Chem 228 – Easy Test 1 (Thursday Oct 4th 2018)

You have enough time to read each question twice before you answer

Schrodinger’s solution of the H-atom gives: En = -1,310 (Z2/n2) in kJ/mol

Name and class list number:

1- When light is passed through a double slit it generates an interference pattern on a screen. Describe what one would see on the screen if the experiment is conducted using sunlight as was done in the original Young’s experiment. Use a drawing to facilitate the description of the details as if you were a scientist writing in a notebook. No explanations of the theory of interference.

2- What is the experiment that shows light has particle character? Describe the experiment briefly using a drawing.

3- There is evidence that expansion of the universe is currently accelerating rather than slowing down or staying steady. What is the accepted cause of this phenomenon. Just couple of key words.

4- The sun is made primarily from hydrogen and helium. What is the evidence that the sun has a little bit of many other elements like, say sodium? Keep it brief.

5- Which do you expect to be more abundant in the universe, silicon or argon? Give your reasoning briefly.

6- What is the difference between hydrogen combustion on earth and hydrogen burning in the sun? Write balanced equations for each transformation.

🡺 Specify the energy change accompanying each transformation.

🡺 Specify the origin of the energy change in each transformation.

7- Give a quantitative estimate for the energy of the following electron transfer reaction:  
Show your work and reasoning. Li + O+ = Li+ + O

8- Without doing any calculations, would you expect the given electron transfer reaction to be energetically favorable or not, give your reasoning. Na + Cl = Na+ + Cl-

9- Use MO theory to explain to a chem 200 student why hydrogen exists in diatomic molecular form at room temperature while helium remains atomic. Please don’t mention “bond order”. Utilized diagrams

10- What are the s and p MOs that can form from interactions between p and d AOs. Draw the bonding and antibonding MOs for each interaction  
 

11- Markku Rasanen and coworkers synthesized a compound of argon, that until today remains the only known compound of this noble gas. What is this compound, how was it made and what was the spectroscopic technique used to confirm its formation?

12- The ()2 configuration of O2 is said to generate a number of microstates that collect into a number of excited state. Enumerate all of these microstates and collect them into electronic states.



13- The electronic spectrum of molecular oxygen has one broad absorption bands between 200 and 250 nm and another between 150 and 200 nm. What is the origin of each of these bands? You need to be specific. Support your answer with relevant drawings.

14- Give the Lewis structure and geometry of ozone, and explain how it is formed in the atmosphere and why its presence in the atmosphere is important in protecting life on earth?

15- a. Draw a Jablonski diagram for a generic dye with a singlet ground state (S0). Include the names of the major photophysical events involving excitation and relaxation.

b. On the same diagram, show how your dye may generate singlet oxygen (photosensitization). c. On the same diagram, show how the singlet oxygen may be manipulated in photodynamic therapy.

d. Which range of the electromagnetic spectrum should the sensitizing dye absorb at to be useful in photodynamic therapy, and why is that so?