Using Practice Exams Effectively

This practice exam contains **actual questions** that have been asked on one of my exams in a previous quarter. This can be a useful studying tool if used properly.

Important notes about the practice exam:

- This practice exam should not be the only studying tool you are using, because **the practice exams only show a small subset of the possible questions that could be tested**.
- **Work the recommended book problems** to make sure that you fully understand all of the concepts that might be on the actual exams.
    - You need to be able to **explain why every step is done** in solving all of the recommended book problems (**without looking at the solutions**). Do not memorize the answers – this will not work.
    - Work problems multiple times to build skill and efficiency (but do not memorize).
- **The actual exam will contain questions that differ from the practice exams. They are not necessarily any easier or harder; they are just different.**
    - It would be pointless to give an exam with the exact same questions as the practice, because it would mean the exam is testing your memorization skills instead of your actual understanding of the material.
    - **To prepare for this, make sure you understand how to do all of the recommended book problems as discussed above.**

What this practice exam is intended to do:

- Help you diagnose general areas of strength/weakness and determine what you need to spend more time studying before the exam
- Allow you to check if you are answering questions quickly enough to complete the actual exam within the time limit
- Give you an idea of the general format of a multiple-choice exam

While taking the exam:

- Take this with a **50 minute time limit**, including the time it would take you to fill out a parscore
- **Do not use any outside notes or help**
- Do not look at any of the answers until you have completed the entire exam

After you complete the exam, check your answers against the key. For any problems you miss:

- Go through the worked-out solutions to see how to answer each question correctly
- **Make sure you understand why every step is done** in solving the problems you miss
- **Rework book problems** that are related to the questions you missed. This will help to strengthen your understanding of the topic. Without this, you will not gain a full understanding of the topic and risk missing similar questions on the actual exam.

Instructions: No hats or hoods allowed. No books or notes allowed. No sharing of calculators. Cell phones, iPods, headsets/headphones, and any other electronic devices must be turned off and put away.

There are a total of six pages (18 questions) on the exam. **Not every question is worth the same number of points**--point values are indicated for each question.

You may work out the problems and write your answers on this exam; however, you must completely fill in the appropriate bubble(s) on your ParSCORE form. Turn in the ParSCORE form only. **Only the answers indicated on your ParSCORE will be graded**, so please be very careful bubbling in your ParSCORE. No credit will be awarded for an incorrectly-bubbled answer. The correct answers to the exam will be posted on our course web page.

1. (5 pts) Assuming constant volume and number of gas particles, increasing the temperature of an ideal gas from 100K to 200K will double the collision frequency (Z).

   a) True b) False

2. (5 pts) Assuming constant volume and number of gas particles, increasing the temperature of an ideal gas from 100K to 200K will double the pressure.

   a) True b) False

3. (5 pts) The bond angle in the nitrite ion (NO_2^-) can best be described as

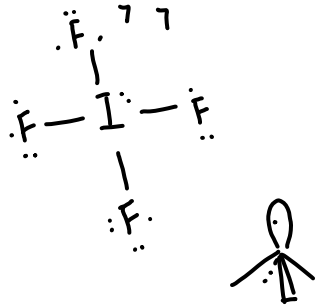
a) 180^o
b) Less than 180^o but greater than 120^o
c) 120^o
d) Less than 120^o but greater than 109.5^o
e) Less than 109.5^o

4. (5 pts) The periodic trend in electron affinity increases as you move _____ on the periodic table.

a) up and to the right
b) down and to the right
c) up and to the left
d) down and to the left

5. (5 pts) Determine the molecular geometry of IF_4^+

a) Tetrahedral
b) Square planar
c) Octahedral
d) Trigonal bipyramidal
e) See-saw



E

6. (5 pts) Which of the following atoms or ions has exactly 3 unpaired electrons?

a) O
b) Al
c) S^{2-}
d) Zn^{2+}
e) Co

E

Either

↑ ↑ ↑ _ _

or

↑↓ ↑↓ ↑ ↑ ↑

or

↑ ↑ ↑

7. (5 pts) How many of the following are valid sets of quantum numbers?

$n = 2, \ell = 2, m_\ell = 2, m_s = ½$ ✗
$n = 3, \ell = 1, m_\ell = 0, m_s = -½$ ✓
$n = 3, \ell = 2, m_\ell = 2, m_s = 0$ ✗
$n = 1, \ell = 0, m_\ell = 0, m_s = -½$ ✓

$\ell \in n-1$

$n \in \mathbb{Z}$

$|m_\ell| \in \ell$

$m_s = \pm\frac{1}{2}$

a) 0 sets of quantum numbers are valid
b) 1 set of quantum numbers is valid
c) 2 sets of quantum numbers are valid
d) 3 sets of quantum numbers are valid
e) 4 sets of quantum numbers are valid

C

16

8. (5 pts) Consider a sulfur (S) atom in its ground state. How many total electrons in this atom are in p orbitals?

a) 16
b) 0
c) 10
d) 4
e) 6

$6 + 4 = 10$

C

9. (5 pts) Use the Bohr model to predict which of the following will have the highest ground-state ionization energy:

a) H
b) He^{+}
c) Li^{2+}
d) Be^{3+}
e) B^{4+}

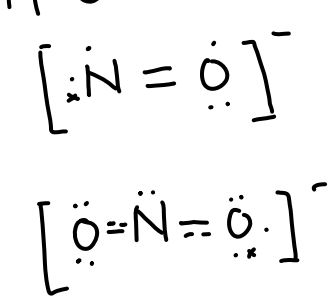
Highest Z^2 value, hence B

E

10. (6 pts) Which of the following has resonance structures?

a) H_2O
b) NO_2^-
c) NO^-
d) More than one of these
e) None of these

B



11. (6 pts) The successive ionization energies for an unknown element are shown below.

IE_1 = 580 kJ/mol
IE_2 = 1815 kJ/mol
IE_3 = 2740 kJ/mol
IE_4 = 11600 kJ/mol

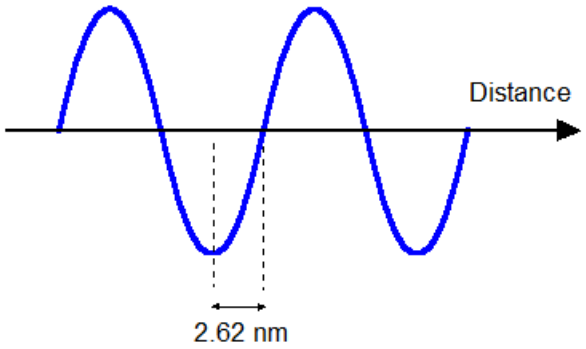
} Big Jump

To which group of the periodic table does the unknown element most likely belong?

a) Group 1A (IA)
b) Group 2A (IIA)
c) Group 3A (IIIA)
d) Group 4A (IVA)
e) Group 5A (VA)

C

12. (6 pts) An electromagnetic (light) wave is pictured below. Calculate the frequency of this wave.



C

a) $1.14 \times 10^{17}\ s^{-1}$
b) $5.73 \times 10^{16}\ s^{-1}$
c) $2.86 \times 10^{16}\ s^{-1}$
d) $1.43 \times 10^{16}\ s^{-1}$
e) $8.65 \times 10^{16}\ s^{-1}$

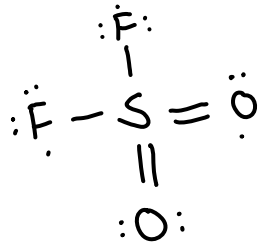
$\lambda = 4 \times 2.62 \times 10^{-9} = 1.048 \times 10^{-8}\ m$

$\frac{3 \times 10^{8}}{1.048 \times 10^{-8}} = 2.86 \times 10^{16}$

13. (6 pts) How many total bonds and total lone pairs are present in the Lewis structure for SO_2F_2 that minimizes formal charge? S is the central atom in this molecule.

a) 4 bonds, 12 lone pairs
b) 5 bonds, 11 lone pairs
c) 6 bonds, 10 lone pairs
d) 7 bonds, 9 lone pairs
e) 8 bonds, 8 lone pairs

C



14. (6 pts) A sample contains gas molecules with an average speed (u_{av}) of 268 meters per second at 238K. What is the molar mass of the gas in grams per mole?

a) 0.0702 g/mol
b) 1.88×10^{4} g/mol
c) 18.8 g/mol
d) 0.692 g/mol
e) 70.2 g/mol

E

$268 = \sqrt{\frac{8 \times 8.31 \times 238}{\pi \times M}}$

$\frac{1}{M} = 14.26$

$M = 70\ g/mol$

15. (6 pts) When a photon with a wavelength of 333 nm strikes the surface of a metal, an electron is ejected with a kinetic energy of 2.4×10^{-19} J. What is the binding energy of the metal, in units of kJ/mol?

a) 5.9×10^{-22} kJ/mol
b) 359 kJ/mol
c) 3.6×10^{-22} kJ/mol
d) 215 kJ/mol
e) 144 kJ/mol

$E_{in} = 5.969 \times 10^{-19}$

$E_{out} = (5.969 - 2.41) \times 10^{-19}$

$= 3.569 \times 10^{-19}$

$\frac{3.569 \times 10^{-19}}{1000} \times 6.02 \times 10^{23}$

214.9

D

16. (6 pts) When an electron in Li^{2+} relaxes from an initial state of n = 7, a photon with a frequency of 5.8×10^{14} s^{-1} is emitted. What is the final state of the electron?

a) n = 4
b) n = 3
c) n = 6
d) n = 5
e) n = 35

$hf = 9 \times 2.18 \times 10^{-18} \times \left(\frac{1}{n^2} - \frac{1}{49} \right)$

$0.01959 = \frac{1}{n^2} - \frac{1}{49}$

$n = 5.00$

D

17. (6 pts) In an experiment, it took 2.8 minutes for 14.3 L of hydrogen gas to effuse through a porous barrier. How long will it take for 5.9 L of neon gas to effuse under the same conditions?

a) 5.2 minutes
b) 2.8 minutes
c) 6.7 minutes
d) 3.7 minutes
e) 0.88 minutes

D

$Rate_1 : Rate_2 = \sqrt{Mass_2 : Mass_1}$

$\frac{14.3}{2.8} / \frac{5.9}{t} = \sqrt{1 : 10}$

$0.866 t = \sqrt{1:10}$

$t = 3.65$

0 1.75 3.8 19

18. (6 pts) Consider the following reaction. $4\ C_2H_2\ (g) + 5\ O_2\ (g) \rightarrow 4\ CO_2\ (g) + 2\ H_2O\ (g)$

3.8 moles of C_2H_2 is reacted with 6.5 moles of O_2 at a constant pressure of 1 atm. Calculate the total volume of gas at 453 K after the reaction has gone to completion.

C_2H_2 limiting

a) 381 L
b) 212 L
c) 141 L
d) 71 L
e) 275 L

E

$$\left(\frac{7.45 \times 8.31 \times 453}{101 \times 10^3} \right) \times \frac{1000\,L}{1\,m^3} \approx 278$$

Answers:	1) B	2) A	3) D	4) A	5) E	6) E
	7) C	8) C	9) E	10) B	11) C	12) C
	13) C	14) E	15) D	16) D	17) D	18) E

For more practice, work the assigned problems from the textbook! Lists of problems and solutions are on Gauchospace.