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

27. A 5.0 g sample of blood is titrated with 3.68 mL of 0.05295 M  $\text{K}_2\text{Cr}_2\text{O}_7$  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.:  $\text{K}_2\text{Cr}_2\text{O}_7$  = 294.20,  $\text{C}_2\text{H}_5\text{OH}$  = 46.068)



- 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.  $\text{P}_4$
- B.  $\text{PH}_2^-$
- C.  $\text{HPO}_3^{2-}$
- D.  $\text{P}_2\text{H}_4^{3-}$
- E.  $\text{PO}_4^{3-}$

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



- 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  $\text{HNO}_3$ .

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

## USEFUL INFORMATION

$$1 \text{ in} = 2.54 \text{ cm}$$
$$1 \text{ mile} = 5280 \text{ ft}$$
$$1 \text{ lb} = 453.59 \text{ g}$$
$$1 \text{ qt} = 946.35 \text{ mL} \quad 1 \text{ gal} = 4 \text{ qt}$$
$$1 \text{ lb} = 16 \text{ oz}$$
$$1 \text{ amu} = 1.66 \times 10^{-24} \text{ g}$$

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

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

	IA	IIA	IIIB	IVB	VB	VIB	VIIb	VIIIb					IB	IIb	IIIa					IVA	VA	VIA	VIIa	VIIIA
1	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	264 Sg 106	262 Ns 107	265 Hs 108	266 Mt 109	269 110	272 111	277 112												

Lanthanide Series	140.12 58 Ce	140.91 59 Pr	144.24 60 Nd	145 61 Pm	150.36 62 Sm	151.96 63 Eu	157.25 64 Gd	158.93 65 Tb	162.50 66 Dy	164.93 67 Ho	167.26 68 Er	168.93 69 Tm	173.04 70 Yb	173.04 71 Lu
Actinide Series	232.04 90 Th	231.04 91 Pa	238.03 92 U	237.05 93 Np	244.06 94 Pu	247.07 95 Am	251.08 96 Cm	259.10 97 Bk	264.10 98 Cf	277.10 99 Es	289.10 100 Fm	289.10 101 Md	289.10 102 No	289.10 103 Lr


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

## EMPIRICAL RULES FOR THE SOLUBILITY OF IONIC SOLIDS IN H<sub>2</sub>O

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 $\text{Ag}^+$ , $\text{Hg}_2^{2+}$ , $\text{Pb}^{2+}$ , $\text{Hg}_2^{2+}$ iodide and $\text{Hg}_2^{2+}$ bromide
sulfates	Soluble	Cmpds of $\text{Sr}^{2+}$ , $\text{Ba}^{2+}$ , $\text{Hg}_2^{2+}$ , $\text{Pb}^{2+}$
hydroxides, oxides, sulfides	Insoluble	Cmpds of alkali metals (grp 1A) , ammonium, $\text{Ca}^{2+}$ , $\text{Sr}^{2+}$ , $\text{Ba}^{2+}$
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	$\text{Li}(s) \longrightarrow \text{Li}^+(aq) + e^-$
Potassium	$\text{K}(s) \longrightarrow \text{K}^+(aq) + e^-$
Barium	$\text{Ba}(s) \longrightarrow \text{Ba}^{2+}(aq) + 2e^-$
Calcium	$\text{Ca}(s) \longrightarrow \text{Ca}^{2+}(aq) + 2e^-$
Sodium	$\text{Na}(s) \longrightarrow \text{Na}^+(aq) + e^-$
Magnesium	$\text{Mg}(s) \longrightarrow \text{Mg}^{2+}(aq) + 2e^-$
Aluminum	$\text{Al}(s) \longrightarrow \text{Al}^{3+}(aq) + 3e^-$
Manganese	$\text{Mn}(s) \longrightarrow \text{Mn}^{2+}(aq) + 2e^-$
Zinc	$\text{Zn}(s) \longrightarrow \text{Zn}^{2+}(aq) + 2e^-$
Chromium	$\text{Cr}(s) \longrightarrow \text{Cr}^{3+}(aq) + 3e^-$
Iron	$\text{Fe}(s) \longrightarrow \text{Fe}^{2+}(aq) + 2e^-$
Cobalt	$\text{Co}(s) \longrightarrow \text{Co}^{2+}(aq) + 2e^-$
Nickel	$\text{Ni}(s) \longrightarrow \text{Ni}^{2+}(aq) + 2e^-$
Tin	$\text{Sn}(s) \longrightarrow \text{Sn}^{2+}(aq) + 2e^-$
Lead	$\text{Pb}(s) \longrightarrow \text{Pb}^{2+}(aq) + 2e^-$
Hydrogen	$\text{H}_2(g) \longrightarrow 2\text{H}^+(aq) + 2e^-$
Copper	$\text{Cu}(s) \longrightarrow \text{Cu}^{2+}(aq) + 2e^-$
Silver	$\text{Ag}(s) \longrightarrow \text{Ag}^+(aq) + e^-$
Mercury	$\text{Hg}(l) \longrightarrow \text{Hg}^{2+}(aq) + 2e^-$
Platinum	$\text{Pt}(s) \longrightarrow \text{Pt}^{2+}(aq) + 2e^-$
Gold	$\text{Au}(s) \longrightarrow \text{Au}^{3+}(aq) + 3e^-$



Ease of oxidation increases

Ease of oxidation increases

**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