Pratt, Scott **Section 999**

–Introductory Physics II *SAMPLE FINAL–*

Spring, 1997 CAPA ID is **3868**

1. [3pt] Enter true(T) if the reaction can take place and false(F) if the reaction violates either baryon number conservation, lepton number conservation or charge conservation. NOTE: A π meson has no baryon or lepton number. The charge is signified by the superscript (+,0,-). A γ is a photon.

A) $\gamma + p \rightarrow n + \pi^+ + \pi^-$

B) $\gamma + p \rightarrow p + \pi^0$

C) $\gamma + p \rightarrow n + \pi^+ + \pi^0$

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2. [3pt] The nucleus of ${}^7_3Li$ has a mass of 7.016928 u. What is the binding energy (in MeV) of the ${}^7_3Li$ nucleus? DATA: The mass of a proton is 1.007276 u, and the mass of a neutron is 1.008665 u.

A) 3.69×10^1 B) 4.90×10^1 C) 6.52×10^1 D) 8.67×10^1
E) 1.15×10^2 F) 1.53×10^2 G) 2.04×10^2 H) 2.71×10^2

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3. [3pt] The energy levels of hydrogen are $E_n = \frac{-13.6eV}{n^2}$. A hydrogen atom in its lowest energy state can jump to the $n = 3$ level by: (Only one answer is correct)

A) absorbing a photon of energy 9.07 eV

B) absorbing a photon of energy 1.51 eV

C) emitting a photon of energy 1.51 eV

D) absorbing a photon of energy 12.09 eV

E) emitting a photon of energy 12.09 eV

F) emitting a photon of energy 9.07 eV

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4. [3pt] A proton and an antiproton each have velocities $0.89c$. They collide head on and produce a new particle X which is at rest: $p + \bar{p} \rightarrow X$. The mass of a proton is 1.67×10^{-27} kg. What is the mass (in kg) of X?

A) 7.33×10^{-27} B) 8.28×10^{-27} C) 9.35×10^{-27} D) 1.06×10^{-26}
E) 1.19×10^{-26} F) 1.35×10^{-26} G) 1.53×10^{-26} H) 1.72×10^{-26}

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5. [3pt] If the decay $p \rightarrow e^+ + \gamma$ was observed, it would violate (mark all correct answers)

A) conservation of electric charge

B) lepton number conservation

C) energy conservation

D) color conservation

E) baryon number conservation

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6. [3pt] The electron in a hydrogen atom in its ground state has (only one answer is correct)

A) zero spin angular momentum

B) zero binding energy

C) zero orbital angular momentum

D) zero kinetic energy

E) zero ionization energy

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7. [3pt] An electron has a kinetic energy of 12 eV. What is its wavelength in meters? DATA: $m_e = 9.11 \times 10^{-31}$ kg.

A) 3.54×10^{-10} B) 5.14×10^{-10} C) 7.45×10^{-10} D) 1.08×10^{-9}
E) 1.57×10^{-9} F) 2.27×10^{-9} G) 3.29×10^{-9} H) 4.77×10^{-9}

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8. [3pt] A radioactive nucleus emits a 8.5 MeV gamma ray with a half life of 14.2 seconds. What is the wavelength of the photon? (in nm)

A) 2.64×10^{-5} B) 3.51×10^{-5} C) 4.67×10^{-5} D) 6.21×10^{-5}
E) 8.26×10^{-5} F) 1.10×10^{-4} G) 1.46×10^{-4} H) 1.94×10^{-4}

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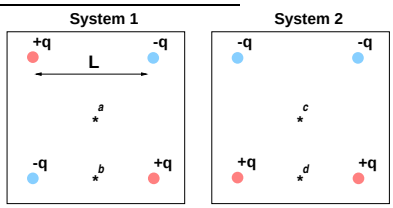
9. [3pt] Galaxies that are 1.6 billion light years away are seen receding at a velocity of $0.1c$. What is Hubble's constant? (in km/s per million light-years)

A) 1.50×10^1 B) 1.88×10^1 C) 2.34×10^1 D) 2.93×10^1
E) 3.66×10^1 F) 4.58×10^1 G) 5.72×10^1 H) 7.15×10^1

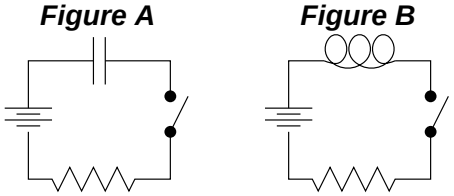


10. [3pt] Consider two positive charges q and two negative charges $-q$ arranged in squares as shown above. Points a and c are at the center of the square while b and d are at the midpoint of the lower side. (For each statement select T True, F False).

A) The electric potential at c is zero.

B) The electric field at b is zero.

C) The electric field at c points North.



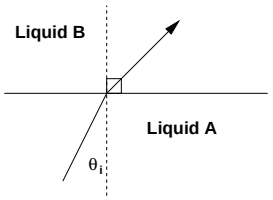
11. [3pt] Consider the circuits above where the switches have been open a long time. (For each statement select T True, F False).

A) A long time after the switch is closed in figure A, the current through the resistor is zero.

B) Immediately after the switch is closed in figure B, the current through the resistor is zero.

C) Immediately after the switch is closed in figure A, the current through the resistor is zero.

(Over)

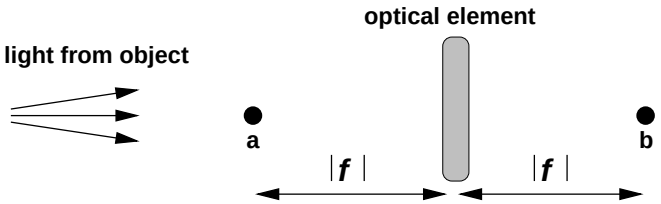


12. [3pt] Light of wavelength 490 nm travels up through liquid A and then enters liquid B as shown above. For incident angles θ_i greater than 60 degrees, total internal reflection is observed. (For each statement select G Greater than, L Less than, E Equal to).

A) The speed of the light in liquid A is (GLE) than the speed of light in liquid B.

B) The index of refraction of liquid A is (GLE) than the index of refraction of liquid B.

C) The frequency of the light in liquid A is (GLE) than the frequency of the light in liquid B.



13. [3pt] Light from an object is incident on an optical element as shown above. The object is to the left of point a, but is not at infinity. (For each statement select T True, F False).

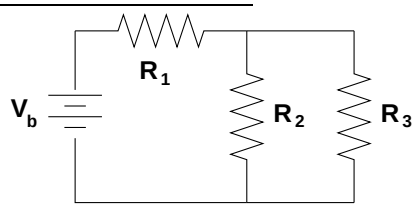
A) If the optical element is a diverging lens, the image is to the right of point a.

B) If the optical element is a converging lens, the image is to the right of point b.

C) If the optical element is a convex mirror, the image is to the left of point b.

14. [3pt] An electron and a proton are separated by 1.5 nm. What is the work (in eV) necessary to move the electron far away?

A) 4.61×10^{-1} B) 5.21×10^{-1} C) 5.89×10^{-1} D) 6.65×10^{-1}
E) 7.52×10^{-1} F) 8.50×10^{-1} G) 9.60×10^{-1} H) 1.08

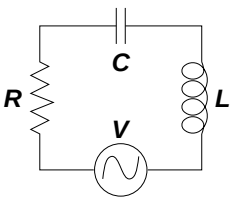


15. [3pt] Consider the circuit above. What is the current (in *amps*) through R_3? DATA: V_b = 6.0 V, R_1 =7.0 Ω, R_2 =28.0 Ω, R_3 =28.0 Ω.

A) 6.79×10^{-2} B) 9.85×10^{-2} C) 1.43×10^{-1} D) 2.07×10^{-1}
E) 3.00×10^{-1} F) 4.36×10^{-1} G) 6.32×10^{-1} H) 9.16×10^{-1}

16. [3pt] The plates of a parallel plate capacitor each have an area of 0.4 m^2, and are separated by 0.450 m. The electric field between the plates is 5.90×10^3 V/m. What is the potential difference (in V) between the plates?

A) 1.13×10^3 B) 1.50×10^3 C) 2.00×10^3 D) 2.65×10^3
E) 3.53×10^3 F) 4.70×10^3 G) 6.25×10^3 H) 8.31×10^3



17. [3pt] For the circuit above, choose the frequency (in Hz) such that the rms current through the resistor is a maximum. DATA: R = 210 Ω, $L = 1.56 \times 10^{-6}$ H, $C = 6.10 \times 10^{-3}$ F, V_{rms} = 75 V.

A) 6.93×10^2 B) 9.21×10^2 C) 1.23×10^3 D) 1.63×10^3
E) 2.17×10^3 F) 2.88×10^3 G) 3.83×10^3 H) 5.10×10^3