Exam Physics 3 - TTh - Fall 2016

Name___________________________________ Perm# ___________________________________

Email ___________________________________ Tel # ___________________________________

Remember to write all work in your Bluebook as well as put the answer on your Scantron

MULTIPLE CHOICE. Choose the one alternative that best completes the statement or answers the question.

1) Four traveling waves are described by the following equations, where all quantities are measured in SI units and $y$ represents the displacement. 1) _______

I: $y = 0.12 \cos(3x + 2t)$

II: $y = 0.15 \sin(6x - 3t)$

III: $y = 0.23 \cos(3x + 6t)$

IV: $y = -0.29 \sin(1.5x - t)$

Which of these waves have the same speed?

A) I and IV
B) III and IV
C) I and III
D) I and II
E) II and III

2) A transverse wave is propagated in a string stretched along the $x$-axis. The equation of the wave, in SI units, is given by: $y = 0.005 \cos \pi(38t - 14x)$. The wave speed, including the sense of direction along the $x$-axis, in SI units, is closest to: 2) _______

A) -0.37 B) 0.37 C) -2.7 D) 2.7 E) zero

3) Ocean tides are waves that have a period of 12 hours, an amplitude (in some places) of 1.50 m, and a speed of 750 km/hr. What is the distance between adjacent crests of these waves? 3) _______

A) 9000 m
B) 32,400 m
C) 2500 m
D) 9000 km
E) 32,400 km

4) A wire, 4.0 m long, with a mass of 20 g, is under tension. A transverse wave is propagated on the wire, for which the frequency is 740 Hz, the wavelength is 0.70 m, and the amplitude is 6.7 mm. The maximum transverse acceleration of a point on a wire, in SI units, is closest to: 4) _______

A) 110,000 B) 130,000 C) 160,000 D) 90,000 E) 140,000

5) Consider the waves on a vibrating guitar string and the sound waves the guitar produces in the surrounding air. The string waves and the sound waves have the same 5) _______

A) amplitude.
B) velocity.
C) frequency.
D) wavelength.
E) More than one of the above is true.

6) A pipe that is 120 cm long resonates to produce sound of wavelengths 480 cm, 160 cm, and 96 cm but does not resonate at any wavelengths longer than these. This pipe is 6) _______

A) open at one end and closed at the other end.
B) open at both ends.
C) closed at both ends.
D) We cannot tell because we do not know the frequency of the sound.

7) An enclosed chamber with sound absorbing walls has a 2.0 m × 1.0 m opening for an outside window. A loudspeaker is located outdoors, 78 m away and facing the window. The intensity level of the sound entering the window space from the loudspeaker is 79 dB. Assume the acoustic output of the loudspeaker is uniform in all directions and that the acoustic energy incident upon the ground is completely absorbed and therefore is not reflected into the window. The threshold of hearing is $1.0 \times 10^{-12}$ W/m$^2$. The acoustic power entering through the window space is closest to 7) _______

A) 320 μW.
B) 160 μW.
C) 79 μW.
D) 790 μW.
E) 1600 μW.

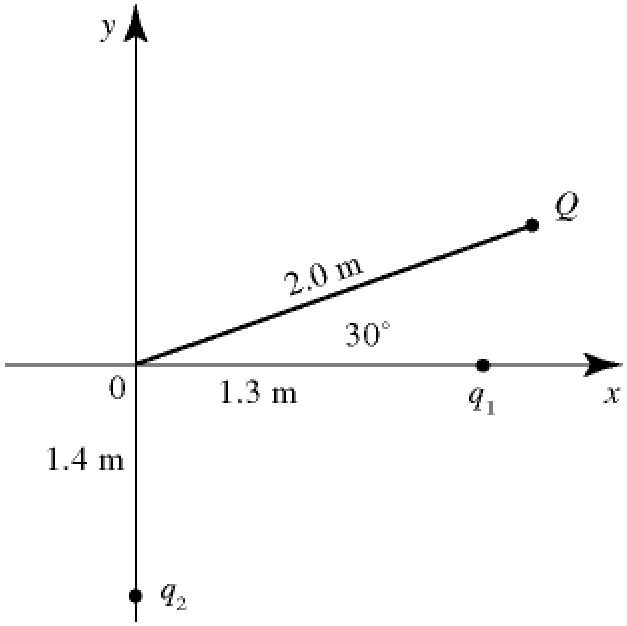
8) A 1.30-m long gas column that is open at one end and closed at the other end has a fundamental resonant frequency 80.0 Hz. What is the speed of sound in this gas? 8) _______

A) 104 m/s B) 61.5 m/s C) 416 m/s D) 246 m/s E) 26.0 m/s

9) What is the intensity level in decibels of a sound whose intensity is $10^{-7}$ W/m$^2$? 9) _______

A) 30 dB B) 40 dB C) 20 dB D) 50 dB E) 60 dB

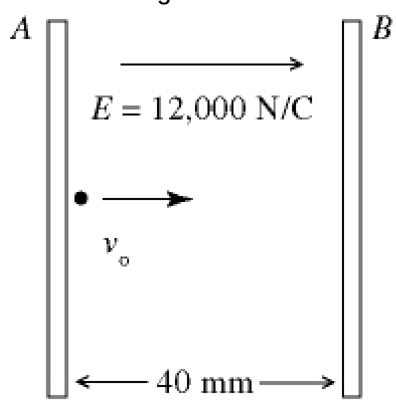
Figure 21.1c




10) A point charge $Q$ = -400 nC and two unknown point charges, $q_1$ and $q_2$, are placed as shown. The electric field at the origin $O$, due to charges $Q$, $q_1$, and $q_2$, is equal to zero. In Fig. 21.1c, the charge $q_2$, in nC, is closest to: 10) ______

A) 310 B) -180 C) -310 D) 180 E) 360

Figure 21.7

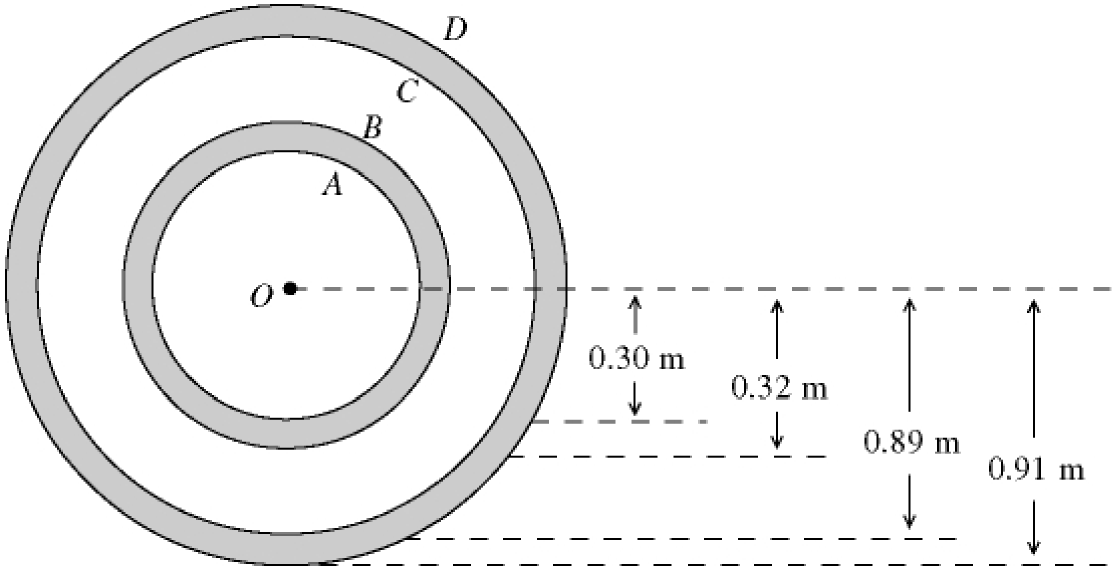



A pair of charged conducting plates produces a uniform field of 12,000 N/C, directed to the right, between the plates. The separation of the plates is 40 mm.

11) In Fig. 21.7 , an electron is projected from plate $A$, directly toward plate $B$, with an initial velocity of $v_o = 2.0 \times 10^7$ m/s. The velocity of the electron as it strikes plate $B$ is closest to: 11) ______

A) $2.4 \times 10^7$ m/s
B) $1.5 \times 10^7$ m/s
C) $1.8 \times 10^7$ m/s
D) $2.1 \times 10^7$ m/s
E) $1.2 \times 10^7$ m/s

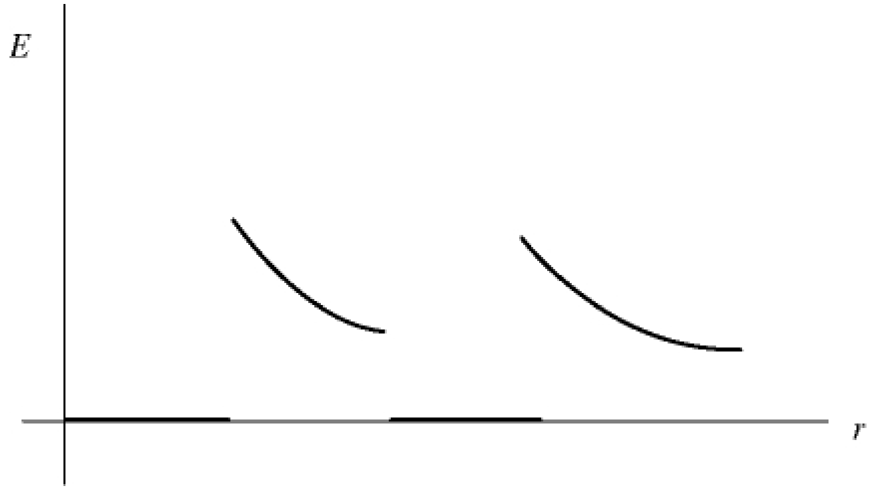
Figure 22.3




12) Two hollow conducting spheres have a common center *O*. The dimensions of the spheres are as shown. A charge of -200 nC is placed on the inner conductor and a charge of +30 nC is placed on the outer conductor. The inner and outer surfaces of the spheres are respectively denoted by *A*, *B*, *C*, and *D*, as shown. In Fig. 22.3, the charges on surfaces *A* and *B* respectively, in nC, are closest to: 12) ______

A) -30 and -200
B) 0 and -30
C) -200 and -30
D) 0 and -170
E) 0 and -200

Figure 22.5



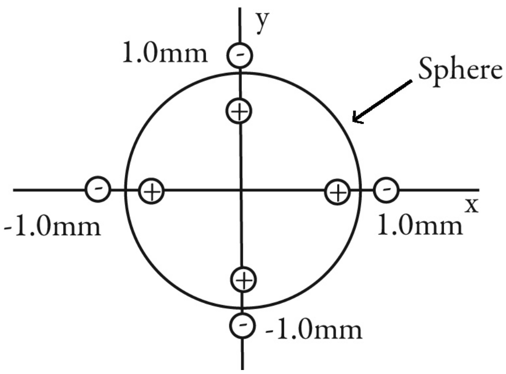

13) The graph in Fig. 22.5 shows the electric field strength (*not* the field lines) as a function of distance from the center for a pair of concentric uniformly charged spheres. Which of the following situations could the graph plausibly represent? (There may be more than one correct choice.) 13) ______

A) A solid nonconducting sphere, uniformly charged throughout its volume, inside of a positively charged conducting sphere.
B) A positively charged nonconducting thin-walled spherical shell inside of another positively charged nonconducting thin-walled spherical shell.
C) A positively charged conducting sphere within an uncharged conducting sphere.
D) A positively charged conducting sphere within another positively charged conducting sphere.
E) A positively charged nonconducting thin-walled spherical shell inside of a positively charged conducting sphere.

14) An electron is released from rest at a distance of 9 cm from a proton. How fast will the electron be moving when it is 3 cm from the proton? 14) ______

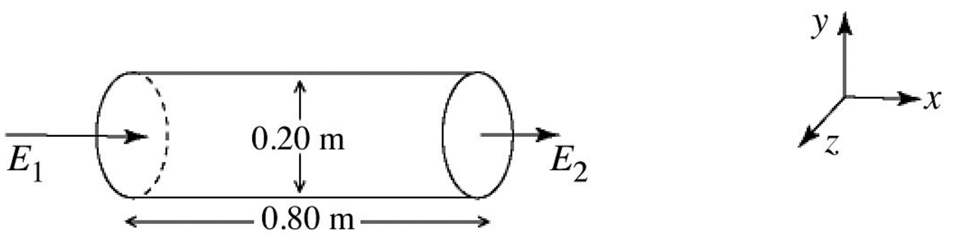
A) 75 m/s
B) $1.06 \times 10^3$ m/s
C) 130 m/s
D) $4.64 \times 10^5$ m/s
E) 106 m/s

15) Four dipoles, each consisting of a +10-μC charge and a -10-μC charge, are located in the *xy*-plane with their centers 1.0 mm from the origin, as shown. A sphere passes through the dipoles, as shown in the figure. What is the electric flux through the sphere due to these dipoles? ($\varepsilon_0 = 8.85 \times 10^{-12}\ C^2/N \cdot m^2$) 15) ______




A) $11 \times 10^5\ N \cdot m^2/C$
B) $4.5 \times 10^6\ N \cdot m^2/C$
C) $9.0 \times 10^6\ N \cdot m^2/C$
D) $0.00\ N \cdot m^2/C$

16) A nonuniform electric field is directed along the *x*-axis at all points in space. This magnitude of the field varies with *x*, but not with respect to *y* or *z*. The axis of a cylindrical surface, 0.80 m long and 0.20 m in diameter, is aligned parallel to the *x*-axis, as shown in the figure. The electric fields $E_1$ and $E_2$, at the ends of the cylindrical surface, have magnitudes of 6000 N/C and 1000 N/C respectively, and are directed as shown. What is the net electric flux passing through the cylindrical surface? 16) ______




A) $+350\ N \cdot m^2/C$
B) $-160\ N \cdot m^2/C$
C) $0.00\ N \cdot m^2/C$
D) $+160\ N \cdot m^2/C$
E) $-350\ N \cdot m^2/C$

1) A
ID: up13 15.1-2

2) D
ID: up12 15.1-3

3) D
ID: up13 15.2-2

4) E
ID: up12 15.1-14

5) C
ID: up12 16.1-13

6) A
ID: up13 16.1-3

7) B
ID: up13 16.2-7

8) C
ID: up13 16.2-16

9) D
ID: up12 16.1-16

10) B
ID: up12 21.1-3

11) B
ID: up12 21.1-23

12) E
ID: up12 22.1-4

13) D, E
ID: up12 22.1-14

14) E
ID: up12 23.1-24

15) B
ID: up13 22.2-7

16) B
ID: up13 22.2-1