Physics 1020 Final Practice Exam

While doing this exam, also try to define each term. Better understanding of the material comes from complete understanding of terms given. **Take this as if it is a real exam.** Do **ALL** Learning Checks, assigned homework (or extra homework for more practice), as well as review the concepts thoroughly in the text and lecture notes.

Chapter 10

1. In regards to Blackbody Radiation, if you increase temperature, 
   a. **more energy is emitted per second at each wavelength of EM radiation**
   b. the frequency and wavelength increases
   c. the frequency decreases and wavelength increases
   d. a heated object colored red will be hotter than a heated object colored blue

2. **True/False:** Planck determined that the energy levels of atomic oscillations are quantized

3. True/False: Increasing the intensity of light hitting a surface increases the number of electrons ejected and the electron’s speed.

4. To increase the energy of a light source, in regards to the photoelectric effect, which of the following must be done? 
   a. Increasing wavelength of incident light.
   b. Going from a Blue to Red light source.
   c. **Increasing frequency of incident light.**
   d. All of the above are possible methods to increase the energy of a light source.

5. **True/False:** The emission-line and continuous spectra is associated with each atom, whether solid or gas, having its own distinct emission spectra when heated to an extant that it emits light.

6. Using de Broglie’s wavelength formula, an electron, with the mass of $9.11 \times 10^{-31}$ kg, assuming it is moving at the same speed as an electromagnetic wave has a wavelength of? $2.43 \times 10^{-12}$ m (Speed of light = $3 \times 10^8$ m, Planck’s constant = $6.63 \times 10^{-34}$ J-s)

7. Which of the following series has the incorrect term assigned to it?
   a. Lyman series, n=2 $\rightarrow$ n=1, emits ultraviolet photons
   b. Balmer series, n=3 $\rightarrow$ n=2, emits visible photons
   c. Paschen series, n=4 $\rightarrow$ n=3, emits infrared photons
   d. All of the above are correct

8. For the molecule Hydrogen, it was found to be at an excited state of n=3, but then the state decays and the Hydrogen atom ends up in ground state, emitting light.
   Which of the following are correct?
   a. The energy released is 12.1 eV, and emitting only visible photons.
   b. The energy absorbed is 12.1 eV, and emitting UV and visible photons.
   c. The energy released is 15.5 eV, and emitting UV and visible photons.
   d. **The energy released is 12.1 eV, and emitting UV and visible photons.**

9. True/False: According to Heisenberg, an electron’s location and momentum can both be calculated at the same time, since the product of both the momentum and location is greater than or equal to Planck’s constant.
10. The Pauli exclusion principle states that
   a. anything that has mass associated with it is excluded from the possibility of
      producing a wave, since only photons produce wave.
   b. any electron present in an atom can have the same quantum state, since all
      electrons in an atom have the same mass and charge.
   c. there can be infinitely amount of electrons occupying an orbital as long as
      enough energy is provided.
   d. **no two electrons can occupy the same quantum state.**

11. The Aurora Borealis, “The Northern Lights”, occurs because:
   a. The Earth’s magnetic South Pole attracts photons from space which excites
      molecules in our atmosphere.
   b. The decaying of energy states of molecules produce visible photons
   c. **All of the above are true.**
   d. None of the above are true.

12. Which of the following could not be used to determine an atom’s characteristic?
   a. Atomic Spectra
   b. X-Ray Spectra
   c. Number of protons and neutrons present in the nucleus.
   d. Its molecular weight.
   e. **All of the above could be used to determine an atom’s characteristic.**

13. What does L.A.S.E.R. stand for? Which of the following regarding lasers are not true?
   (Note: Also know each application of lasers)
   a. **Depending on its source, it is monochromatic light.**
   b. All light are not in phase (incoherent).
   c. It consists of multiple wavelengths.
   d. Can only be pulsed.

**Chapter 11**

1. True/False: When calculating Atomic Mass experimentally, you can use the following
   formula: Atomic Mass = Number of Neutrons + Number of Electrons
2. A nucleus is usually stable, and consists of protons and neutrons. Which of the following
   in regards to the nucleus is true?
   a. **Protons, though positively charged, are all able to stay inside a nucleus due to strong intramolecular (nuclear) forces.**
   b. Protons stay close to each other due to the repulsive forces of having the same
      charge being cancelled out by the negative charge on the neutron.
   c. Protons are a considerable distance away from neutrons, allowing them to stay
      inside the nucleus area easily.
   d. All of the above are true regarding the nucleus.

3. True/False: Isotopes in vast majority of cases have different number of protons, due to
   its charge and abilities to leave the nucleus easily.
4. For each of the following cases, complete the reaction and state what type of decay is occurring:

a. \[ ^{238}\text{U} \rightarrow ^{234}\text{Th} + ^{4}\text{He} \] \text{ALPHA}

b. \[ ^{22}\text{Na} \rightarrow ^{22}\text{Ne} + ^{+}\text{e} \] \text{BETA POSITIVE}

c. \[ ^{238}\text{U} \rightarrow ^{238}\text{U}^* \] \text{GAMMA}

d. \[ ^{137}\text{Cs} \rightarrow ^{137}\text{Ba} + ^{-}\text{e} \] \text{BETA NEGATIVE}

5. True/False: A Geiger counter will not be able to detect the possibility of all the above reactions occurring.

6. Which of the following is not an application of radioactivity?
   b. Smoke detector.
   c. Sterilization of products.
   d. All of the above are applications of radiation.

7. A clump of Sodium-24, with a half-life of 15 hours, is found after 5 days. What fraction of Sodium-24 is remaining after this time?
   \[ 5\text{days} \times 24\text{hours} = 120\text{hours} = 8 \times 15\text{hours}. \text{This clump has undergone 8 half-lifes.} \]
   \[ \left(\frac{1}{2}\right)^8 = \frac{1}{256} \]

8. Cobalt-60, with a half-life of roughly 5 years, started off originally at 2kg. After 30 years, how much of Cobalt-60 is remaining?
   a. 15.625g
   b. 62.5g
   c. **31.25g**
   d. 125g

9. Two hydrogen atoms are bombarded against each other to produce Helium and a neutron. The neutron released is the major source of energy in this reaction. What type of reaction is this?
   a. Cold Fusion.
   b. Nuclear Fission.
   c. **Nuclear Fusion.**
   d. Not enough information provided.

10. True/False: Nuclear fission reactions occur with large atoms creating two smaller atoms and with the release of three neutrons.
Chapter 12

1. [Question taken from the SI Flyer]: If Galileo was travelling at half of the speed of light, and Einstein passes him at the speed of light, what is Einstein’s relative speed to Galileo? The speed of light.

2. True/False: If you were to be travelling in space with no windows on your spacecraft, and there are no vibrations or gravity effects changing your path or any electrical devices, it is still possible to detect whether or not you are moving.

3. True/False: In regards to the situation in #2, if there were a clock on board, it would be running slower compared to a clock at rest on Earth.

4. A particle is travelling at a speed of $3.75 \times 10^7$ m/s. If a person at rest had seen this particle travel $1.5 \times 10^8$ m in 4s. The particle would see itself take how long to complete this distance?
   a. 4.38s
   b. 4.21s
   c. **4.06s**
   d. 4.11s