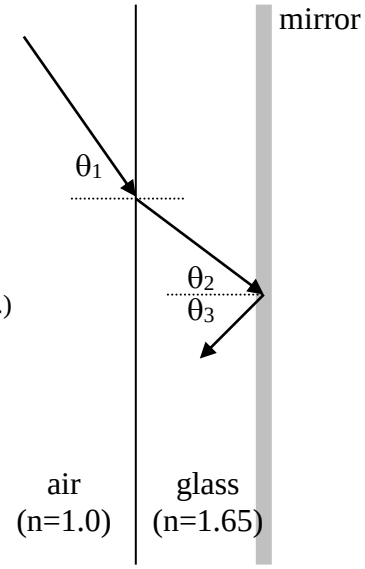
Light is incident on a mirror with a glass covering. The incoming ray makes an angle of $\theta_1 = 50$ degrees with the normal to the glass.

1) 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



2) In this situation, compare angles θ_2 and θ_3. (Note: angles may not be drawn to scale.)

a) $\theta_2 = \theta_3$
b) $\theta_2 < \theta_3$
c) $\theta_2 > \theta_3$

An object is placed 10.0 cm in front of a Christmas tree ornament (with radius of curvature 2 cm) that acts as a convex mirror.

3) How far from the mirror is the image located?

a) -1.1 cm (behind the mirror)
b) -0.9 cm (behind the mirror)
c) 0 cm (at the mirror)
d) +0.9 cm (in front of the mirror)
e) +1.1 cm (in front of the mirror)

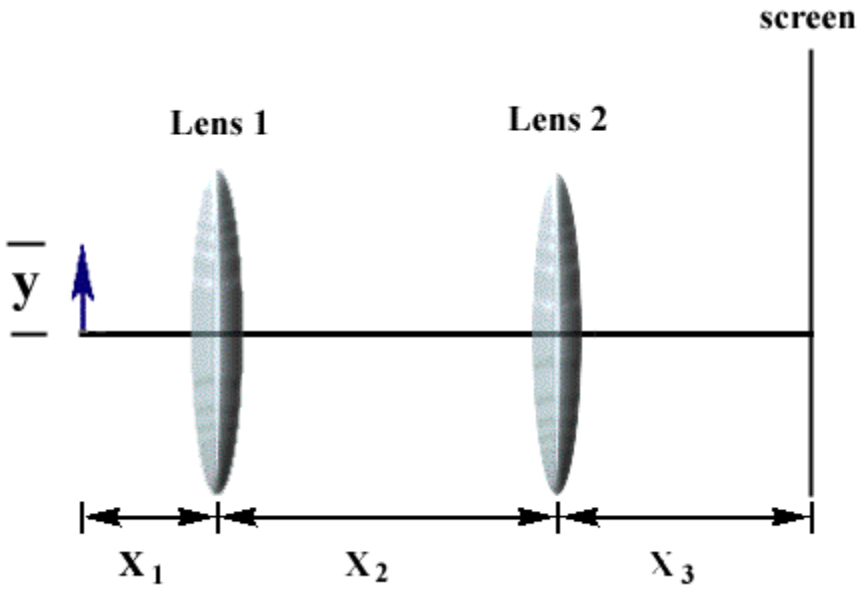
4) Describe the image:

a) real
b) virtual
c) it could be either

5) Describe the image:

a) upright
b) inverted
c) it could be either

An object is 30 cm in front of converging lens 1 that has a focal length of 8 cm.



6) Where is the image of the object through ONLY THE FIRST LENS located?

a) 6.59 cm
b) 7.21 cm
c) 8.57 cm
d) 9.33 cm
e) 10.91 cm

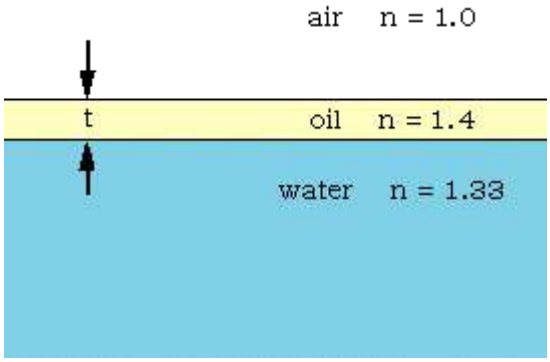
7) Lens 2 is located 28 cm to the right of lens 1. If the final imaged is focused on a screen 22 cm to the right of lens 2, what is the focal length of lens 2?

a) 6.59 cm
b) 7.21 cm
c) 8.57 cm
d) 9.62 cm
e) 10.52 cm

8) Describe the final image:

a) real
b) virtual
c) it could be either

Light with wavelengths from 400 nm to 750 nm is involved in thin film interference with oil on water.



9) At what minimum thickness will there be constructive interference for green light? (550nm)

a) 98.2 nm
b) 137.5 nm
c) 196.4 nm
d) 275.0 nm
e) 392.9 nm

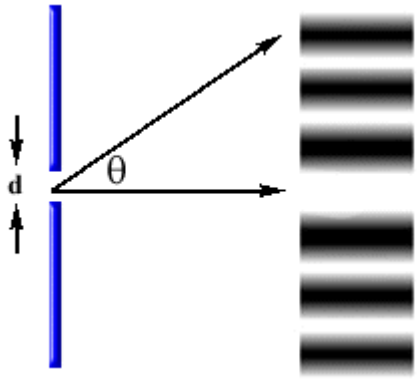
10) At what minimum thickness will there be destructive interference for blue light? (450nm)

a) 80.4 nm
b) 112.5 nm
c) 160.7 nm
d) 225 nm
e) 321.4 nm

11) If there was water above the thin film also (instead of air), how would the previous answer (to #10) change?

a) It would increase.
b) It would decrease.
c) It would remain the same.

Light with wavelength 703 nm goes through a single slit of width 0.016 mm and displays a diffraction pattern on a screen 2.2 m away.



12) What is the width of the central bright fringe?

a) 0.19 m
b) 0.32 m
c) 0.48 m
d) 0.64 m
e) 0.80 m

13) What is the angle to the 4^{th} dark fringe?

a) 2°
b) 4°
c) 6°
d) 8°
e) 10°

14) If the slit width was decreased, what would happen to the pattern?

a) the fringes would spread out
b) the fringes would get closer together
c) nothing

It is known that an electron in an atom is in the 4d orbital.

15) What are the possibilities for the quantum number m_ℓ?

a) -4, -3, -2, -1, 0, +1, +2, +3, or +4
b) -3, -2, -1, 0, +1, +2, +3
c) -2, -1, 0, +1, or +2
d) 0, 1, 2, or 3
e) -1/2 or +1/2

16) What is the principle quantum number n?

a) 4
b) 3
c) 2

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

17) 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

18) If the deflection occurs at an angle less than 180 degrees, what will happen to the above answer?

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

A certain metal in the photoelectric effect experiment has a work function of 2.3 eV. For a given experiment, the maximum kinetic energy of the ejected electrons is 1.6 eV.

19) What is the wavelength of the incident photons?

a) 218 nm
b) 318 nm
c) 418 nm
d) 518 nm
e) 618 nm

20) What is the DeBroglie wavelength of the ejected electrons?

a) 0.57 nm
b) 0.67 nm
c) 0.77 nm
d) 0.87 nm
e) 0.97 nm

21) What is the maximum wavelength of photons that would eject electrons from this metal?

a) 339 nm
b) 439 nm
c) 539 nm
d) 639 nm
e) 739 nm

22) If the intensity of light was increased, how would the above answer change?

a) it would increase
b) it would decrease
c) it would stay the same

Light of wavelength 434 nm is produced from electron transitions in the Hydrogen atom.

23) What energy levels does this transition involve?

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

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

a) 4.57×10^{-19} J, 1.52×10^{-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

Here are three unrelated physics 122 problems:

25) All transitions of electrons in the Hydrogen atom that produce visible light involve which energy level?

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

26) In radioactive decay, an alpha particle is _____, a beta particle is _____, and a gamma particle is _____.

a) an electron, electromagnetic radiation, a helium nucleus
b) electromagnetic radiation, a helium nucleus, an electron
c) a helium nucleus, an electron, electromagnetic radiation

27) What is the meaning of a materials half-life?

a) the amount of material remaining when half of it has decayed away
b) the energy released from the nucleus in radioactive decay
c) the time it takes for half of a sample to decay away

A UFO streaks across the sky at 0.5c, lands on earth, and then flies back into space at an unknown speed.

28) While moving at 0.5c 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) 0.5c
b) 1.0c
c) 1.5c

29) 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) 115 m
b) 199 m
c) 230 m
d) 266 m
e) 460 m

30) As the spaceship pulls away from earth, the ship turns on a flashing light that flashes every 2.0 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

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) Bubble in the ID number section of the scantron form with FIVE ZEROS and then the LAST FIVE DIGITS of your SOCIAL SECURITY NUMBER. (For example 0000054321.)

2) This Exam is 90 min long - 30 multiple-choice questions. Choose the one BEST answer for each question. You are not penalized for guessing. Watch your time! (Answer all questions.)

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

4) 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!

5) 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 = 144 pts.

6) This is test form __A__. Be sure to FILL THIS IN on your scantron form. All forms are "equivalent" tests (only numbers have been changed.)

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

Good Luck!

DID YOU BUBBLE IN AN ID NUMBER AND TEST FORM ON THE SCANTRON?

(see front page for instructions)