Sample Exam PHYS1008

Name: Student Number:

Section A: Multiple Choices Questions

(Circle the correct answer)

1. In a conductor charges are
   b. free to move

2. The presence of a dielectric in a capacitor
   a. decreases the electric field between plates

3. According to Kirchhoff's rule the net voltage change around any circuit loop must be
   c. zero

4. The stimulating photon in a stimulated emission in the hydrogen atoms has
   a. The same phase as the emitted photon

5. According to Kirchhoff's node rule the total current entering a node must be
   c Same as that leaving the node

6. An electron is in the n=2 energy level. How many quantum states could this electron have?
   b. 8

7. There are two RC circuits, one with (R_1, C_1) and the other with (R_2, C_2) where $C_1=C_2$ and $R_1=2R_2$. The time to fully charge C_1 is
   a. Longer than C_2

8. As the distance from a current carrying wire increases the magnetic field must
   a. Decrease

9. In an AC circuit the reactive of the capacitor changes with
   c. Frequency

10. When a light ray travels from an medium with a lower index of refraction to one of higher index of refraction, the angle of refraction with respect to the normal
    b. Gets smaller

11. Light, incident on a metal surface, at with a frequency just above the threshold frequency will
    a. Free electrons from the metal surface

12. The peak of intensity of radiation coming from a blackbody depends on what?
    a. The temperature of the blackbody

13. What effect does a diode have on the current in an AC circuit?
    c. Blocks current in a specific direction

14. The intensity of EM radiation is proportional to
    d. The rms electric field squared

15. A path difference of three halves of a wavelength between two coherent light beams with equal frequencies produces
    b. Complete destructive interference

16. The all images produced in a single converging lens with objects at the focal length are
    b. on the same side of the lens as the object

17. In order to adjust the magnification of a standard compound microscope one must adjust what parameter?
    c. The distance between objective and eyepiece

18. What is the effect of increasing the number of windings (or turns) in a solenoid?
    c. Magnetic field is increased

19. What is the role of the iris in the human eye?
    c. It adjusts to change the amount of light entering the eye

20. The amplitude of the E field in an EM wave is observed to have decreased since its creation what else can we conclude about the wave?
    d. The intensity of the wave is decreased over some distance.

Section B: Simple Calculation Questions

1. **Enter answer in given area, perform calculations in space provided as these may be included as part of the mark, additional space in exam booklet.**
2. **Clearly mark your questions.**
3. **Include the equations to be used in your calculations**
4. **Use 3 significant figures and scientific notation when appropriate.**
5. **Be sure to include the appropriate units for all answers**

1. How many electrons must be transferred to an object to give it -30 nC of charge?
   1.87×10^{9}
2. A parallel plate capacitor has 0.15 mm gap between its plates with a 20V potential difference, what is the electric field between the plates?
   1.33×10^{3} V/m
3. How far apart must 2 electrons be if the force between them is 1.0×10^{-12} N?
   15.2 nm
4. What is the acceleration experienced by an electron due in a 2200 N/C electric field?
   3.67×10^{17} m/s
5. What is the magnitude of the force on a proton in an electric field of 600 N/C?
   9.61×10^{-17} N
6. A capacitor has square plates of 2.0 cm length, separated by 1.2 mm. If the gap is filled by a plastic slab with dielectric constant of 1.35, what is the capacitance?
   3.98 μF
7. How much potential energy will an electron gain if it moves through a potential difference of 800 V?
   1.28×10^{-16} J
8. The electric field between two plates connected to a 45 V battery is 600 V/m. What is the distance between the plates?
   7.50 cm
9. A steady current of 2.5A flows in a wire connected to a battery, after 4 min the battery is disconnect and the current stops. How much charge has passed through the wire?
   600 C
10. Three resistors, 10Ω, 20Ω and 25Ω, are in parallel in a circuit what is their equivalent resistance?
    5.25 Ω
11. What is the magnitude and direction of the electric field midway between two point charges, -15μC and 12μC that are 8.0 cm apart
    1.52×10^{8} m toward the negative charge
12. Two 1 C charges experience a repulsive electrostatic force of 2.5 N, what is the distance between the two charges
    3.60×10^{9} m
13. Two protons in a ^{238}U nucleus are 6.0×10^{-15} m apart, what is the mutual potential energy between these protons?
    3.84×10^{-14} J

14. An electron in a hydrogen atom is in the 6^{th} energy level a photon of what frequency is required for emission for the electron to drop to the ground state (1^{st} energy level)?

    93.8 nm

15. What is the wavelength of a 4.1×10^{18} Hz X-ray?

    0.317 nm

16. A capacitor has a potential difference of 3.0 V and capacitance of 35.1 μF, what is the charge on the capacitor?

    105 μC

17. An electron with kinetic energy of 4.5 keV is scattered off of a lead atom, what is the minimum frequency of an X-ray produced as a result of the scatter?

    0.276 nm

Section C: Longer Calculation Questions

1. An electron is placed at rest on the negative surface of a two charged plates. If the electric field is 1500 N/C between the plates and the distance between plates is 1.2 mm, what is the electron's velocity when it strikes the other plate?
   v=7.66x10^{5} m/s
2. Light of 560 nm and 730 nm is incident on a diffraction grating with 6000 slits/cm. What is the distance between the m=1 maxima of the two wavelengths on a screen 1.2 m away?
   Δy= 12.2 cm
3. How much energy (in MeV) is released when a ^{232}U nucleus (mass = 232.037156 u) decays to a ^{228}Th (mass = 228.028741 u) nucleus by alpha emission (mass = 4.002603 u)?
   E=5.4 MeV
4. The distance between two converging lens is 25 cm, each with a focal length of 12 cm. If an object is place 28 cm to the right of the right most lens what is it magnification in the lens system?
   m=1.13
5. Two light bulbs with resistances of 100 Ω and 200 Ω respectively are connected in series with a 2.5 V EMF. How much power is dissipated through each light bulb?
   P_{100}=6.94x10^{-3} W, P_{200}=1.39x10^{-2} W
6. A calcium ion (q=2e^{+}, m=66.4x10^{-27} kg) is accelerated through a potential different of 12 kV and then injected to a magnetic field of 0.85 T. What is the radius of the orbit of the resulting trajectory in the field?
   r=8.29 cm
7. It takes 6.0 J of energy to move a 2.0 mC charge from one plate of a 60 μF capacitor to the other. What charge is on each plate?
   Q=0.18 C