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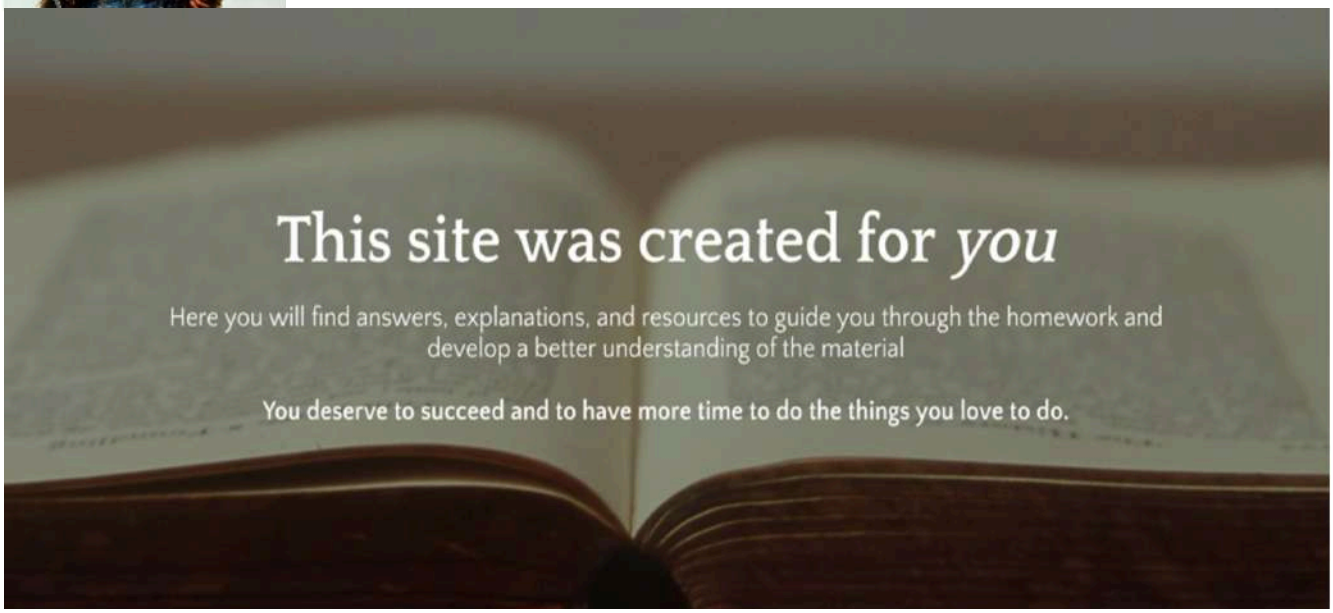

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GENERAL CHEMISTRY 115 FALL 2005 SECTION NO.
SECOND EXAM NAME

R = 0.0821 L atm/K mol 1 L atm/K mole = 101.3 kJ/K mole

1. Calculate the number of moles of an ideal gas in a 830 mL container at a pressure of 650 mm Hg and a temperature of −15°C.

a) 0.0335 c) 33.5 e) 0.235 g) 0.354
b) 0.0652 d) 6.52 f) 23.5 h) 3.54

2. Arrange the gases Cl_2, O_2, F_2, N_2 in order of increasing average molecular speed at 25°C.

a) Cl_2, F_2, O_2, N_2 c) N_2, F_2, Cl_2, O_2 e) F_2, Cl_2, O_2, N_2 g) Cl_2, O_2, N_2, F_2
b) Cl_2, O_2, F_2, N_2 d) Cl_2, F_2, N_2, O_2 f) O_2, N_2, F_2, Cl_2, h) Cl_2, N_2, O_2, F_2

3. At STP, the root-mean-square speed of CO_2 is how many times that of SO_2?

a) 2.001 c) 1.000 e) 1.456 g) 1.856
b) 2.119 d) 1.206 f) 1.500 h) 1.236

4. According to the kinetic-molecular theory, molecules of different gases at the same temperature always have the same

a) molecular weight c) average kinetic energy
b) pressure d) volume

5. A flask contains a mixture of two gases, A and B, at a total pressure of 2.6 atm. There are 2.0 moles of gas A and 5.0 moles of gas B in the flask. What is the partial pressure (in atm) of gas A?

a) 9.1 c) 1.04 e) 6.32 g) 0.26
b) 6.5 d) 0.74 f) 4.72 h) 1.86

6. Automobile air bags use the decomposition of sodium azide as their source of gas for rapid inflation: $2NaN_3(s) \longrightarrow 2Na(s) + 3N_2(g)$. How many grams of NaN_3 are required to provide 40.0 L of N_2 at 25°C and 763 mm Hg?

a) 1.64 g c) 160 g e) 107 g g) 15.7 g
b) 1.09 g d) 71.1 g f) 157 g h) 45.0 g

7. What is the pressure in a 12.2 L vessel that contains 2.34 g of carbon dioxide, 1.73 g of sulfur dioxide, and 3.33 g of argon at 42°C?

a) 263 torr c) 395 torr e) 135 torr g) 324 torr
b) 134 torr d) 116 torr f) 153 torr h) 632 torr

8. What is the molecular weight of a gas which has a density of 5.75 g/L at STP?

a) 3.90 c) 141 e) 56 g) 284
b) 129 d) 578 f) 73 h) 106

9. The value of ΔH° for the following reaction is -6535 kJ. How many kJ of heat will be evolved during the combustion of 16.0 g of $C_6H_6(l)$?
The heats of formation for CO_2 and H_2O are -393.5 kJ/mol and -286 kJ/mol respectively.

$$2C_6H_6(l) + 15O_2(g) \text{ ----------> } 12CO_2(g) + 6H_2O(l)$$

a) 1.34×10^3 c) 670 e) 1.58×10^2 g) 5.32×10^3
b) 5.23×10^4 d) 2.68×10^3 f) 2.68×10^2 h) 3.28×10^3

10. When 72 g of a metal at 97.0°C is added to 100 g of water at 25.0°C, the final temperature is found to be 29.1°C. What is the heat capacity per gram of the metal?
(Heat capacity of H_2O = 4.184 J/g °C)

a) 0.46 J/g °C c) 0.65 J/g °C e) 1.22 J/g °C g) 8.32 J/g °C
b) 2.8 J/g °C d) 2.0 J/g °C f) 0.35 J/g °C h) 0.56 J/g °C

11.

Substance	ΔH_f° (kJ/mol)
SO_2 (g)	-297
SO_3 (g)	-396
SO_2Cl_2 (g)	-364
H_2SO_4 (l)	-814
H_2O (l)	-286

The value of ΔH° for the following reaction is -62 kJ. What is the value of ΔH_f° (in kJ/mol) for HCl (g)?

$$SO_2Cl_2(g) + 2H_2O(l) \text{ ---------> } H_2SO_4(l) + 2HCl(g)$$

a) –184 c) –92 e) 50 g) -30
b) 60 d) 30 f) 130 h) –60

12.

Substance	ΔH_f° (kJ/mol)
H_2O (l)	-286
NO (g)	90
NO_2 (g)	34
HNO_3 (aq)	-207
NH_3 (g)	-46

Calculate the value of ΔH° (in kJ) for the following readtion.

$$4NH_3(g) + 5O_2(g) \text{ ---------> } 4NO(g) + 6H_2O(l)$$

a) –1892 c) –1540 e) –3654 g) –1248
b) –189 d) –1172 f) –150 h) –1982

13. A gas is allowed to expand from 5.3 L to 15.5 L against a constant pressure of 3.5 atm. How much heat is absorbed if the change in internal energy is 3081 J.

a) 2675 J c) 1410 J e) 5350 J g) 3117 J
b) 1290 J d) 5780 J f) 6697 J h) 3045 J

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Some equations: $E = -R_H(1/n^2)$; $\lambda = h/mu$; $E = h\nu$

Some units: $1A = 1 \times 10^{-10}$ m; $h = 6.626 \times 10^{-34}$ J s; $c = 3.0 \times 10^{8}$ m/sec; $R_H = 2.18 \times 10^{-18}$ J

14. What is the frequency of electromagnetic radiation with a wavelength of 0.53 m?

(a) $5.7 \times 10^{8}\ s^{-1}$	c) $1.6 \times 10^{8}\ s^{-1}$	e) $2.3 \times 10^{33}\ s^{-1}$	g) $7.3 \times 10^{13}\ s^{-1}$
b) $1.8 \times 10^{-9}\ s^{-1}$	d) $1.3 \times 10^{-33}\ s^{-1}$	f) $1.9 \times 10^{-23}\ s^{-1}$	h) $5.8 \times 10^{9}\ s^{-1}$

15. An electron in a hydrogen atom is found to have an energy of -1.362×10^{-19} J. What orbit would the electron be in according to the Bohr model of the hydrogen atom?

a) 1	c) 3	e) 5	(g) 7
b) 2	(d) 4	f) 6	h) 8

16. The valence shell of the element X contains 2 electrons in a 5s orbital. Below that shell, element X has a partially filled 4d subshell. What type of element is X?

a) main group element	c) halogen	e) alkali metal
b) chalcogen	(d) transition metal	

17. Determine the energy (in joules) of a photon of light needed to promote an electron from the first major energy level to the third major energy level.

a) 2.057×10^{6}	c) 4.091×10^{-19}	e) 4.746×10^{-12}	(g) 1.938×10^{-18}
b) 4.862×10^{-7}	(d) 7.523×10^{-21}	f) 4.943×10^{-17}	h) 3.591×10^{5}

18. Calculate the mass **(in grams)** of a particle that exhibits a wavelength of 1.32 A and traveling at a speed of 2.50×10^{7} m/sec.

a) 8.43×10^{-31}	c) 6.38×10^{-28}	e) 5.32×10^{-33}	g) 3.73×10^{-28}
b) 1.76×10^{-10}	(d) 2.01×10^{-31}	f) 3.86×10^{-29}	(h) 2.01×10^{-28}

19. Which statement is false?

a) An electron that has n = 3 cannot be in an f sublevel
b) An electron that has n = 5 could be in an s, p, d, or f sublevel
(c) If an electron has the quantum number $\ell = 2$, the only possible values of m_l are 0 and 1.
d) If an electron has $m_l = -1$, it might be in a p, d, or f sublevel but not in an s sublevel
(e) If an electron has the quantum number n = 3, the electron could be in a d sublevel.

20. What is the energy, in J/photon, of blue light having a wavelength of 4.240×10^{-7} m?

a) 2.81×10^{-38}	(c) 4.69×10^{-19}	e) 5.63×10^{-19}	g) 3.23×10^{-11}
b) 6.42×10^{-17}	d) 7.07×10^{-20}	f) 6.28×10^{-11}	h) 9.54×10^{-11}

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21. Write the electron configurations for each of the following.

a) $_{25}Mn$ [Ar] $4s^2 3d^5$ ✓

b) $_{17}Cl$ [Ne] $3s^2 3p^5$ ✓

c) $_{19}K$ [Ar] $4s^1$ ✓

d) $_{9}F$ [He] $2s^2 2p^5$ ✓

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22. What is the electron configuration of oxygen, O_2?

	1s	2s	2p
a)	↑↓	↑↓	↑ ↑ ↑
b)	↑↓	↑	↑↓ ↑ ↑
c)	↑↓	—	↑↓ ↑↓ ↑↓
d)	↑↓	↑↓	↑↓ ↑↓ ↑
e)	↑↓	↑↓	↑↓ ↑ ↑

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23. The ionization energy (the energy required to just remove an electron from an atom) for the hydrogen atom in kJ/mole can be calculated using the Rydberg equation which allows you to calculate the energy states of the electron in one atom. Use this equation to calculate the ionization energy for hydrogen in kJ/mole.

0

a) 1476
b) 2985
c) 410
d) 578
e) 5576
f) 1312
g) 3223
h) 3698

24. Which set of quantum numbers are a correct set? (n, l, m_l, m_s)

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a) 1, 2, 3, +1/2
b) 1, 2, -3, +1/2
c) 1, 1, 0, +1/2
d) 1, 0, 0, +1/2
e) 1, 1, 1, -1/2
f) 1, 3, 2, -1/2
g) 2, 2, 1, -1/2
h) 5, 4, -5, -1/2

$$-2.18 \times 10^{-18} \times \left(\frac{1}{1}\right) \times \frac{6.022 \times 10^{23}}{100}$$