

CHEM-1211
Fall 2013
First Examination
Form A

Multiple Choice - Choose the BEST Answer

1. An Erlenmeyer flask weighs 38.57 g when it is empty. A student fills the flask to the top with H₂O (density = 1.0000 g/mL) and reweighs it to find it now weighs 167.33 g. The student then pours out the H₂O, dries the flask and fills to top again with a different liquid. The student finds the new mass to be 139.78 g. What is the density of the 2nd liquid?

- A) 0.78604 g/mL
- B) 1.2722 g/mL
- C) 0.83536 g/mL
- D) 1.1971 g/mL
- E) 0.2759 g/mL

2. Which of the following is the most correct balanced chemical equation for a reaction of solid magnesium with atmospheric nitrogen to form solid magnesium nitride?

- A) $\text{Mg(s)} + \text{N(g)} \rightarrow \text{MgN(s)}$
- B) $\text{Mg(s)} + \text{N}_2\text{(g)} \rightarrow \text{Mg}_3\text{N}_2\text{(s)}$
- C) $3 \text{Mg(s)} + 2 \text{N(g)} \rightarrow \text{Mg}_3\text{N}_2\text{(s)}$
- D) $2 \text{Mg(s)} + \text{N}_2\text{(g)} \rightarrow 2 \text{MgN(s)}$
- E) $3 \text{Mg(s)} + \text{N}_2\text{(g)} \rightarrow \text{Mg}_3\text{N}_2\text{(s)}$

3. Which of the following molecule/compound is classified incorrectly?

- A) SF₄ binary covalent compound
- B) H₂SO₃ ternary acid
- C) NH₄Br pseudobinary ionic compound
- D) Fe₂S₃ binary ionic compound
- E) All molecules/compounds are classified correctly

4. Lithium Carbonate, Li₂CO₃ is a drug used to treat bipolar I and bipolar II disorders. When placed in the body, the lithium ion is the active ingredient in the compound. If your friend was prescribed 200. mg of Li₂CO₃ per day, how many mg of Li⁺ would they be taking each day?

- A) 18.79 mg Li⁺
- B) 9.39 mg Li⁺
- C) 37.6 mg Li⁺
- D) 27.8 mg Li⁺
- E) 40.0 mg Li⁺

Multiple Choice - Choose the BEST Answer

5. A compound contains 32.56% potassium, 1.68% hydrogen, 25.79% phosphorous and the remainder oxygen. What is the empirical formula of this compound?

- A) KH_2PO_3
- B) K_2HPO_4
- C) KH_2PO_4
- D) K_2HPO_3
- E) KHPO_4

6. In 3.4 mole of $(\text{NH}_4)_2\text{CO}_3$ how many atoms of hydrogen are present?

- A) 2.0×10^{24} H atoms
- B) 1.6×10^{25} H atoms
- C) 2.1×10^{22} H atoms
- D) 1.7×10^{23} H atoms
- E) 1.2×10^{25} H atoms

7. A solution is prepared by placing 0.500 g of NaNO_3 0.500 g of Na_3PO_4 and 0.500 g of NaCl in H_2O . The total solution volume is 250. mL. What is concentration in molarity, M , of the final solution of sodium ions?

The molecular weights of the compounds are as follows:

$\text{NaNO}_3 = 85.00 \text{ g/mol}$

$\text{Na}_3\text{PO}_4 = 163.94 \text{ g/mol}$

$\text{NaCl} = 58.44 \text{ g/mol}$

- A) 0.109 M Na^+
- B) 0.0944 M Na^+
- C) 0.0700 M Na^+
- D) 0.0175 M Na^+
- E) 0.0856 M Na^+

8. In lab 100.0 mL of $0.0750 \text{ M NaOH (aq)}$ is needed for an experiment. You come across a bottle labeled $0.0500 \text{ M NaOH (aq)}$ containing 50.0 mL of solution. Solid NaOH is also readily available. You decide to add all of the 50.0 mL $0.0500 \text{ M NaOH (aq)}$ to a 100.0 mL volumetric flask and then weigh out _____ g of NaOH and add to the flask. You then add H_2O to the 100.0 mL line to make the required 100.0 mL of 0.0750 M NaOH .

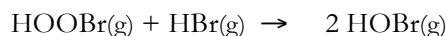
- A) 0.100 g NaOH(s)
- B) 0.0075 g NaOH(s)
- C) 0.300 g NaOH(s)
- D) 0.200 g NaOH(s)
- E) Not enough information is given

Multiple Choice - Choose the BEST Answer

9. A reaction vessel contains 3.06 g of HBr(g) and 0.943 g of O₂(g). The first reaction takes place is the formation of HOObBr(g):



If enough HBr(g) is present, it will react with HOObBr(g) to produce HOBr(g) :



What is the mass of HOBr(g) produced?

MW's: HBr = 80.91 g/mol ; O₂ = 32.00 g/mol ; HOObBr = 112.91 g/mol ; HOBr = 96.91 g/mol

- A) 7.33 g of HOBr
- B) 5.71 g of HOBr
- C) 1.62 g of HOBr
- D) The 2nd reaction does not take place.
- E) Not enough information is given.

10. The atomic mass of silicon in a natural sample on earth is 28.0855 amu. The sample is known to consist 92.23 % of ²⁸Si (27.97693 amu). The remainder is composed of ²⁹Si (28.97649 amu) and ³⁰Si (29.97377 amu). What is the percentage of abundance of ²⁹Si?

- A) 4.67 %
- B) 3.885 %
- C) 7.77 %
- D) 2.282 %
- E) 7.87 %

11. In lab you have an aqueous homogenous mixture of two metal ions, K⁺ and Zn²⁺. Which of the following could you add to precipitate out one of the ions into an ionic compound?

- A) HCl
- B) HClO₃
- C) H₂SO₄
- D) CH₃COOH
- E) H₂S

Multiple Choice - Choose the BEST Answer

12. How many unpaired electrons are predicted for the ground-state configuration of an atom of iron, Fe?

- A) 0
- B) 6
- C) 2
- D) 4**
- E) 8

13. One difference between an s and p orbital is that:

- A) An s orbital has a probability density of an electron of zero at the nucleus and a p orbital does not.
- B) The p orbital is present when $m_\ell = -1$ and the s orbital is present when $m_\ell = 0$.
- C) The p orbital can hold two electrons in each lobe and the s orbital can hold two electrons.
- D) The s orbital is spherically symmetrically whereas the p orbital has a node separating its $+/-$ lobes.**
- E) A p orbital has a different n quantum number than an s orbital.

14. What is the difference between the ℓ and m_ℓ quantum numbers?

- A) The ℓ quantum number represents a specific orbital whereas the m_ℓ represents a subshell in an atom.
- B) The m_ℓ is the positive and negative lobes of the ℓ quantum number.
- C) The ℓ quantum number is represented by (+) and (-) values where the m_ℓ quantum number is only represented by (+) values.
- D) The ℓ quantum number is said to be degenerate whereas the m_ℓ quantum number is said to be non-degenerate.
- E) None of the above.**

15. How many values of m_ℓ are allowed for an electron in a $4p$ -subshell?

- A) 6
- B) 4
- C) 3**
- D) 16
- E) 1

16. Which of the following transitions, for a hydrogen atom, will lead to the emission of the highest energy photon?

- A) $n=2 \rightarrow n=5$
- B) $n=1 \rightarrow n=5$
- C) $n=3 \rightarrow n=4$
- D) $n=5 \rightarrow n=2$**
- E) $n=4 \rightarrow n=2$

Multiple Choice - Choose the BEST Answer

17. The equation: $\lambda = h/mv$ is used to describe_____.

- A) the wave-particle duality of small particles.
- B) the relationship between frequency and speed of light
- C) that $m_2 < m_1$
- D) that electrons in an atom reside in discrete energy levels
- E) how the position and the momentum of an electron cannot be known simultaneously with precision

18. The following types of photons of electromagnetic radiation are in order of increasing energy. What is the order of these types of electromagnetic radiation in longest to shortest wavelength?

- A) Infrared ; Visible ; Ultraviolet ; X-ray
- B) X-ray ; Ultraviolet ; Visible ; Infrared
- C) X-ray ; Visible ; Ultraviolet ; Infrared
- D) Visible ; Ultraviolet ; Infrared; X-ray
- E) All types electromagnetic radiation has a variety of wavelengths; it does not follow an order.

19. Calculate the difference in energy (in joules) between a photon with $\lambda = 680. \text{ nm}$ (red light) and a photon with $\lambda = 442 \text{ nm}$ (blue light).

- A) $1.57 \times 10^{-19} \text{ J}$
- B) $2.92 \times 10^{-19} \text{ J}$
- C) $2.38 \times 10^{-7} \text{ J}$
- D) $8.35 \times 10^{-19} \text{ J}$
- E) $4.50 \times 10^{-19} \text{ J}$

20. How are the actual nuclear charge and the effective nuclear charge, experienced by an electron in a many electron atom, related to one another?

- A) The actual nuclear charge is always less than the effective nuclear charge.
- B) The actual nuclear charge is always greater than the effective nuclear charge.
- C) The actual nuclear charge and the effective nuclear charge are equal.
- D) A, B and C are correct; it depends on the number of protons and electrons
- E) All are incorrect