1) When an object is placed outside the center of curvature of a convex mirror, the image is _____ .

a) upright and virtual
b) inverted and smaller
c) larger and real

2) When an object is placed inside the focal point of a converging lens, the image is _____ .

a) upright and virtual
b) inverted and smaller
c) larger and real

3) When a laser beam travels from air (n = 1.0) into water (n = 1.33) the beam _____.

a) bends toward the normal
b) bends away from the normal
c) travels in a straight line

4) Mirrors work off the principle of _____.

a) refraction
b) diffraction
c) reflection

5) Compared to a double slit interference experiment in air, when placed underwater the bright fringes _____.

a) are the same distance apart
b) move closer together
c) move farther apart

6) The _____ of light explains the bending of light through a single slit.

a) polarization
b) diffraction
c) interference

7) In the Compton effect, the angle that the photon scatters off the electron affects the photon's final _____.

a) polarization
b) wavelength
c) speed

8) Which experiment cannot be explained by the particle properties of light?

a) two slit interference
b) the Compton effect
c) the photoelectric effect

9) The highest energy photons in the hydrogen spectra involve transitions that end at the _____ energy level.

a) n = 1
b) n = 2
c) n = 3

10) How many electrons can fit in the s subshell?

a) 2
b) 6
c) 10

11) As a space ship approaches the speed of light, observers on the ship measure light to _____.

a) speed up
b) slow down
c) move at the same constant speed

12) Which is NOT a consequence of the theory of relativity?

a) nothing can travel faster than the speed of light
b) moving clocks are measured to run slow
c) light has a wave-particle duality

An object is placed in front of a convex mirror with a radius of curvature of magnitude 10 cm. The mirror produces an image that is 4 cm behind the mirror.

13) How far from the mirror was the object placed?

a) 5 cm
b) 10 cm
c) 15 cm
d) 20 cm
e) 25 cm

14) What is the magnification?

a) +5
b) +1/5
c) 0
d) -1/5
e) -5

An object that is 2 cm tall is 18 cm in front of a converging lens and creates a real image 8 cm beyond the lens.

15) What is the focal length of the lens?

a) 1.54 cm
b) 3.54 cm
c) 5.54 cm
d) 7.74 cm
e) 9.94 cm

16) What is the height of the image?

a) +3.89 cm
b) +0.89 cm
c) 0 cm
d) -0.89 cm
e) -3.89 cm

Light with wavelengths from 400 nm to 750 nm is involved in a two slit interference experiment with a slit spacing of 0.0025 mm. (1 nm = $1x10^{-9}$ m and 1 mm = $1x10^{-3}$ m)

17) At what angle will the second order maximum be located for green light (575 nm)?

a) 17 degrees
b) 27 degrees
c) 37 degrees
d) 47 degrees
e) 57 degrees

18) How many total full order spectra (from 400nm to 750nm) can be seen on <u>both</u> sides of the central bright fringe?

a) 2
b) 4
c) 6
d) 8
e) 10

Radar with a wavelength of 1.35 cm is incident on a thin protective coating covering a stealth fighter. The index of refraction of the thin coating is 1.84.

19) What is the wavelength of the radar waves in the thin coating?

a) 0.73 cm
b) 1.12 cm
c) 1.35 cm
d) 1.86 cm
e) 2.48 cm

20) At what minimum thickness is the reflected radar a minimum (destructive interference)?

a) 0.07 cm
b) 0.15 cm
c) 0.18 cm
d) 0.29 cm
e) 0.41 cm

In the photoelectric effect, the maximum wavelength for electrons to be emitted from a surface is 786 nm.

21) What is the momentum of these photons?

a) 2.43×10^{-28} kg-m/s
b) 3.43×10^{-28} kg-m/s
c) 5.43×10^{-28} kg-m/s
d) 8.43×10^{-28} kg-m/s
e) 9.43×10^{-28} kg-m/s

22) What is the work function of this metal? (1 eV = 1.6×10^{-19} J)

a) 1.58 eV
b) 2.58 eV
c) 3.58 eV
d) 3.58 eV
e) 4.58 eV

23) Now light with frequency 7.28×10^{14} Hz is directed unto the metal. What is the speed of the emitted electrons?

a) 1.1×10^{5} m/s
b) 3.1×10^{5} m/s
c) 5.1×10^{5} m/s
d) 7.1×10^{5} m/s
e) 9.1×10^{5} m/s

Two unrelated radioactivity problems are asked below.

24) Carbon ${}^{14}_{6}C$ decays into Nitrogen ${}^{14}_{7}N$ via what type of decay?

a) α
b) β+
c) β-
d) δ
e) γ

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

a) 1
b) 10
c) 100
d) 1,00
e) 1,000,000

An electron in an excited hydrogen atom makes two transitions. First the electron drops from the n=6 to the n=2 state, then the electron drops from the n=2 to the n=1 state.

26) Calculate the wavelength of the photon emitted in the first transition.

a) 310 nm
b) 410 nm
c) 510 nm
d) 610 nm
e) 710 nm

27) Calculate the energy of the photon emitted in the second transition.

a) 2.2 eV
b) 4.2 eV
c) 6.2 eV
d) 8.2 eV
e) 10.2 eV

On the earth, you are watching a spaceship move directly away from the earth at 0.6c relative to the earth.

28) While moving at 0.6c away from earth it sends a smaller ship away from the earth at 0.9c (relative to the spaceship). How fast do you (an observer on earth) measure the smaller ship to be moving?

a) 0c
b) 0.3c
c) 0.97c
d) 1.0c
e) 1.5c

29) Observers on earth measure the spaceship to be 100 m long. What is the spaceship's proper length (that people on the spaceship measure it to be)?

a) 60 m
b) 80 m
c) 100 m
d) 125 m
e) 167 m

30) After a while, you (an observer on earth) notice 15 minutes have passed on the clocks of the spaceship. How much time has passes on your clocks (on earth)?

a) 9 min
b) 12 min
c) 15 min
d) 19 min
e) 25 min

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

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

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

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

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

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

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

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

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

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

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)