KEY

General&Analytical Chemistry I
CHMG.141

Exam I (V.1)

Name_____

$c = 3.00 \times 10^{8}$ m/s
$h = 6.626 \times 10^{-34}$ J.s (or kg.m2/s

$R_H = -2.18 \times 10^{-18}$ J

MULTIPLE CHOICE. Choose the one alternative that best completes the statement or answers the question.

1) What is the volume of a gold nugget that weighs 2.20 kg? The density of gold is 19 g/cm^3. 1) _____

A) 0.116 cm^3
B) 8.60 × 10^3 cm^3
C) 11.6 cm^3
D) 116 cm^3
E) 8.60 cm^3

2) Where is most of the mass of an atom concentrated? 2) _____

A) neutrons B) protons C) electrons D) nucleus E) orbitals

3) How many neutrons does an atom of $^{46}_{22}$Ti have? 3) _____

A) 24 B) 0 C) 68 D) 22 E) 46

4) Which element is most likely to have chemical properties similar to those of potassium (atomic number 19)? 4) _____

A) Rb (atomic number 37)
B) Sc (atomic number 21)
C) Sr (atomic number 38)
D) Ca (atomic number 20)
E) Ar (atomic number 18)

5) The shell having n = 2 contains _____ subshells, _____ orbitals, and up to _____ electrons. 5) _____

A) 3, 6, 12
B) 1, 2, 4
C) 4, 8, 16
D) 2, 4, 8
E) none of the above

6) The number of valence electrons in an element with electron configuration $1s^2 2s^2 2p^6 3s^2 3p^4$ is _____. 6) _____

A) 2 B) 16 C) 4 D) 8 E) 6

7) How many Li atoms are contained in 97.9 g of Li? 7) _____

A) 7.09×10^{21} Li atoms
B) 5.90×10^{25} Li atoms
C) 4.27×10^{22} Li atoms
D) 8.49×10^{24} Li atoms
E) 4.18×10^{24} Li atoms

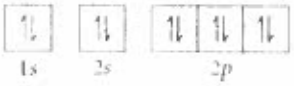
8) How many different values of m_l are possible in the 3d sublevel? 8) _____

A) 1 B) 5 C) 2 D) 3 E) 7

9) Choose the orbital diagram that represents the ground state of N. 9) _____

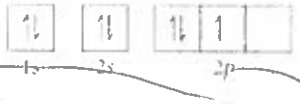
A)

B)



C)

D)



E)

10) What period 3 element is described by the following ionization energies (all in kJ/mol)? 10) _____

$IE_1 = 1012$ $IE_2 = 1900$ $IE_3 = 2910$ $IE_4 = 4960$ $IE_5 = 6270$ $IE_6 = 22{,}200$

A) Si B) S C) Mg D) P E) Cl

11) Place the following elements in order of increasing atomic radius. 11) _____

P Ba Cl

A) P < Cl < Ba
B) Ba < Cl < P
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12) Write the name for $Ca_3(PO_4)_2$. 12) _____

A) calcium (II) phosphite
B) calcium phosphate
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13) The formula for the compound chromium(II) nitrate is _____. 13) _____

A) Cr_2NO_3 B) C_2NO_3 C) $CrNO_3$ D) $CrNO_2$ E) $Cr(NO_3)_2$

14) Which of the following elements is most likely to form an ion with a -2 charge? 14) _____

A) S B) Mg C) Si D) Ti E) K

15) An element belonging to the halogen family would be expected to have a _____ ionization energy and a _____ electron affinity. 15) _____

A) small, small
B) large, large
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16) All of the following are properties typical of ionic compounds **except** 16) _____

A) shatter when crystals are struck.
B) form distinct molecules by interaction of specific particles.
C) have very high melting points and boiling points.
D) exist as crystalline solids at room temperature.
E) conduct electrical current if dissolved in water.

17) Write a nuclear equation for the alpha decay of $^{238}_{92}U$. 17) _____

A) $^{238}_{92}U \rightarrow {}^{1}_{0}n + {}^{237}_{92}U$

B) $^{238}_{92}U \rightarrow {}^{0}_{-1}e + {}^{238}_{91}Pa$

C) $^{238}_{92}U \rightarrow {}^{4}_{2}He + {}^{234}_{90}Th$

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E) $^{238}_{92}U \rightarrow {}^{0}_{-1}e + {}^{238}_{93}Np$

18) Place the following in order of **decreasing** magnitude of lattice energy. 18) _____

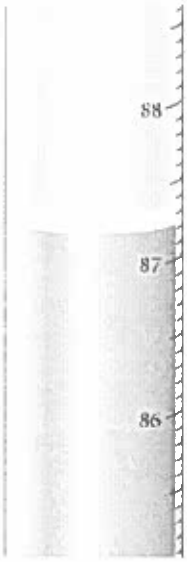
KF MgS RbI

A) RbI > KF > MgS
B) MgS > KF > RbI
C) KF > RbI > MgS
D) RbI > MgS > KF
E) MgS > RbI > KF

19) 95.0°F is the same as 19) _____

A) 203°C. B) 85°C. C) 35°C. D) 171°C. E) 21°C.

20) Read the temperature with the correct number of significant figures. 20) _____



A) 87°C B) 87.2°C C) 87.24°C D) 87.240°C E) 87.2400°C

21. What answer should be reported, in scientific notation, with the correct number of significant figures, for the following calculation?

$(965.43 \times 3.911) + 9413.4136 =$ $13189 = \boxed{1.3189 \times 10^4}$

3775.796

22. How many photons are contained in a flash (signal) of green light (525 nm) that contains 189 kJ of energy?

Show calculations, pay attention for units; perform conversions if they are needed!

$525\ nm \times \frac{10^{-9} m}{1\ nm} = 5.25 \times 10^{-7} m$; $189\ kJ \times \frac{10^3 J}{1\ kJ} = 1.89 \times 10^5 J$

$E_{phot.} = \frac{h \cdot c}{\lambda} = \frac{6.626 \times 10^{-34} J \times 3.00 \times 10^8 m}{5.25 \times 10^{-7} m} = 3.79 \times 10^{-19} J$

$\#photons = \frac{1.89 \times 10^5 J}{3.79 \times 10^{-19} J} = \boxed{4.99 \times 10^{23} \text{ photons}}$

23&24. Write the ground state electron configuration for a) Co atom and b) Co^{2+} ion. Use any notation (box notation; or s, p, d, f, or noble gas notation).

a) Co $[Ar] 4s^2 3d^7$

b) Co^{2+} $[Ar] 3d^7$

25&26.

(a) Calculate the wavelength (nm) of light associated with the transition from n=6 to n=2 in the hydrogen atom. Show calculations, show conversion m to nm).

($R_H = -2.18 \times 10^{-18}$ J)

$E_{atom} = -2.18 \times 10^{-18} J \left(\frac{1}{2^2} - \frac{1}{6^2}\right) = -4.84 \times 10^{-19} J$

$E_{photon} = 4.84 \times 10^{-19} J$

$E_{photon} = h \cdot \nu = \frac{h \cdot c}{\lambda}$; $\lambda = \frac{h \cdot c}{E_{phot.}} = \frac{6.626 \times 10^{-34} J \cdot s \times 3.00 \times 10^8 \frac{m}{s}}{4.84 \times 10^{-19} J} =$

$= 4.10 \times 10^{-7} m$

(b) In what region of the spectrum is this radiation found?

$\lambda = 4.10 \times 10^{-7} m \times \frac{10^9 nm}{1 m} = \boxed{410\ nm}$

visible light, blue

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KEY

Exam 1 (V.2)

Name_____

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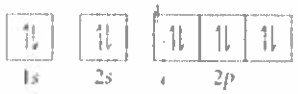

C)

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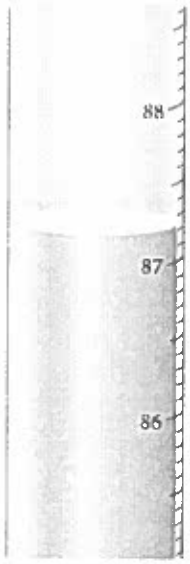

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visible light, blue

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Exam 1 (V.3)

KEY

Name_____

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C)

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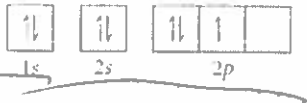

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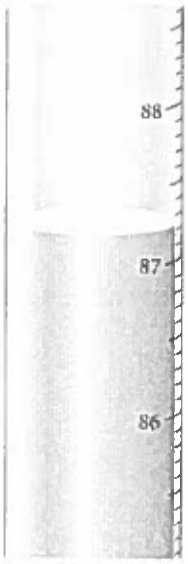

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(b) In what region of the spectrum is this radiation found?

$\lambda = 4.10 \times 10^{-7} \cancel{m} \times \frac{10^9 nm}{1\ \cancel{m}} = \boxed{410\ nm}$

visible light, blue