Exam Physics 3 - MW - 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: $y = 0.12\cos(3x - 21t)$
II: $y = 0.15\sin(6x + 42t)$
III: $y = 0.13\cos(6x + 21t)$
IV: $y = -0.27\sin(3x - 42t)$

Which of these waves have the same period?

A) I and IV, and also II and III
B) I and III, and also II and IV
C) I and II, and also III and IV
D) All of them have the same period.
E) They all have different periods.

2) When a weight W is hanging from a light vertical string, the speed of pulses on the string is V. If a second weight W is added without stretching the string, the speed of pulses on this string will now become 2) _____

A) $V/2$. B) $2V$. C) $\sqrt{2}V$. D) V. E) $V/\sqrt{2}$.

3) Find the speed of an ocean wave whose vertical displacement y as a function of time t is given by $y(x,t) = 3.7\cos(2.2x - 5.6t)$, where all quantities are in SI units. 3) _____

A) 2.5 m/s B) 4.5 m/s C) 1.9 m/s D) 3.5 m/s

4) Two people are talking at a distance of 3.0 m from where you are and you measure the sound intensity as 1.1×10^{-7} W/m^2. Another student is 4.0 m away from the talkers. What sound intensity does the other student measure? Assume that the sound spreads out uniformly and undergoes no significant reflections or absorption. 4) _____

A) 8.3×10^{-8} W/m^2
B) 2.5×10^{-8} W/m^2
C) 6.2×10^{-8} W/m^2
D) 7.8×10^{-7} W/m^2
E) 1.5×10^{-7} W/m^2

5) Which one of the following statements is true? 5) _____

A) The intensity level (in dB) obeys an inverse-square distance law, but the sound intensity does not.
B) Both the intensity level (in dB) and the sound intensity can be negative.
C) Both the intensity level (in dB) and the sound intensity can never be negative.
D) The sound intensity can never be negative, but the intensity level (in dB) can be negative.
E) Both intensity level (in dB) and sound intensity obey inverse-square distance laws.

6) Consider a pipe of length L that is open at both ends. What are the wavelengths of the three lowest-pitch tones produced by this pipe? 6) _____

A) $4L$, $2L$, $L/2$
B) $2L$, L, $2L/3$
C) $4L$, $4L/3$, $4L/5$
D) $4L$, $2L$, L
E) $2L$, L, $L/2$

7) A pipe that is 20.0 m long and 10.0 cm in diameter contains olive oil. The density of the olive oil is 890 kg/m^3 and the bulk modulus is 1.3×10^9 Pa. A 3.4-Hz longitudinal wave is transmitted in the oil. How many milliseconds does it take for the wave to travel the length of the pipe in the oil? 7) _____

A) 17 ms B) 13 ms C) 15 ms D) 12 ms E) 14 ms

8) The howler monkey is the loudest land animal and, under some circumstances, can be heard up to a distance of 8.9 km. Assume the acoustic output of a howler to be uniform in all directions and that the threshold of hearing is 1.0×10^{-12} W/m^2. A juvenile howler monkey has an acoustic output of 63 μW. What is the ratio of the acoustic intensity produced by the juvenile howler to the reference intensity I_0, at a distance of 210 m? 8) _____

A) 170 B) 230 C) 76 D) 110 E) 300

9) *X* and *Y* are two uncharged metal spheres on insulating stands, and are in contact with each other. A positively charged rod *R* is brought close to *X* as shown in Figure (a). 9) _____

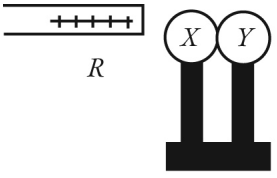


Figure (a)

Sphere *Y* is now moved away from *X*, as in Figure (b).

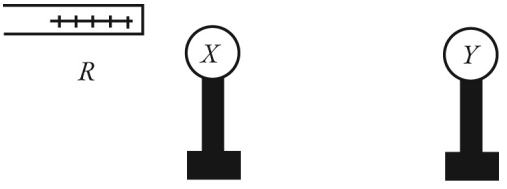


Figure (b)

What are the final charge states of *X* and *Y*?

A) *X* is positive and *Y* is neutral.
B) Both *X* and *Y* are negative.
C) *X* is negative and *Y* is positive.
D) Both *X* and *Y* are neutral.
E) *X* is neutral and *Y* is positive.

10) A point charge Q is located a short distance from a point charge $3Q$, and no other charges are present. If the electrical force on Q is F, what is the electrical force on $3Q$? 10) _____

A) $F/3$ B) $3F$ C) $F/\sqrt{3}$ D) $\sqrt{3}F$ E) F

11) A 1.0-C point charge is 15 m from a second point charge, and the electric force on one of them due to the other is 1.0 N. What is the magnitude of the second charge? 11) _____

($k = 1/4\pi\varepsilon_0 = 8.99 \times 10^9$ N • m^2/C^2)

A) 0.025 C B) 25 nC C) 25 C D) 10 nC E) 1.0 C

12) Two long straight parallel lines, #1 and #2, carry uniform positive linear charge densities. The charge density on line #2 is twice as great as the charge density on line #1. The locus of points where the electric field due to these lines is zero is 12) _____

A) along a line perpendicular to lines #1 and #2.
B) along a line between the lines closer to line #1 than line #2.
C) along a line between the lines closer to line #2 than line #1.
D) at a point midway between the lines.

13) Which of the following statements about Gauss's law are correct? (There may be more than one correct choice.) 13) _____

A) Only charge enclosed within a Gaussian surface can produce an electric field at points on that surface.

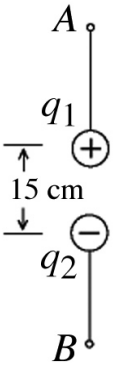
B) Gauss's law is valid only for symmetric charge distributions, such as spheres and cylinders.

C) If a Gaussian surface is completely inside an electrostatic conductor, the electric field must always be zero at all points on that surface.

D) The electric flux passing through a Gaussian surface depends only on the amount of charge inside that surface, not on its size or shape.

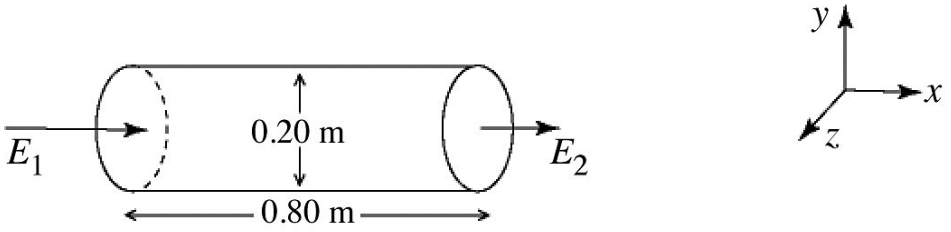
E) If there is no charge inside of a Gaussian surface, the electric field must be zero at points of that surface.

14) Two small insulating spheres are attached to silk threads and aligned vertically as shown in the figure. These spheres have equal masses of 40 g, and carry charges q_1 and q_2 of equal magnitude 2.0 μC but opposite sign. The spheres are brought into the positions shown in the figure, with a vertical separation of 15 cm between them. Note that you cannot neglect gravity. ($k = 1/4\pi\varepsilon_0 = 8.99 \times 10^9$ N • m^2/C^2) The tension in the lower thread is closest to 14) _____



A) 1.4 N. B) 1.6 N. C) 1.2 N. D) 2.0 N. E) 1.8 N.

15) 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? 15) _____



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

16) A charge q = 2.00 μC is placed at the origin in a region where there is already a uniform electric field $\vec{E}$ = (100 N/C) $\hat{i}$. Calculate the flux of the net electric field through a Gaussian sphere of radius R = 10.0 cm centered at the origin. (ε_0 = 8.85 × 10^{-12} C^2/N • m^2) 16) _____

A) 1.13 × 10^5 N • m^2/C
B) 5.52 × 10^5 N • m^2/C
C) 2.26 × 10^5 N • m^2/C
D) zero

Answer Key
Testname: MIDTERM-PHYS3 - MW - F16-A

1) B
ID: up13 15.1-1
2) C
ID: up13 15.1-7
3) A
ID: up13 15.2-5
4) C
ID: up13 15.2-13
5) D
ID: up13 16.1-2
6) B
ID: up13 16.1-4
7) A
ID: up13 16.2-3
8) D
ID: up13 16.2-6
9) C
ID: up13 21.1-1
10) E
ID: up13 21.1-4
11) B
ID: up13 21.2-2
12) B
ID: up13 22.1-6
13) C, D
ID: up13 22.1-3
14) C
ID: up13 21.2-8
15) B
ID: up13 22.2-1
16) C
ID: up13 22.2-5