EX2 CHEM101(DTM) FORM E 22 Oct rm100 HELD (11:30 Class)

Name KEY E **(Print last name in CAPS)**

SECTION 514 - 524 **(same as your lab section)**

1.	**Fill in your ID, the department=CHEM, Course no. = 101, and Section= your lab section. Blacken the corresponding letters and numbers.**
2.	Read each question carefully before answering.
3.	Mark the choice that best answers the question or completes the statement.
4.	Use the scantron provided. Use a no. 2 pencil and clearly mark your choice. If you change an answer, completely erase your previous mark.
5.	Answer each question. There is no penalty for guessing. However, multiple answers are graded as incorrect, and blank answers are graded as incorrect.
6.	On the scantron, fill in your last name, first name and initial. Blacken the corresponding letters.
7.	Use the test for scratch paper.
8.	Mark your answers on the test so you can check them with the key /
9.	***Turning in a blank scantron results in a grade of zero. ***
10.	You may be asked to turn in <u>both</u> the scantron and the exam, have your PHOTO ID and your calculator ready to be checked when you do so.
11.	Work at a steady pace and you will have ample time to finish.
12.	The keys will be posted on my class web page as soon as possible. You may check your grade at the class web site. Your password is the middle 5 numbers of your student ID followed by the first letter of your last name in CAPS. Be patient and give the webmaster time to enter all of this information.

There are 30 questions for 150 points. Good Luck!

E

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Possibly Useful Information

$M = \frac{\text{mol solute}}{\text{L soln}}$ $M_1V_1 = M_2V_2$ $\text{density} = \frac{\text{mass}}{\text{volume}}$ $\lambda\nu = c$

$\frac{w}{w}\% = \frac{\text{mass}}{\text{total mass}} \times 100$ $E = mc^2$ $E = h\nu$ $\lambda = h/mv$ $1\ \text{Å} = 1 \times 10^{-10}\text{m}$

A periodic table is also provided on the last page of this exam.

Q.1	Which statement is false?
a.	Atomic nuclei are very dense. ✔
b.	Ordinary chemical reactions do not involve changes in nuclei. ✔
c.	Nuclei are positively charged. ✔
d.	Electrons contribute only little to the mass of an atom. ✔
(e.)	The nucleus occupies nearly all of the volume of an atom. ✗

Q.2	What would be the outer electron configuration of the halogens?
a.	ns^2np^6
b.	ns^2np^7
c.	$ns^2nd^5p^0$
d.	ns^2np^4
(e.)	ns^2np^5

Q.3	What is the frequency of light of wavelength 7000 Å?
a.	$6.67 \times 10^{15}s^{-1}$
(b.)	$4.28 \times 10^{14}s^{-1}$
c.	$4.72 \times 10^{14}s^{-1}$
d.	$2.48 \times 10^{13}s^{-1}$
e.	$8.41 \times 10^{15}s^{-1}$

$\nu = \frac{c}{\lambda} = \frac{3.00 \times 10^{8}\ m \cdot s^{-1}}{7000 \times 10^{-10}\ m} = 4.285 \times 10^{14}\ s^{-1}$

$4.28 \times 10^{14}\ s^{-1}$

Q.4	Which of the responses contains all the true statements and no others regarding electromagnetic radiation?
	I. As wavelength increase frequency decrease. T
	II. As energy increases frequency decreases. F
	III. As wavelength increases energy decreases. T
	IV. The product of wavelength and frequency is constant. T
(a.)	I, III, IV
b.	I and II
c.	II, III, and IV
d.	I, II, and IV
e.	III and IV

$\lambda = \frac{c}{\nu}$

$E = h\nu = \frac{hc}{\lambda}$

$\nu\lambda = c$

I III IV

Q.5	Radio waves are very low energy forms of EMR. What is the energy of a photon of radio waves with a wavelength of 150. m?
a.	1.38×10^{-26}J
b.	3.30×10^{-27}J
c.	1.33×10^{-27}J
d.	1.10×10^{-17}J
e.	2.22×10^{-19}J

$E = h\nu = \frac{hc}{\lambda}$

$E = \frac{6.626 \times 10^{-34}\ J.s * 3.00 \times 10^{8}\ m.s^{-1}}{150\ m}$

$E = 1.325 \times 10^{-27}\ J$

Q.6	Which element has the largest atomic radius?
a.	In
b.	Tℓ
c.	B
d.	Ga
e.	Aℓ

All in Gp IIIA

Q.7	Determine the oxidation number of sulfur in SO_3^{2-}.
a.	-2
b.	+3
c.	+4
d.	+2
e.	-3

$X + 3(-2) = -2$

$X - 6 = -2$

$X = +4$

Q.8	What is the electron configuration of silicon?
a.	$1s^2 2s^2 2p^6 3s^2 3p^4$
b.	$1s^2 1p^6 2s^2 2p^4$
c.	$1s^2 2s^2 2p^6 3s^2 3p^2$
d.	$1s^2 1p^6 2s^2 2p^2$
e.	$1s^2 2s^2 2p^6 2d^4$

$_{14}Si$ $1s^2 2s^2 2p^6 3s^2 3p^2$

Q.9	Determine the oxidation number of nitrogen in NH_2^-.
a.	-1
b.	-3
c.	+2
d.	+3
e.	+1

$X + 2(1) = -1$

$X = -3$

Q.10 The electron configuration:

1s	2s	2p	3s	3p	4s
↑↓	↑↓	↑↓ ↑↓ ↑↓	↑↓	↑↓ ↑↓ ↑↓	↑↓

represents the element ...

a. Ti
b. Ca
c. Rb
d. Ge
e. Sr

20e⁻ ∴ Ca

Q.11 Identify the net ionic equation for the reaction of hydrochloric acid and lithium hydroxide.

a. $HC\ell\,(aq) + 2\,OH^-(aq) \rightarrow C\ell_2^-(aq) + 2\,H_2O\,(\ell)$
b. $HC\ell O_2\,(aq) + OH^-(aq) \rightarrow C\ell O_2^-(aq) + H_2O\,(\ell)$
c. $H^+(aq) + OH^-(aq) \rightarrow H_2O\,(\ell)$ ← (strong acid + strong base)
d. $2\,HC\ell\,(aq) + 2\,OH^-(aq) \rightarrow 2\,C\ell O_2^-(aq) + 2\,H_2O\,(\ell)$
e. $2\,HC\ell O_2\,(aq) + LiOH\,(aq) \rightarrow LiC\ell O_2\,(aq) + H_2O\,(\ell)$

Q.12 All orbitals of a given degenerate set must be singly occupied before pairing begins in that set, is a statement of ...

a. the Aufbau Principle
b. the Heisenberg Uncertainty Principle
c. Planck's Theory
d. the Bohr Theory
e. Hund's Rule

Q.13 Which response includes all the following statements that are true and no others?

I. An s orbital can accommodate a maximum of two electrons. T
II. A set of d orbitals can accommodate a maximum of ten electrons. T
III. Each d orbital within a set consists of two lobes, 180° apart. F
IV. There are nine f orbitals in a set of f orbitals. F

a. I, III, and IV
b. II, III, and IV
c. I and IV
d. I and II
e. II and IV

I, II

Q.14	Which of the statements is false?
a.	Carbon dioxide is the acidic anhydride of carbonic acid.
(b.)	Sulfur dioxide is the acidic anhydride of hydrosulfuric acid. ✗
c.	CaO is the basic anhydride of calcium hydroxide.
d.	Metal oxides are usually basic.
e.	Nonmetal oxides are usually acidic.

Q.15	Which pair of species has the most nearly identical chemical properties?
(a.)	^{16}O and ^{18}O ←
b.	K^+ and Na^+
c.	Rb^+ and Sr^{2+}
d.	$C\ell^-$ and F^-
e.	O and S

Q.16	What is (are) the spectator ion(s) in the following reaction?
	$2\ HC\ell O_3\ (aq) + Sr(OH)_2\ (aq) \rightarrow Sr(C\ell O_3)_2\ (aq) + 2\ H_2O\ (\ell)$
a.	Sr^{2+} and OH^-
b.	H^+ and OH^-
c.	H^+
d.	OH^-
(e.)	Sr^{2+} and $C\ell O_3^-$

Strong acid + strong base
∴ Sr^{2+} and ClO_3^-

Q.17	Which of the following is not a valid magnetic quantum number for the 3d set of orbitals?
a.	1
(b.)	-3
c.	-2
d.	2
e.	0

Q.18	Classify the following reaction by giving the reaction type that applies.
	$2\ NiS\ (s) + 3O_2\ (g) \rightarrow 2\ NiO\ (s) + 2\ SO_2\ (g)$
(a.)	redox ✓
b.	combination
c.	double displacement
d.	single displacement
e.	decomposition

Q.19 Which response contains all of the following that are oxidation-reduction reactions and no others?

I. $PC\ell_3\,(\ell) + 3\,H_2O\,(\ell) \rightarrow 3\,HC\ell\,(aq) + H_3PO_3\,(aq)$ no

II. $Fe_2O_3\,(s) + 3\,CO\,(g) \rightarrow 2\,Fe\,(s) + 3\,CO_2\,(g)$ yes

III. $CaCO_3\,(s) + 2\,HC\ell O_3\,(aq) \rightarrow Ca(C\ell O_3)_2\,(aq) + CO_2\,(g) + H_2O\,(\ell)$ no

a. II and III
b. I and II
c. III
(d.) II
e. I

Q.20 Which of the following compounds is **not** a strong electrolyte?

a. RbF
(b.) HF ← weak acid
c. $Mg(NO_3)_2$
d. $Ni(C\ell O_3)_2$
e. HNO_3

Q.21 Gallium has two naturally occurring isotopes. Ga-69 (68.9257 amu) is the more abundant isotope at 60.40%. If the atomic mass of gallium is 69.723 amu, what is the mass of the other isotope?

a. 39.60 amu
(b.) 70.94 amu
c. 71.51 amu
d. 71.00 amu
e. 69.98 amu

$69.723 = .6040(68.9257) + .3960(x)$

$\frac{69.723 - 41.6311}{.3960} = X = 70.939$

Q.22 Which element has the smallest radius?

a. Na
(b.) $C\ell$
c. K
d. Mg
e. Rb

3rd period { Na Mg Cl → decreases

Q.23 Which of the following, if any, is incorrect?

a. The electron has both particle and wave properties. T
b. EMR can be thought of as a stream of particles called photons. T
c. The energy of matter is not continuous, it is quantized. T
d. Energy can only occur in discrete units called quanta. T
(e.) All the above are correct.

Q.24 Which of the following is incorrect?

(a.)	$LiC\ell O_3$	lithium chlorite ←	lithium chlorate
b.	$HC\ell O_2$	chlorous acid ✔	
c.	HBrO	hypobromous acid ✔	
d.	$Sr(C\ell O_4)_2$	strontium perchlorate ✔	
e.	HIO_3	iodic acid ✔	

Q.25 What are the oxidation numbers(oxidation states) of the elements in HCO_3^-?

a.	H = +1, C = +5, O = -2
b.	H = +2, C = +2, O = -2
c.	H = +1, C = +2, O = -2
d.	H = +1, C = +3, O = -2
(e.)	H = +1, C = +4, O = -2

H = +1
O = -2
C = +4

Q.26 Which of the following responses contains all true statements and no others?

I. The elements at the far right of the periodic table, except the noble gases, have the tendency to form anions. T
II. The elements with the least tendency to form ions are those at the far left of the periodic table. F
III. Bonds in compounds consisting of two adjacent elements in the periodic table are likely to be covalent. T
IV. The elements at the far left of the periodic table possess poor electrical conductivity. F

a.	I, II, and III
b.	II and IV
c.	I, II, and IV
d.	IV
(e.)	I and III

I , III

Q.27 What is the de Broglie wavelength of a 16.0 lb shotput moving at a velocity of 7.26 m/s? [454 g = 1 lb]

(a.)	1.26×10^{-35} m
b.	1.30×10^{-38} m
c.	2.60×10^{-36} m
d.	6.63×10^{-31} m
e.	1.85×10^{-30} m

$$\lambda = \frac{h}{mv} = \frac{6.626 \times 10^{-34}\ kg\ m^2 . s^{-2} . s}{16.0\ lb \times \frac{454\ g}{1\ lb} \times \frac{1\ kg}{10^3\ g} \times 7.26\ m . s^{-1}}$$

$$\lambda = 1.256 \times 10^{-35}\ m$$

$$\lambda = 1.26 \times 10^{-35}\ m$$

Q.28	In interpreting the results of his oil drop experiment in 1909, Robert Millikan was able to determine ...
a.	that the masses of protons and neutrons are nearly the same.
b.	that electrically neutral particles(neutrons) are present in the nuclei of atoms.
c.	the extremely dense nature of the nuclei of atoms.
d.	the charge on the proton.
(e.)	the charge on the electron.

Q.29	Paramagnetism is characteristic of systems containing ...
a.	only p electrons.
b.	no paired electrons.
(c.)	one or more unpaired electrons.
d.	only d electrons as valence electrons.
e.	only s electrons as valence electrons.

Q.30	Which of the following pairs of elements are most likely to show the same oxidation state?
(a.)	Ba, Ca
b.	Cℓ, P
c.	Si, P
d.	Ca, F
e.	Ba, F

End of Test

Key E Exam 2

Magnuson 22 Oct 2003

30 questions each 5 points for a total of 150 points

Q1	E
Q2	E
Q3	B
Q4	A
Q5	C
Q6	B
Q7	C
Q8	C
Q9	B
Q10	B
Q11	C
Q12	E
Q13	D
Q14	B
Q15	A
Q16	E
Q17	B
Q18	A
Q19	D
Q20	B
Q21	B
Q22	B
Q23	E
Q24	A
Q25	E
Q26	E
Q27	A
Q28	E
Q29	C
Q30	A