Practice Problems for Common exam 3 (Chapter 12 sect. 1-7 Chapter 16 Sect. 1-5, 7 Chapt 17 Sect.1-2 Chapt. 18 Sect. 1-7 Chapter 19 Sect.1-5,7
Common Exam 3 – April 27

1. The intensity at a distance of 4.0 m from a source that is radiating equally in all directions is 9.85 x 10^{-7} W/ m^2. What is the intensity level in dB at a distance of 6 m?

A) 17.8 dB
B) 20.0 dB
C) 26.5 dB
D) 32.2 dB
E) 56.4 dB

$P = I*4\pi R^2 = 9.85x10^{-7} *4\pi 4^2 = 1.98x10^{-4}W$

$I = \frac{P}{4\pi R^2} = \frac{1.98x10^{-4}}{4\pi 6^2} = 4.37x10^{-7}$ $\beta = 10dB\log\frac{4.37x10^{-7}}{10^{-12}}$ 56.4 dB

2. The intensity of a certain sound wave is 2x10^{-7} W/m^2. If its intensity is raised by 30 decibels, what is the new intensity in W/m^2?

A) 6x10^{-5} W/m^2
B) 5x10^{-4} W/m^{2I}
C) 2x10^{-4} W/m^2
D) 6 x10^{-3} W/m^2
E) 2x10^{-2} W/m^2

$$\beta_2 - \beta_1 = 10dB \log \frac{I_2}{I_1}$$

$$3 = \log \frac{I_2}{I_1} \qquad I_2 = I_1*10^3 = 2x10^{-4}$$

3. A factory siren indicating the end of the shift has a frequency of 80 Hz. What frequency is perceived by the occupant of a car traveling away from the factory at 30 m/s? The speed of the sound is 343 m/s.

A) 73 Hz
B) 79 Hz
C) 85 Hz
D) 89 Hz
E) 120 Hz

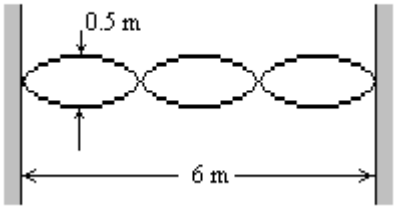
4. A factory siren indicating the end of the shift has a frequency of 82 Hz. If the occupant of a car traveling away from the factory perceives frequency of 76 Hz, what is the speed of the car? The speed of the sound is 343 m/s.

A) 7.7 m/s
B) 17 m/s
C) 25.1 m/s
D) 32 m/s
E)12.4 m/s

5. A 500-Hz whistle is moved toward a listener at a speed of 10.0 m/s. At the same time, the listener moves at a speed of 20.0 m/s in a direction away from the whistle. What is the apparent frequency heard by the listener? (The speed of sound is 340 m/s.)

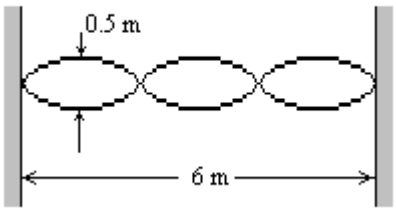
A) 463 Hz
B) 485 Hz
C) 533 Hz
D)547 Hz
E) 562 Hz

6. A standing wave of frequency 45 Hz is set up on a string 6 m long as shown.
What is the speed at which wave propagates on the string?



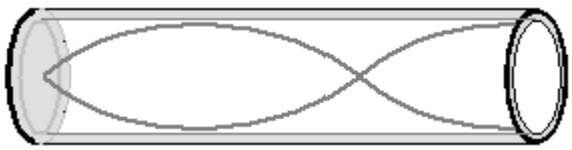
A) 25 m/s
B) 45 m/s
C) 100 m/s
D) 180 m/s
E) 220 m/s

7. A 0.025-kg string stretched with a tension of 43 N between two fixed points 6.0 m apart oscillates according to pattern shown in the figure. What is the frequency of the oscillating string?



A. 6 Hz
B. 12 Hz
C. 18 Hz
D. 25 Hz
E. 80 Hz

8. If an organ pipe shown is to resonate at 370 Hz, what is its required length? v = 343 m/s



A) 70 cm
B) 60 cm
C) 50 cm
D) 40 cm
E) 30 cm

9. An organ pipe, open at both ends, is 2.2 m long. If the velocity of sound in air is 343 m/s, the frequency of third harmonic of this pipe is:

A) 116 Hz
B) 234 Hz
C) 366 Hz
D) 499 Hz
E) 5640 Hz

10. A violin string 20.0 cm long with mass 4.8 g and tension 48 N, fixed at both ends, oscillates in its n=2 mode. What is the wavelength in air of the sound emitted by this vibrating string? (The speed of the sound in air is 343 m/s.)
A) 0.002 m
B) 0.082 m
C) 0.170 m
D) 0.246 m
E) 1.534 m

11. The attractive electrostatic force between the two point charges $4x10^{-6}$ C and Q has a magnitude of 1.77 N when the separation between charges is 25 cm. The sign and magnitude of the charge Q is closest to

A) $+ 3x10^{-6}$ C
B) $-3x10^{-6}$ C
C) $+ 5x10^{-7}$C
D) $-5x10^{-7}$C
E) $+2x10^{-9}$C

12. A 2 mg particle carrying a charge of 4nC is placed in a uniform electric field of magnitude of 100 N/C. Find the particle's acceleration.

A) 0.2 m/s^2
B) 0.85 m/s^2
C) 7.2 m/s^2
D) 80.0 m/s^2
E) 0.0025 m/s^2

13. How many electrons are removed from a metal ball if the ball is to carry a positive charge of 3.2 nC?

A) $5x10^6$
B) $5x10^8$
C) $2x10^{10}$
D) $8x10^2$
E) $2x10^6$

14. Find the magnitude of the electric field in a distance of 2 m from the 6 nC charge.

A) 56 N/C
B) 0.5 N/C
C) 560 N?C
D) 48 N/C
E) 27 N/C

15. Determine the magnitude and direction of the electric field midway between a -8nC and a -6 nC charge 60 cm apart.

A) 200 N/C to the right
B) 200 N/C to the left
C) 1400 N/C to the left
D) 1400 N/C to the right
E) none of the above

16. What is the speed of a proton that has been accelerated from rest through a potential difference of 4.0 kV? (m_p=1.67x10^{-27} kg, e=1.6x10^{-19}C
A) 1.1×10^6 m/s
B) 9.8×10^5 m/s
C) 8.8×10^5 m/s
D) 1.2×10^6 m/s
E) 6.2×10^5 m/s

17. How strong is the electric field between two parallel plates 8 cm apart if the potential difference between them is 50 V
A) 625 V/m
B) 25 V/m
C) 0.52 V/m
D) 1250 V/m
E) 156 V/m

18. When a 1.0-m length of metal wire is connected to a 1.5 V battery, a current of 8.0 mA flows through it. What is the diameter of the wire? The resistivity of the metal is $2.24 \times 10^{-8}\ \Omega \cdot$ m.

A) 12 μm
B) 6.0 μm
C) 24 μm
D) 2.2 μm
E) 45 μm

19. The wiring in a house must be thick enough so it does not become so hot to start a fire. What diameter must a copper wire ($\rho = 1.68 \times 10^{-8}\ \Omega m$) be if it is to carry a maximum current of 30 A and produce no more than 1.6 W of heat per meter of length?

A) 0.025 mm
B) 0.44 mm
C) 3.5 mm
D) 8.4 mm
E) 2.2 cm

20. An electrical heating coil of resistance of 28 Ω is used to heat up a 3.0 kg of water at 20^0C. What is the current in the heating coil if the water warms up to 60^0C in 5 min? (specific heat of water is 4186 J/kg^{0}C)

A) 1.2 A
B) 2.4 A
C) 4.8 A
D) 7.7 A
E) 8.8 A

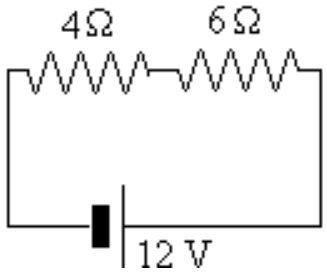
21. A 200-W driveway light bulb is on 10 hours per day. Assuming the power company charges 10 cents for each kilowatt-hour of electricity used, estimate the annual cost to operate the bulb. (1 year = 365 days)
A) $3.65
B) $7.3
C) $36.5
D) $73.00
E) $125

22. What is the resistance of a light bulb that uses an average power of 125 W when connected to **ac** power source with maximum voltage of 250 V?
A) 50 Ω
B) 90 Ω
C) 120 Ω
D)150 Ω
E) 250 Ω

23. An ac voltage of $80V \cdot \sin(377rad/s \cdot t)$ is applied across a resistor of 35 Ω. What is the rms value of the current in this resistor?

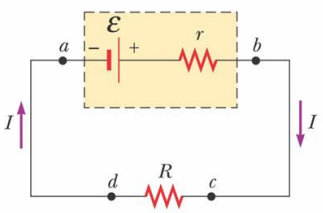
A) 1.62 A
B) 1.12 A
C) 0.85 A
D) 0.05 A
E) 2.8 A

24. The power dissipated in the 6 Ω resistor is:



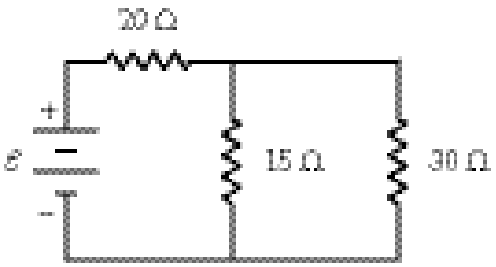
A)2.25W
B)8.64W
C)9.56W
D)12.5W
E)24.0W

25. If the terminal voltage of the 9- V battery connected across 10- Ω resistor R is 8.4 V, what is the internal resistance of the battery?



A) 0. 9 **Ω**
B) 8.0 **Ω**
C) 0.70 Ω
D) 6.4 **Ω**
E) 0.25 **Ω**

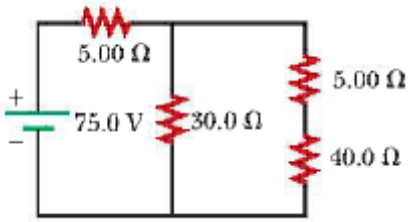
26. If the current in the 15-Ω resistor is 0.2 A, what is emf of the battery V?



A) 9 V
B) 3 V
C) 12 V
D) 5 V
E) 18 V

For the circuit shown
Calculate the current through the battery.

27.



A) 3.26 A
B) 8.64 A
C) 0.96 A
D) 4.25A
E) 1.96A

28. Calculate the power dissipated in the 30 Ω resistor
A) 2.25W
B) 115 W
C) 95 W
D) 12.5W
E) 24.0W