

Review 4

**Waves**

1. Explain, with the help of a sketch, what each of these terms means with respect to waves:

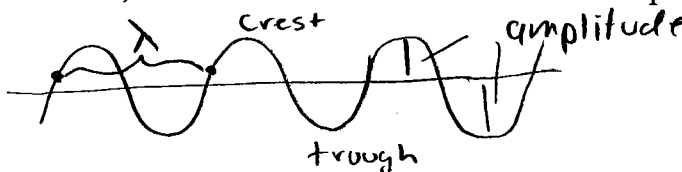
(a) crest;

(b) trough;

(c) wavelength;  $\lambda$

(d) frequency; - # of cycles/sec

(e) amplitude.



2. A dog wags its tail 50 times in 20 s. What are (a) the frequency and (b) the period of vibration of the tail?

$f = \frac{50 \text{ times}}{20 \text{ sec}} = 2.5 \text{ Hz}$        $T = \frac{1}{f} = \frac{1}{2.5} = 0.4 \text{ s}$

3. Explain the difference between refraction and diffraction. Give an example of each phenomenon from everyday experience.

refraction: bend wave when changing speed  
diffraction: bend wave around a barrier

4. When waves slow down on entering a new medium, what happens to

(a) their wavelength? *decrease*

(b) their frequency? and *same*

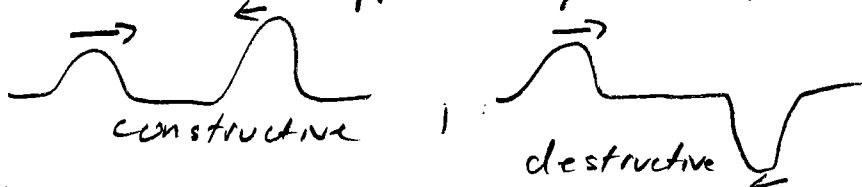
(c) their direction? *bend towards the normal.*

Under what conditions will the direction *not* change? *approaching straight on*

5. What is

(a) constructive interference?

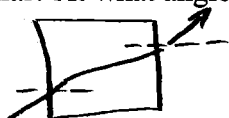
(b) destructive interference?



6. What is the Doppler Effect? What causes it?

*Change in frequency due to motion of source/detector*

7. A beam of light makes an angle of  $35^\circ$  with the normal as it approaches a flat glass block. If the index of refraction of the glass is 1.60, at what angle will the refracted beam enter the glass, relative to the normal? At what angle will the beam leave the other side of the block of glass if the walls are parallel?



$n_1 \sin \theta_1 = n_2 \sin \theta_2$  ,  $\sin \theta_2 = .358$   
 $(1.0) \sin 35^\circ = 1.6 \sin \theta_2$   
 $\theta_2 = 21^\circ$

8. What is the critical angle for a glass that has an index of refraction of 1.52?

*glass to air*  
 $n_1 \sin \theta_1 = n_2 \sin \theta_2$        $1.52 \sin \theta_1 = 1.0 \sin 90^\circ$   
 $\theta_1 = 41^\circ$

9. The critical angle of a liquid is  $45^\circ$ . What is the index of refraction of the liquid?

*liquid to air*  
 $n_1 \sin \theta_1 = n_2 \sin \theta_2$   
 $n_1 \sin 45^\circ = 1.0 (\sin 90^\circ)$   
 $n_1 = 1.41$

10. What phenomena are primarily involved in the making of a rainbow?

A. reflection and refraction

B. reflection and interference

**C. reflection, refraction and dispersion**

D. refraction, interference and diffraction

11. What property of light is used in lenses?

- A. refraction
- B. reflection
- C. diffraction
- D. interference

12. When a prism spreads light into its component colours, what is the phenomenon called?

- A. reflection
- B. diffraction
- C. interference
- D. dispersion

13. Sun tan and sun burn are caused by

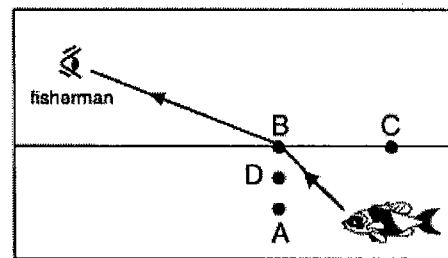
- A. infrared light.
- B. ultraviolet light.
- C. red light.
- D. all visible wavelengths.

14. When light of a certain pure colour enters a new medium at, say,  $30^\circ$ , what property of the light does *not* change?

- A. speed
- B. direction
- C. frequency
- D. wavelength

15. Where should the fisherman aim his spear if the fish, which is not moving, is to be eaten tonight?

- A. At A
- B. At B
- C. At C
- D. At D



16. A beam of light from air enters a liquid at an incident angle of  $35^\circ$ . It refracts at  $25^\circ$  to the normal. What is the **index of refraction** of the liquid?

- A. 0.71
- B. 1.4
- C. 0.74
- D.  $10^\circ$

$$1.0 \sin 35^\circ = n_2 \sin 25^\circ$$

17. Diamond has an index of refraction of 2.42. If light enters from air the diamond at an angle of incidence of  $63.0^\circ$ , at what angle will the light refract?

- A.  $0.3682^\circ$
- B.  $2.42^\circ$
- C.  $21.6^\circ$
- D.  $26.0^\circ$

$$1.0 \sin 63^\circ = 2.42 \sin \theta_2$$

18. Light speed is  $3.00 \times 10^8$  m/s in air. What is its speed in a plastic, whose index of refraction is 1.453?

- A.  $2.06 \times 10^8$  m/s
- B.  $3.00 \times 10^8$  m/s
- C.  $4.36 \times 10^8$  m/s
- D.  $0.484 \times 10^8$  m/s

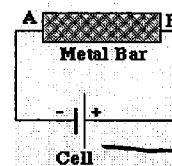
$$n = \frac{V_{vac}}{V_{med}} \Rightarrow 1.453 = \frac{3.0 \times 10^8}{V_{med}}$$

$$V_{med} = \frac{3.0 \times 10^8}{1.453}$$

Circuits

19. What direction would conventional current flow through the metal bar shown below?

- a. up
- b. down
- c. from A to B
- d. from B to A



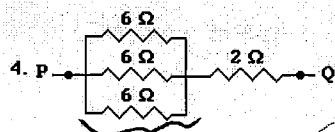
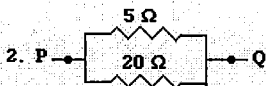
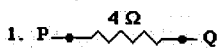
↑ current flows  
+ to - thru  
Circuit

20. Electrical current is described as the....

- a. speed at which electrons flow in a wire.
- b. net charge transfer per unit time.
- c. number of neutrons passing a point every second.
- d. amount of electrical energy flowing in a wire

$$I = \frac{Q}{t}$$

21. Which of the following connections have the same equivalent resistance between points P and Q?



$$\frac{1}{5} + \frac{1}{20} = \frac{4}{20} + \frac{1}{20} = \frac{5}{20} \rightarrow \frac{20}{5} = 4\Omega$$

$$\rightarrow 4\Omega$$

$$\frac{1}{6} + \frac{1}{6} + \frac{1}{6} = \frac{3}{6} \rightarrow \frac{6}{3} = 2\Omega$$

2Ω / 4Ω

- a. Only 1 and 2
- b. Only 1, 2, and 3
- c. Only 1, 2, and 4
- d. 1, 2, 3, and 4

22. What is the resistance of a toaster that uses 4.0 A on a 110 V line?

- a. 440 Ω
- b. 27.5 Ω
- c. 4.0 Ω
- d. 0.036 Ω

$$V = IR$$

$$110V = 4A(R) \quad R = \frac{110}{4} = 27.5\Omega$$

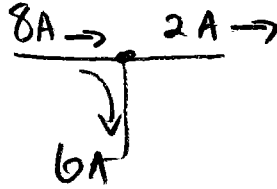
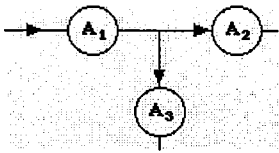
23. What is the resistance of a 110 V appliance that draws 300 mA current?

- a. 367 Ω
- b. 0.37 Ω
- c. 33 Ω
- d. 37 Ω

$$V = IR$$

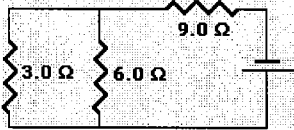
$$110V = (.300A)R \quad R = \frac{110}{.3} = 367\Omega$$

24. Three ammeters are located in an electric circuit as shown. If  $A_1$  reads 8 A and  $A_2$  reads 2 A, what is the reading on  $A_3$ ?



- a. 16 A
- b. 6 A
- c. 5 A
- d. 4 A

25. In the circuit below, the current through the  $3.0 \Omega$  resistor is 1.0 A. What is the current through the  $9.0 \Omega$  resistor?



$V_0$      $I_0$      $R_{eq} = 11 \Omega$   
 $V_1$      $I_1$      $1.5 A$      $R_1 = 9 \Omega$   
 $V_2 = 3V$      $I_2 = 0.5 A$      $R_2 = 6 \Omega$   
 $V_3 = 3V$      $I_3 = 1.0 A$      $R_3 = 3 \Omega$

$\left. \begin{matrix} \\ \\ \\ \end{matrix} \right\} \frac{1}{6} + \frac{1}{3} = \frac{1}{6} + \frac{2}{6} = \frac{3}{6} \rightarrow \frac{6}{3} = 2 \Omega$

- a. 1.0 A
- b. 1.5 A
- c. 2.0 A
- d. 3.0 A

26. The diagram shows two different resistors connected in parallel across a 12.0 V battery. What is the power dissipated by resistor  $R_2$ ?



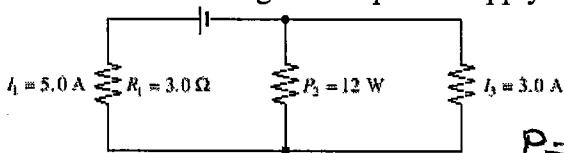
$P = I^2 R$   
 $= (1.5)^2 (8)$

- a. 18 W
- b. 54 W
- c. 81 W
- d. 160 W

$V_0 = 12V$      $I_0$      $R_{eq} = 2.67$   
 $V_1 = 12V$      $I_1 = 3.0$      $R_1 = 4 \Omega$   
 $V_2 = 12V$      $I_2 = 1.5$      $R_2 = 8 \Omega$

$\left. \begin{matrix} \\ \\ \end{matrix} \right\} \frac{1}{4} + \frac{1}{8} = \frac{2}{8} + \frac{1}{8} = \frac{3}{8} \rightarrow \frac{8}{3} = 2.67$

27. What is the voltage of the power supply shown in the diagram?



$P = V \cdot I \rightarrow$

$V_0 = 21V$	$I_0 = 5.0A$	$R_{eq}$	$P_0$
$V_1 = 15V$	$I_1 = 5.0A$	$R_1 = 3.0$	$P_1$
$V_2 = 6V$	$I_2 = 2.0A$	$R_2$	$P_2 = 12W$
$V_3 = 6V$	$I_3 = 3.0A$	$R_3$	$P_3$

- a. 12 V
- b. 19 V
- c. 21 V
- d. 27 V

28. What is the equivalent resistance of a 120 V household circuit which has TWO 150 W and TWO 75 W light bulbs turned on?

$P_{out} = P_{used} = (150 \times 2) + (75 \times 2)$   
 $= 450 W$

$V = I R$   
 $120 = 3.75 (R)$

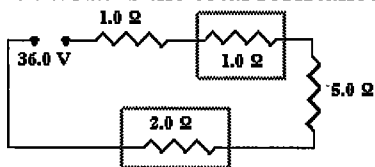
$R = 32 \Omega$

$P_{out} = 450 W = V \cdot I$

$450 W = 120 (I) \quad I = 3.75 A$

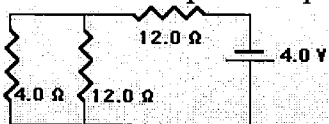
# PHYSICS 11

29. What is the total resistance in the circuit? Complete the V, I, R chart



$V_0 = 36V$   $I_0 = 4A$   $R_{eq} = 9\Omega$   
 $V_1 = 4V$   $I_1 = 4A$   $R_1 = 1\Omega$   
 $V_2 = 4V$   $I_2 = 4A$   $R_2 = 1\Omega$   
 $V_3 = 20V$   $I_3 = 4A$   $R_3 = 5\Omega$   
 $V_4 = 8V$   $I_4 = 4A$   $R_4 = 2\Omega$

30. How much power is produced by the 4.0 Ω resistor? Complete the V, I, R, P chart.

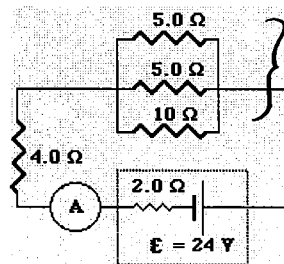


$V_0 = 4V$   $I_0 = .27$   $R_{eq} = 15\Omega$   $P = 1.07W$   
 $V_1 = .8V$   $I_1 = .2A$   $R_1 = 4\Omega$   $P_1 = .16W$   
 $V_2 = .8V$   $I_2 = .07A$   $R_2 = 12\Omega$   $P_2 = .06W$   
 $V_3 = 3.2V$   $I_3 = .27$   $R_3 = 12\Omega$   $P_3 = .85W$

$\frac{1}{4} + \frac{1}{12} = \frac{3}{12} + \frac{1}{12} = \frac{4}{12} \rightarrow \frac{12}{4} = 3\Omega$

31. What is the potential drop across through the 4.0 Ω resistor?

- a. 3 V
- b. 4 V
- c. 12 V
- d. 24 V



**Answers:**

1) See solution sheet, 2) 2.5 Hz, 0.40 s, 3)-6) See solution sheet, 7) 21°, 8) 41°, 9) 1.41, 10) C, 11) A, 12) D, 13) A, 14) C, 15) D, 16) B, 17) C, 18) A, 19) d, 20) b, 21) d, 22) b, 23) a, 24) b, 25) b, 26) a, 27) c, 28) 32Ω, 29) 9Ω, 30) 0.16W, 31) c

$V_0 = 24$	$I_0 = 3A$	$R_{eq} = 8\Omega$
$V_1$	$I_1 = 3A$	$R_1 = 2\Omega$
$V_2 = 12V$	$I_2 = 3A$	$R_2 = 4\Omega$
$V_3$	$I_3$	$R_3 = 5\Omega$
$V_4$	$I_4$	$R_4 = 5\Omega$
$V_5$	$I_5$	$R_5 = 10\Omega$

} 2Ω