First Name _____ Last Name _____

Student ID _____ Signature _____

CHEM 101/3, J1

Quiz - 04 October 2007

Instructions

Complete the answer sheet by entering:

Name

ID Number

Special Code J,K :

Enter the numbers you see in a square box at the bottom of page - 3 - .

Select the best possible answer for questions 1 – 20 and

fill the corresponding circle in the bottom part of the answer sheet .
Read questions carefully; there might be "trick" or "non-sensical" questions.

Assume there is only one correct answer.

You must hand in **both** the answer sheet and the question sheets, incl. the Chemistry Data Sheet.
But only the answer sheet will be evaluated.
Closed book exam; no calculators permitted.

Time allowed: 60 min.
There are **20** questions.

Useful data might be found on the **attached Chemistry Data Sheet**.

1. Symbols and names of elements. Which of the following are correct?

   i. Fe = iron ii. Mn = magnesium iii. K = potassium

   iv. B = beryllium v. Co = copper

   a) i & ii b) i & iii c) ii & v d) ii & iv e) iii & v

2. Measurement units. Which of the following are correct? *(Don't worry about sig. figures)*

   i. The units Hz and s^{-1} are equivalent.

   ii. 400 pm = 0.0004 μm

   iii. Wavelengths can be expressed in units of m/s.

   a) i b) ii c) iii d) i & ii e) ii & iii

3. Which statements are in agreement with the Law of Conservation of Mass?

   i. The total number of atoms will be the same before and after a chemical reaction.

   ii. Gases must be excluded when applying this Law.

   iii. Electrons can disappear during chemical reactions.

   a) none b) i c) ii d) iii e) i & iii

4. The following statements are in agreement with the Law of Definite Proportions:

   i. It does not apply if the same compound is found in nature or is made in a factory.

   ii. Two elements can form only one (1) kind of compound.

   iii. It applies to the composition of air.

   a) none b) i c) ii d) iii e) ii & iii

5. Thomson Experiment. Which of the following statements are correct?

i. It confirmed all aspects of Dalton's Atomic Theory.

ii. It can be used directly to determine the minimum possible charge.

iii. Cathode rays are equivalent to a stream of electrons.

a) i b) ii c) iii d) i & ii e) all

6. Millikan Experiment. The purpose of the use of X rays is to

i. increase the magnitude of the applied voltage.

ii. generate hydrogen ions.

iii. reduce the size of the oil droplets.

a) none b) i c) ii d) iii e) i &iii

7. Rutherford Experiment. Which of the following statements are correct?

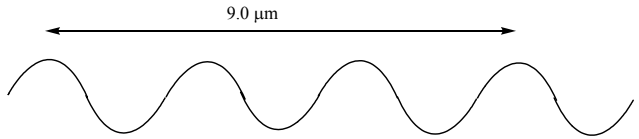
i. α radiation is equivalent to a stream of He^{2+} ions.

ii. The most significant observation was the rebound of radioactive rays from a central metal foil.

iii. The mass of an atom is concentrated in less than 1% of the available space.

a) iii b) i & ii c) i & iii d) ii & iii e) all

8.



Assuming that the above represents a electromagnetic wave, the frequency of this radiation is about

a) $3 \times 10^{13}\ s^{-1}$ b) 1×10^{14} s c) 1×10^{14} Hz d) 1×10^{-14} Hz e) $3 \times 10^{-14}\ s^{-1}$

9. The probability that all three (3) C atoms in a molecule of propane, $H_3C\text{-}CH_2\text{-}CH_3$,

are C-13 isotopes is

a) 1 : 10 b) 1 : 100 c) 1 : 1000 d) 1 : 10 000 e) 1 : 1 000 000

10. The following statements relate to phosphorus which is isotopically pure (only one isotope exists).

i. Mass number and atomic mass have the same numerical value

ii. The mass number has the units "atomic mass units".

iii. The C-12 isotope is used as reference when determining the (relative) atomic mass of phosphorus.

a) none b) i c) ii d) iii e) ii & iii

11. In the visible range, the typical **absorption** spectrum shows

a. colored lines on a dark background

b. white lines on a colored background

c. colored lines on a white background

d. dark lines on a colored background

e. white lines on a dark background

a) b) c) d) e)

12. Photoelectric effect. Which of the following statements are correct?

i. Only photons with a frequency above a threshold (minimum) frequency can cause electrical current to flow.

ii. Some energy of a photon can be converted to kinetic energy of an electron.

iii. It demonstrated that electromagnetic radiation has particle characteristics.

a) i b) i & ii c) i & iii d) ii & iii e) all

13. Consider the He^+ species. When an electron moves from n = 2 to n = ∞ the system energy change is

a.) R_H b.) $\frac{1}{4}R_H$ c.) $-\frac{1}{4}R_H$ d.) $4\ R_H$

e.) cannot be calculated using conventional Bohr theory (as taught in class)

a) b) c) d) e)

14. What is the total number of atomic orbitals that can have n = 4 and $\ell = 3$?

a) 5 b) 6 c) 7 d) 8 e) 14

15. Orbital nodes. Which of the following statements are correct?

i. The number of nodes in 3d and 4d orbitals is the same.

ii. The 2s orbital has two (2) nodes

iii. A 2p orbital has two (2) nodes.

a) none b) i c)i & ii d) i & iii e) all

16. Which of the following electron configuration assignments are correct?

i. C : $1s^2\ 2s^1\ 2p^3$

ii. Al : [Ne] $3s^2 3d^1$

iii. Mn^{2+} : [Ar] $3d^5$

a) none b) i c) ii d) iii e) i & iii

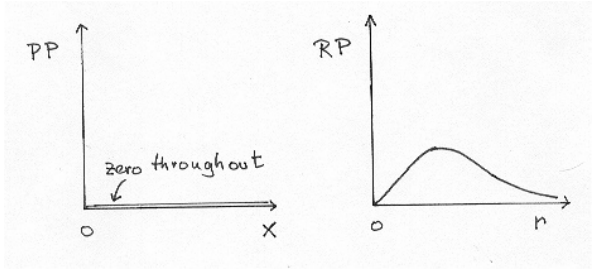
17. Which of the following has two (2) or more unpaired electrons (in the ground state)?

i. O ii. F iii. Al iv. V v. Cu^+

a) i & ii b) i & iii c) i & iv d) iv & v e) i, iv & v

18. Following are a PP and a RP graph.

(We have called Ψ^2, "point probability", (PP) and $4\pi r^2 \Psi^2$, radial probability (RP). Pay attention to the labeling of the axes.)



Now consider the orbitals

i) 1s ii) $2p_x$ iii) $2p_y$ iv) $3d_{xy}$ v) $3d_{x2-y2}$

To which orbital(s) does the above set of graphs apply?

a) i & ii b) ii & iii c) iii d) iii & iv e) ii & v

19. The following represents the **first ionization energies** of the indicated elements.

i.) Li > Na ii.) N > O iii.) O > F iv.) F > Ne v.) Na > Ne

Which statements are correct?

a) i & ii b) i & v c) ii, iii & iv d) iii & iv e) iii & v

20. List the following ions in order of increasing size: $K^+,\ Se^{2-},\ Cl^-,\ Mg^{2+},\ S^{2-}$

a. $Cl^- < S^{2-} < Se^{2-} < Mg^{2+} < K^+$

b. $Mg^{2+} < K^+ < Cl^- < S^{2-} < Se^{2-}$

c. $K^+ < Mg^{2+} < Se^{2-} < S^{2-} < Cl^-$

d. $K^+ < Mg^{2+} < Cl^- < S^{2-} < Se^{2-}$

e. $Mg^{2+} < S^{2-} < Cl^- < K^+ < Se^{2-}$

a) b) c) d) e)