PHYSICS 2002

Practice Final - 1

Instructions:

a. Print your name and student number below, then sign your name as it appears on your LSU I.D. card.

b. Print and bubble in your name (LAST NAME FIRST), student number, and section number on the scantron provided.

c. When you hand in your paper, be sure to put it in the stack labeled with YOUR INSTRUCTOR's NAME, **AND** THE CORRECT EXAM FORM.

PRINT NAME: KEY

STUDENT NUMBER: _____

SIGNATURE: _____

SECTION: ____

INSTRUCTOR: _____

Section 1,	8:40 – 9:30 MWF,	Young
Section 2,	1:40 – 2:30 MWF,	Johnson
Section 3,	7:40 – 9:00 TTh,	Goodrich
Section 4	1:40 – 3:00 TTh,	Slovak

Throughout this test, directions (left, right, up, down, in, out) are referenced to the plane of the page.

Good luck and have a great summer!

1. An electron is held fixed at a distance of 1 m from the nucleus of a uranium atom (Z = 92). If the electron is then released, what is the magnitude of its initial **acceleration**?

a) 9.8 m/s^2 b) 1250 m/s^2 c) 20,000 m/s^2 **d) 23,300 m/s^2** e) 46,000 m/s^2

2. The third **Balmer** line (Hγ) is seen in emission when an excited hydrogen (H) atom has an electron move from the 5th energy level (E_5 = -0.54 eV) to the 3rd level (E_3 = -3.40 eV). What is the **wavelength** λ of this line?

a) 410.1 nm b) **434.7 nm** c) 486.1 nm d) 656.3 nm

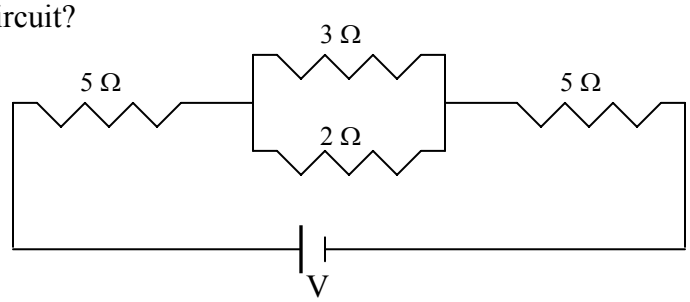
3. A current of 2 A is maintained in a simple circuit with a total resistance of 2 Ω. How much **heat** is generated in 3 seconds?

a) 96 J **b) 24 J** c) 12 J d) 6 J e) 3 J

4. A circuit including 4 resistors is connected to a battery as shown. What is the **equivalent resistance** of the circuit?

a) 1.2 Ω b) 5.7 Ω

c) 11.2 Ω d) 9.2 Ω



5. In the problem above, if V = 12 volts, how much **power** is dissipated in each of the 5 Ω resistors?

a) 1.2 W b) 6.8 W c) 4.6 W d) 3.5 W **e) 5.7 W**

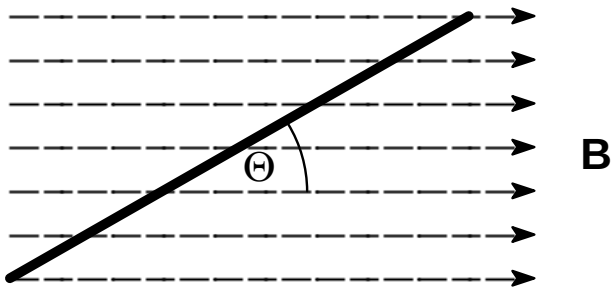
6. An electron is accelerated from rest through a potential difference of 17,000 volts. What is the **final velocity** of the electron?

a) 2.44 x 10^7 m/s b) 2.96 x 10^7 m/s c) 5.14 x 10^7 m/s **d) 7.73 x 10^7 m/s**

7. An electron is accelerated from rest through a potential of 100 V. What is its **deBroglie wavelength**?

a) 0.034 nm b) **0.123 nm** c) 0.382 nm d) 0.973 nm

8. A wire runs through a 0.7 T magnetic field as shown. The dashed lines represent the magnetic field, and the solid black line the wire. The angle Θ indicated is 30 degrees. The force per unit length on the wire is 0.35 N/m. What is the **magnitude of the current** through the wire? (Direction is unimportant here)



a) 0.58 A

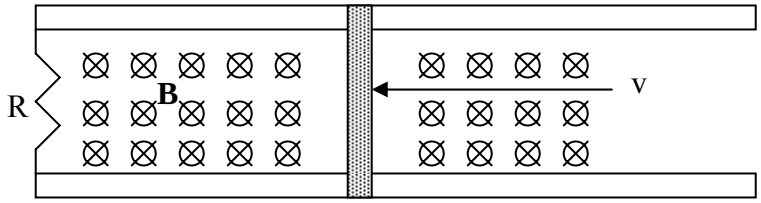
b) 0.71 A

c) 1.4 A

d) 2.4 A

e) **1.0 A**

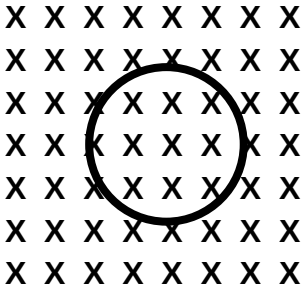
9. In the figure below a sliding conducting rod is being mechanically pulled to the left along two conducting rails that are connected at one of their ends through a resistor R. A uniform magnetic field, B, is applied into the plane of the page throughout the area enclosed by the rod, rails, and resistor.



According to Lenz's law, what is the direction of the **current** around the loop formed by the resistor, the rails and the conducting rod?

a) clockwise b) zero current flow c) counter-clockwise
d) both counter-clockwise and clockwise e) insufficient information to tell.

10. A circular loop is in a magnetic field into the page as shown. The magnetic field is decreasing with time. In which direction does the **induced current** flow?



a) There is no current.
b) Clockwise.
c) Counterclockwise.
d) In the page
e) Out of the page.

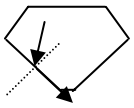
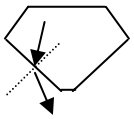
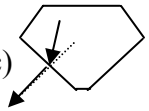
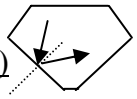
11. Current in a power line runs from south to north. At a point directly below the power line, what is the **direction** of the magnetic field created by this current?
a) south b) east c) **west** d) up e) down

12. A **convex lens** (a converging lens) has a focal length of 20.0 cm. If it is used to view an object at an *infinite* distance away, what is the **image distance**?

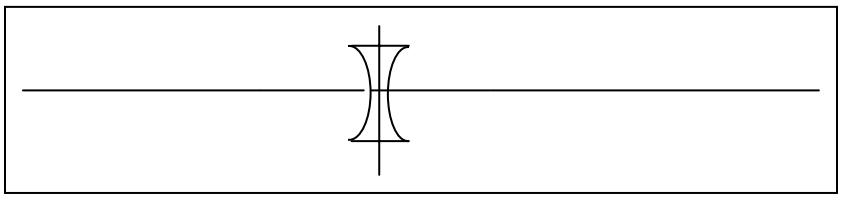
a) +0.10 m b) **+0.20 m** c) -0.20 m d) –0.10 m e) none of these

13. Cobalt-60 (^{60}Co) is often used as a radiation source in medical applications. It has a half-life of 5.25 years. If a patient is injected with a 0.52 μg sample of ^{60}Co, **how much** of it will be in their system after 2.11 years?
a) 0.14 μg b) 0.26 μg c) **0.39 μg** d) 0.46 μg

14. Four identical looking faceted gemstones are claimed to be diamonds. A smart buyer knows that the **critical angle** inside a diamond (with air surrounding it) is 24.4 degrees, smaller than all other hard transparent substances. She aims a laser carefully into each gem so that it strikes the gem-air interface as shown at an angle of 28.0 degrees. Which one is the diamond? (The dashed line is the normal at the gem-air interface.)

a)  b)  c)  d) 

Questions 15 - 17. A candle of height 2.3 cm is placed 10.0 cm to the left of a **concave lens** of with a focal point that is 6.5 cm from the lens.



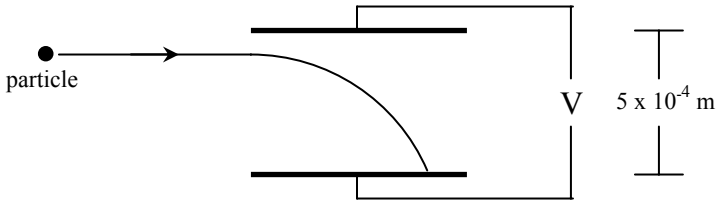
15. The **image** formed by the lens is best described by which of the following?
a) real, to the left of the lens, magnified b) virtual, erect, magnified
c) real, inverted, reduced d) **virtual, to the left of the lens, reduced**

16. The **image distance** is _____.
a) **-3.94 cm** b) +18.57 cm c) +3.94 cm d) -18.57 cm

17. The **magnification** m is _____.
a) –3.94 b) -0.394 c) +3.94 d) **+0.394**

18. A particle carrying a charge of – 4.5 μC, initially moving horizontally, enters a region of space between the plates of a parallel plate capacitor which are separated by a distance of 5 x 10^{-4} m (see figure). A potential difference, V = 17,500 volts is applied across the plates. If the particle follows the path shown, which **plate** is at a higher potential, and what is the **magnitude of the electrostatic force** that acts on the particle?

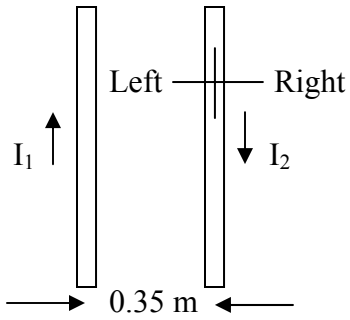
a) upper plate, 158 N
b) <u>lower plate, 158 N</u>
c) upper plate, 0.08 N
d) lower plate, 0.08 N
e) upper plate, 8.8 N



19. A photon of energy E = 6.4 x 10^{-19} J gives ALL of its energy to an electron in a metal so that the photoelectron leaves with 1.1 eV of kinetic energy. What is the **work function** W_o of the metal?
a) **<u>2.9 eV</u>** b) 1.3 eV c) 0.65 eV d) 0.17 eV

20. A tungsten (W) target is bombarded by electrons accelerated through a potential of 60 kV. What is the **cutoff wavelength** of the X-rays emitted from the target?
a) **<u>2.07 x 10^{-11} m</u>** b) 2.07 x 10^{-8} m c) 2.07 x 10^{-6} m d) 2.07 x 10^{-4} m

21. Two **straight wires** parallel to each other carry currents of I_1 = 2.0 A and I_2 = 3.0 A in opposite directions. The wires are separated by a distance of 0.35 m.



What is the **direction** and **magnitude** of the force per meter acting on wire 2?
a) 3.43 x 10^{-6} N/m, left **<u>b) 3.43 x 10^{-6} N/m, right</u>**
c) 2.45 x 10^{-6} N/m, left d)2.45 x 10^{-6} N/m, left

22. If the ionization energy for hydrogen (H) is –13.6 eV, what is the **energy** of the level with principal quantum number n = 3?
a) –13.6 eV b) –0.89 eV c) **<u>–1.51 eV</u>** d) –4.56 eV

23. The electron in the hydrogen (H) atom can be viewed as orbiting the nucleus (a proton) in circular orbits of increasing radii. What is the **radius** of the third electron orbit?
a) 0.356 nm b) **<u>0.478 nm</u>** c) 0.875 nm d) 0.973 nm

24. A **concave mirror** forms a real image 55 cm from the mirror when an object is placed 75 cm in front of it. What is the **focal length** of the mirror?

a) 19.4 cm b) 25.4 cm c) **31.7 cm** d) 55.2 cm e) 68.4 cm

25. A **proton** with a speed of 6.0×10^5 m/s moves in a circular orbit in the magnetic field of the earth. If the strength of the field is 5.0×10^{-5} T, what is the radius of the orbit?

a) 5.27×10^{-6} m b) 0.068 m c) 0.752 m d) 250 m e) **125 m**

26. The **total energy density** (joules per cubic meter) u of an electromagnetic wave is given by the expression:

$$u = (1/2)\varepsilon_o E^2 + B^2/(2\mu_o)$$

where E = strength of electric field, B = strength of magnetic field, ε_o= electric permittivity of free space and μ_o = magnetic permeability of free space. The **intensity** S of light is defined by: $S = cu$
where c = speed of light. What are the **SI units** of intensity S?

a) W **b) W/m^2** c) J d) J/m^2 e) none of these

27. The following fusion (nuclear) reaction takes place in the core of the sun (it is called the proton-proton chain).

$$4H \rightarrow He + 2e^+ + \text{energy}$$

where is e^+ a positron (a positive electron). The atomics masses of H and He are respectively 1.007825u and 4.002604u and the mass of a positron is 0.000549u. What is the **energy** released in this reaction? (Recall that 1u = 1.6605 x 10^{-27} kg.)
a) 2.13 x 10^{-12} J b) **4.12 x 10^{-12} J** c) 4.74 x 10^{-12} J d) 5.85 x 10^{-12} J