A coin is placed 8.0 cm in front of a concave mirror. The mirror produces a real image that has a diameter 4.0 times larger than that of the coin.

1) Which statement best describes the image of the coin?

a) It is upright and closer to the mirror than the object.
b) It is inverted and closer to the mirror than the object.
c) It is upright and farther from the mirror than the object.
d) It is inverted and farther from the mirror than the object.
e) None of the above.

2) What is the focal length of the mirror?

a) +2.67 cm
b) +6.4 cm
c) -2.67 cm
d) -6.4 cm
e) Not enough information is given to calculate the focal length!

An object is 18 cm in front of a diverging lens that has a focal length of –12 cm.

3) Which statement best describes the image of the object?

a) Real and Upright
b) Real and Inverted
c) Virtual and Upright
d) Virtual and Inverted
e) No image is formed in this situation.

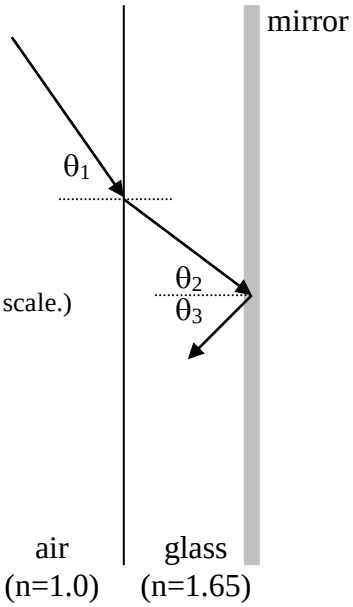
4) What is the magnitude of the distance the image is located from the lens?

a) 7.2 cm
b) 13.5 cm
c) 17.3 cm
d) 28.7 cm
e) 36.0 cm

Light is incident on a mirror with a glass covering. The incoming ray makes an angle of 45 degrees with the normal to the glass.

5) At what angle does the ray strike the mirror (θ_2)?

a) 25 degrees
b) 28 degrees
c) 35 degrees
d) 39 degrees
e) 45 degrees



6) In this situation, compare the three angles shown. (Note: angles may not be drawn to scale.)

a) $\theta_1 = \theta_2 = \theta_3$
b) $\theta_1 > \theta_2 = \theta_3$
c) $\theta_1 = \theta_2 > \theta_3$
d) $\theta_1 < \theta_2 = \theta_3$
e) $\theta_1 = \theta_2 < \theta_3$

Light with wavelength 400 nm is involved in two separate interference experiments.

7) In the first experiment, it is incident on a thin soap bubble (n = 1.34) surrounded by air (n = 1.0). What is the minimum thickness for destructive interference to occur with the reflected light?

a) 75 nm
b) 115 nm
c) 150 nm
d) 250 nm
e) 375 nm

8) In the second experiment, the light travels through two slits 0.2 mm apart. At what angle will the 1st order constructive interference fringe result?

a) 0.1 degrees
b) 0.2 degrees
c) 0.3 degrees
d) 0.4 degrees
e) 0.5 degrees

Light of wavelength 656 nm is produced from electron transitions in the Hydrogen atom.

9) What energy levels does this transition involve?

a) n = 4 to n = 2
b) n = 3 to n = 2
c) n = 7 to n = 3
d) n = 2 to n = 5
e) n = 1 to n = 3

10) What is the energy and momentum of this photon?

a) 4.08×10^{-19} J, 1.36×10^{-27} kg-m/s
b) 2.06×10^{-19} J, 4.28×10^{-27} kg-m/s
c) 1.17×10^{-19} J, 2.19×10^{-27} kg-m/s
d) 5.48×10^{-19} J, 5.31×10^{-27} kg-m/s
e) 3.02×10^{-19} J, 1.01×10^{-27} kg-m/s

11) If this light were to be directed on to a metal with a work function of 1.2 eV, what would be the speed of ejected electrons?

a) 209,000 m/s
b) 334,000 m/s
c) 492,000 m/s
d) 689,000 m/s
e) No electrons would be ejected.

12) This light is now directed through a single slit of width 0.014 mm. How many dark fringes are seen in the diffraction pattern?

a) 32
b) 42
c) 56
d) 66
e) 79

13) If the pattern is displayed on a screen 1.3 m away, how far from the central bright fringe is the 2^{nd} order diffraction minimum?

a) 9 cm
b) 12 cm
c) 15 cm
d) 18 cm
e) 21 cm

Photons with a frequency of 2.5×10^{14} Hz collide off an electron in a Compton Effect experiment.

14) What is the change in wavelength of the photons if the photon rebounds directly backwards (at an angle of 180 degrees)?

a) 1.85×10^{-12} m
b) 2.85×10^{-12} m
c) 3.85×10^{-12} m
d) 4.85×10^{-12} m
e) 5.85×10^{-12} m

15) If the electron ends up moving with a velocity of 49 m/s, what is its Debroglie wavelength?

a) 11 μm
b) 13 μm
c) 15 μm
d) 17 μm
e) 19 μm

16) If the deflection occurs at an angle less than 180 degrees, what will happen to the above two answers?

a) the change in wavelength will be less and the Debroglie wavelength will be less
b) the change in wavelength will be greater and the Debroglie wavelength will be less
c) the change in wavelength will be less and the Debroglie wavelength will be greater
d) the change in wavelength will be greater and the Debroglie wavelength will be greater
e) It depends on what the angle is!

Two unrelated radioactivity problems are asked below.

17) Osmium ${}^{191}_{76}Os$ decays into Iridium ${}^{191}_{77}Os$ via what type of decay?

a) α
b) β+
c) β-
d) δ
e) γ

18) How many half-lives are required for the number of radioactive nuclei to decrease to one-millionth of the initial number?

a) 1
b) 2
c) 20
d) 200
e) 1,000,000

A UFO streaks across the sky at 0.9c, lands on earth, and then flies back into space.

19) While moving at 0.9c it sends a laser pulse out into space (which it measures to move at the speed of light). How fast does and observer on earth measure the laser pulse to be moving?

a) 0c
b) 0.1c
c) 0.9c
d) 1.0c
e) 1.9c

20) The length of the UFO is seen to be 230 m when moving at this speed. How long will it be measured to be if it lands on earth?

a) 100 m
b) 175 m
c) 230 m
d) 389 m
e) 528 m

21) As the spaceship pulls away from earth, the ship turns on a flashing light that flashes every 1.5 s. An observer on earth measures the time between flashes to be 2.5 s. How fast is the spaceship traveling away from the earth?

a) 0.2c
b) 0.4c
c) 0.6c
d) 0.8c
e) 1.0c

It is known that the possible values for the magnetic quantum number m_ℓ are –4, -3, -2, -1, 0, +1, +2, +3, +4.

22) What is the orbital quantum number ℓ?

a) -5
b) 5
c) -4
d) 4
e) 0

23) What is the smallest possible value for the principle quantum number n?

a) 6
b) 5
c) 4
d) 3
e) 1

In a photoelectric effect experiment, the minimum frequency of light to eject electrons is 6.2×10^{14} Hz.

24) What is the work function of the metal?

a) 1.56 eV
b) 2.15 eV
c) 2.56 eV
d) 3.06 eV
e) 3.76 eV

25) The wavelength is now doubled. What will the energy of the ejected electrons be?

a) 1.07 eV
b) 1.28 eV
c) 4.15 eV
d) 5.12 eV
e) No electrons will be ejected!

Online Physics 122 Formulas

$$F = ma \qquad F = \frac{kq_1q_2}{r^2} \qquad E = \frac{F}{q_o} \qquad E = \frac{kq}{r^2}$$

$$U = \frac{kq_1q_2}{r} \qquad V = \frac{U}{q_o} \qquad V = \frac{kq}{r} \qquad E = \frac{V}{d}$$

$$C = \varepsilon_o \frac{A}{d} \qquad C = \frac{Q}{V} \qquad U = \frac{1}{2}QV \qquad I = \frac{Q}{t}$$

$$C_p = C_1 + C_2 \qquad \frac{1}{C_s} = \frac{1}{C_1} + \frac{1}{C_2} \qquad R_s = R_1 + R_2 \qquad \frac{1}{R_p} = \frac{1}{R_1} + \frac{1}{R_2}$$

$$R = \rho \frac{L}{A} \qquad V = IR \qquad P = IV \qquad Q = Q_o e^{\frac{-t}{RC}}$$

$$Q = Q_o\left(1 - e^{\frac{-t}{RC}}\right) \qquad F = qvB\sin\theta \qquad F = ILB\sin\theta \qquad B = \frac{\mu_o I}{2\pi r}$$

$$B = \mu_o nI \qquad r = \frac{mv}{qB} \qquad \Phi_B = BA\cos\phi \qquad emf = vBL$$

$$emf = -N\frac{\Delta\Phi_B}{\Delta t} \qquad U = \frac{1}{2}LI^2 \qquad \frac{V_s}{V_p} = \frac{N_s}{N_p} \qquad V_{rms} = I_{rms}Z$$

$$Z = \sqrt{R^2 + \left(X_L - X_C\right)^2} \qquad X_c = \frac{1}{2\pi fC} \qquad X_L = 2\pi fL$$

$$\overline{P} = V_{rms}I_{rms}\cos\phi \qquad \tan\phi = \frac{X_L - X_C}{R} \qquad f_o = \frac{1}{2\pi\sqrt{LC}} \qquad c = \lambda f$$

$$c = \frac{1}{\sqrt{\varepsilon_o\mu_o}} \qquad U = \frac{1}{2}\varepsilon_o E^2 + \frac{1}{2\mu_o}B^2 \qquad E = cB$$

$$I = I_o\cos^2\theta$$

$$k = 8.99\times10^9\, Nm^2/C^2$$
$$\varepsilon_o = 8.85\times10^{-12}\, C^2/m^2N$$
$$q_e = 1.60\times10^{-19}\, C$$
$$\mu_o = 4\pi\times10^{-7}\, Tm/A$$
$$c = 3\times10^8\, m/s$$

Online Physics 122 Formulas

$$\frac{1}{d_o}+\frac{1}{d_i}=\frac{1}{f} \qquad m=\frac{h_i}{h_o}=-\frac{d_i}{d_o} \qquad f=\frac{1}{2}R \qquad \theta_i=\theta_r$$

$$n=\frac{c}{v} \qquad n_1\sin\theta_1=n_2\sin\theta_2 \qquad \sin\theta_c=\frac{n_2}{n_1} \qquad \tan\theta_B=\frac{n_2}{n_1}$$

$$P=\frac{1}{f} \qquad d\sin\theta=\left(m+\frac{1}{2}\right)\lambda \qquad d\sin\theta=m\lambda \qquad W\sin\theta=m\lambda$$

$$\theta_{\min}=1.22\frac{\lambda}{D} \qquad 2t=\left(m+\frac{1}{2}\right)\lambda' \qquad 2t=m\lambda' \qquad \lambda'=\frac{\lambda}{n}$$

$$hf=KE_{\max}+W_o \qquad \lambda'-\lambda=\frac{h}{mc}(1-\cos\theta) \qquad p=\frac{h}{\lambda} \qquad E=hf$$

$$E^2=p^2c^2+m^2c^4 \qquad E_n=\frac{-13.6eV}{n^2} \qquad \Delta p\Delta y\geq\frac{h}{4\pi} \qquad \Delta E\Delta t\geq\frac{h}{4\pi}$$

$$\Delta t=\frac{\Delta t_o}{\sqrt{1-\frac{v^2}{c^2}}} \qquad L=L_o\sqrt{1-\frac{v^2}{c^2}} \qquad p=\frac{mv}{\sqrt{1-\frac{v^2}{c^2}}} \qquad E=\frac{mc^2}{\sqrt{1-\frac{v^2}{c^2}}}$$

$$v_{AB}=\frac{v_{AC}+v_{CB}}{1+\frac{v_{AC}v_{CB}}{c^2}}$$

$$c=3\times10^8\,m/s$$
$$h=6.626\times10^{-34}\,J\cdot s$$
$$m_e=9.11\times10^{-31}kg$$
$$m_p=1.67\times10^{-27}kg$$

ON-LINE PHYSICS 122
EXAM #2
MR. POTTER

Name: _____ Date: _____

1) This Exam is 90 min long - 25 multiple choice questions. Choose the one BEST answer for each question. You are not penalized for guessing. Watch your time! (Answer all questions.)

2) You may use only a pencil and calculator. (Formula sheet is provided.)

3) Use the test as scratch paper (or the paper provided by the testing center). Hand EVERYTHING back in or you will receive a 0 on the exam!

4) Scoring: all 5 answer choice questions are 6 pts. each, all 3 answer choice questions are 3 pts. each, all 2 answer choice questions are 2 pts. each. Total possible points = 150 pts.

5) This is test form ____. Be sure to write this on your scantron form. All forms are "equivalent" tests (only numbers have been changed.)

6) Also, write your name, the class, the date, and my name on the scantron form.

Good Luck!