

## 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 quizzes. 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.

**Before doing anything, fill in the following on your ParSCORE form:**

- 1) Write your name
- 2) Bubble in **FORM A**
- 3) Bubble in your **PERM** number (7 digits only—no extra numbers)

**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 seven 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) Which of the following has the smallest atomic radius?
  - a) Rb
  - b) I
  - c) Br
  - d) K
  
2. (5 pts) The light absorbed for the  $n=2$  to  $n=4$  transition in the H atom will have \_\_\_\_\_ wavelength than the light absorbed for the  $n=2$  to  $n=4$  transition in  $\text{He}^+$ .
  - a) shorter
  - b) the same
  - c) longer
  
3. (5 pts) Determine the number of core electrons in an atom with the electron configuration  $1s^2 2s^2 2p^4$ .
  - a) 2
  - b) 4
  - c) 6
  - d) 8
  - e) none of these

4. (5 pts) Which of the following gases will have an effusion rate most similar to that of  $\text{SeO}_2$ ? Assume ideal gas behavior.

- a)  $\text{SO}_2$
- b) Ar
- ☒ c)  $\text{SeBr}_2$
- d)  $\text{N}_2$
- e)  $\text{SF}_4$  108

E

Similar mass

111

5. (5 pts) Which of the following is a possible subshell designation?

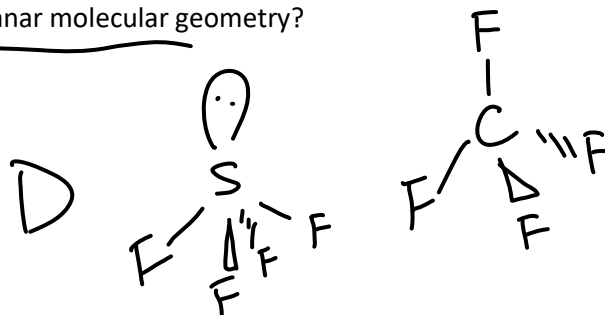
- ☒ a)  $1p^5$
- b)  $5s^1$
- ☒ c)  $3d^{11}$
- d) more than one of these are possible
- e) none of these are possible

$1s^2 \ 2s^2 \ 2p^6 \ 3s^2 \ 3p^6 \ 3d^{10}$

B

6. (5 pts) Which of these has a square planar molecular geometry?

- a)  $\text{SF}_4$
- ☒ b)  $\text{CF}_4$
- c) Both (a) and (b)
- d) Neither (a) nor (b)



7. (5 pts) If a chemical reaction releases heat, then the bonds in the reactants are, on average, A

- a) weaker than the bonds in the products
- b) stronger than the bonds in the products
- c) equally as strong as the bonds in the products

A-C A-B

C-A-A-B

100 + 300

→ 500

8. (5 pts) The electron pair in a C–F bond could be considered

- a) closer to C because carbon has a lower electronegativity than fluorine.
- b) closer to C because carbon has a larger radius and thus exerts greater control over the shared electron pair.
- c) closer to F because fluorine has a higher electronegativity than carbon.
- d) centrally located directly between the C and F.

9. (6 pts) Which of these has a bond angle smaller than that of the nitrite ion ( $\text{NO}_2^-$ )?

- a)  $\text{SF}_2$
- b)  $\text{BF}_3$
- c) Both (a) and (b)
- d) Neither (a) nor (b)

10. (6 pts) Determine the total number of electrons in a krypton (Kr) atom that have the magnetic quantum number  $m_l = +1$ . Assume the krypton atom is in its ground state.

- a) Between 0 and 6
- b) Between 7 and 12
- c) Between 13 and 18
- d) Between 19 and 24
- e) 25 or more

11. (6 pts) The valve between a 3.75 L tank containing  $\text{O}_2$  (g) at 8.00 atm and a 2.06 L tank containing Ne (g) at 4.84 atm is opened. Calculate the ratio of the partial pressure of  $\text{O}_2$  to the partial pressure of Ne in the container ( $P_{\text{O}_2}/P_{\text{Ne}}$ ) after the gases mix. Assume temperature is constant, and assume no chemical reactions occur.

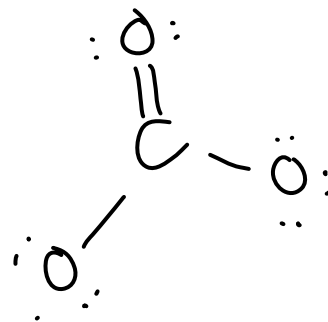
- a) 0.623
- b) 1.65
- c) 1.82
- d) 3.01
- e) 0.332

12. (6 pts) Which of the following molecules is/are polar?

- a)  $\text{NH}_3$
- b)  $\text{SO}_2$
- c)  $\text{IF}_3$
- d) Two of these are polar
- e) All three of these are polar

13. (6 pts) How many of the following statements are true about the carbonate ion ( $\text{CO}_3^{2-}$ )?

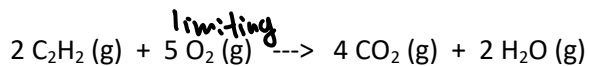
- There are a total of exactly four bonds in the Lewis structure ✓
- One of the carbon/oxygen bonds is shorter than the others ✗
- This molecule can not have resonance structures ✗
- The formal charge of the carbon is nonzero ✗



- a) none of the statements are true  
 b) one of the statements is true  
 c) two of the statements are true  
 d) three of the statements are true  
 e) four of the statements are true

B

14. (6 pts) A closed container is filled with 43.2 g of  $\text{C}_2\text{H}_2$  gas (26 g/mol) and 64.3 g of  $\text{O}_2$  gas (32 g/mol) at 400K. A spark results in the combustion of the  $\text{C}_2\text{H}_2$  according to the following equation:



What is the mole fraction of  $\text{CO}_2$  gas at 400K after the reaction has gone to completion?

- a) 0.49  
 b) 0.67  
 c) 0.75  
 d) 0.25  
 e) 0.83

$$1.6 / 1.6 + 0.8 + (1.66 - 0.8)$$

A

15. (6 pts) An atom of element X, traveling at a velocity equal to its rms speed ( $u_{\text{rms}}$ ) at  $219^\circ\text{C}$ , has a de Broglie wavelength of  $1.30 \times 10^{-11}$  m. Find the molar mass of element X in grams per mole.

- a) 0.077 g/mol
- b) 172 g/mol
- c) 0.172 g/mol
- d)  $2.12 \times 10^{-46}$  g/mol
- e) 77 g/mol

E

rms at  $219^\circ\text{C}$

$$\sqrt{\frac{3 \times 8.31 \times (219 + 273)}{M}} = v = \frac{110.7}{\sqrt{M}}$$

$$\frac{6.626 \times 10^{-34}}{110.7 \sqrt{M} / 6.02 \times 10^{23}} = 1.3 \times 10^{-11}$$

$$1/\sqrt{M} = 3.609$$

$$M \approx 0.07675 \text{ kg/mol}$$

16. (6 pts) What is the maximum wavelength of light (in nm) capable of ionizing a hydrogen atom initially in the energy state characterized by  $n = 3$ ?

- a) 91 nm
- b) 274 nm
- c) 103 nm
- d) 938 nm
- e) 821 nm

$$1^2 \times 2.18 \times 10^{-18} \times \left( \frac{1}{3^2} \right) = \frac{6.626 \times 10^{-34} \times 3 \times 10^8}{\lambda}$$

e

$$\lambda = 821 \text{ nm}$$

17. (6 pts) The energy required to remove electrons from the surface of a metal is 229 kJ/mol. If the metal is exposed to light of an unknown wavelength, and each ejected electron has a kinetic energy of  $6.9 \times 10^{-19}$  J, then what is the wavelength of the light?

- a)  $6.4 \times 10^{-7}$  m
- b)  $1.9 \times 10^{-7}$  m
- c)  $8.7 \times 10^{-31}$  m
- d)  $2.9 \times 10^{-7}$  m
- e)  $1.4 \times 10^{-54}$  m

$$\frac{hc}{\lambda} = 6.9 \times 10^{-19} + \frac{229 \times 10^3}{(6.02 \times 10^{23})}$$

$$\lambda = 1.857 \times 10^{-7}$$

B

18. (6 pts) A mixture of gas contains 30% Ne (g) and 70% He(g) by moles. Calculate the density of this mixture at STP.

- a) 0.89 g/L
- b) 0.18 g/L
- c) 1.1 g/L
- d) 0.39 g/L
- e) 0.54 g/L

D

3 mol      7 mol

88 g

$$PV = nRT$$

$$101 \times V = 10 \times 8.31 \times (273)$$

$$V = 22462$$

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

Notes:

- Question #10 is based on book problem 12.88(c)
- Question #12 is based on book problem 13.110
- Question #13 is based on book problem 13.79
- Question #16 is based on book problem 12.44
- Question #18 is based on book problem 5.52