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

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

2) When an object is placed very far from 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) slows down
b) does not change speed
c) moves faster

4) Lenses work off the principle of _____.

a) refraction
b) diffraction
c) reflection

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

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

6) _____ interference occurs when two waves overlap that are in phase.

a) Destructive
b) Constructive
c) No

7) In the photoelectric effect, light from a certain source ejects no electrons from a metal. Increasing the _____ of the light will eject electrons.

a) frequency
b) intensity
c) wavelength

8) Light _____.

a) is a wave
b) is a particle
c) has properties of both waves and particles

9) The shortest wavelength 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 d subshell?

a) 2
b) 6
c) 10

11) As a space ship approaches the speed of light, observers on the earth would measure the length of the spaceship _____.

a) to increase
b) to decrease
c) to remain the same

12) As a space ship approaches the speed of light, observers on the earth would measure the clocks of the spaceship _____.

a) to slow down
b) to speed up
c) to remain the same

An object is placed in front of a convex mirror with a radius of curvature of magnitude 8 cm. The mirror produces an image that is 3 cm behind the mirror.

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

a) 2 cm
b) 7 cm
c) 12 cm
d) 17 cm
e) 22 cm

14) What is the magnification?

a) +4
b) +1/4
c) 0
d) -1/4
e) -4

An object that is 3 cm tall is 17 cm in front of a converging lens and creates a real image 9 cm beyond the lens.

15) What is the focal length of the lens?

a) 1.88 cm
b) 3.88 cm
c) 5.88 cm
d) 7.88 cm
e) 9.88 cm

16) What is the height of the image?

a) +3.6 cm
b) +1.6 cm
c) 0 cm
d) -1.6 cm
e) -3.6 cm

Light with wavelengths from 400 nm to 700 nm is involved in thin film interference with oil (n=1.4) on water (n=1.3).

17) At what minimum non-zero thickness will there be constructive interference for blue light? (400nm)

a) 71.4 nm
b) 142.9 nm
c) 250 nm
d) 350 nm
e) 500 nm

18) At what minimum non-zero thickness will there be destructive interference for red light? (700nm)

a) 71.4 nm
b) 142.9 nm
c) 250 nm
d) 350 nm
e) 500 nm

Light with wavelength 675 nm goes through a single slit of width 0.012 mm and displays a diffraction pattern on a screen 2.2 m away.

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

a) 0.15 m
b) 0.25 m
c) 0.35 m
d) 0.45 m
e) 0.55 m

20) What is the angle to the 3rd dark fringe?

a) 2°
b) 4°
c) 6°
d) 8°
e) 10°

A certain metal in the photoelectric effect experiment has a work function of 3.2 eV. For a given experiment, the maximum kinetic energy of the ejected electrons is 1.5 eV.

21) What is the wavelength of the incident photons?

a) 264 nm
b) 364 nm
c) 464 nm
d) 564 nm
e) 664 nm

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

a) 1 nm
b) 2 nm
c) 3 nm
d) 4 nm
e) 5 nm

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

a) 288 nm
b) 388 nm
c) 488 nm
d) 588 nm
e) 688 nm

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=3 state, then the electron emits a photon with an energy of 12.1 eV.

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

a) 1.74×10^{14} Hz
b) 2.74×10^{14} Hz
c) 3.74×10^{14} Hz
d) 4.74×10^{14} Hz
e) 5.74×10^{14} Hz

27) What is the wavelength of the second photon and what state does the electron end in?

a) 102 nm, n=1
b) 202 nm, n=1
c) 202 nm, n=2
d) 302 nm, n=1
e) 302 nm, n=2

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)