YEAR 11 PHYSICS TERM 3 TEST 1. W-85

1. State the laws of reflection. (2)

2. A pulse reaches the boundary of a medium less rigid than the one from which it came. Describe the reflected pulse and all energy changes that occur. (3).

3. A wave meets the boundary of a different medium at an angle. If its velocity increases in this new medium, describe those things that stay the same, and change. (3)

4. What conditions are necessary to produce standing waves? (3)

5. Explain why a noise made outside the door of a room can be clearly heard inside a room. (2)

6. Draw a diagram to show: (a) the 3rd harmonic of an open pipe
(b) the 5th harmonic of a closed pipe. (4)

7. A closed organ pipe is made to resonate to its fundamental frequency of 512 Hz. If the velocity of sound in air is $3{\cdot}40 \times 10^{2}\ ms^{-1}$, calculate the shortest length of pipe necessary. (3)

8. A 3·00m length of pipe 15·0cm in diameter is placed into a pool and submerged. As it is slowly raised out of the water, a $4{\cdot}50 \times 10^{2}$ Hz tuning fork is sounded above it. How many positions of resonance would be heard? (Take velocity of sound = $3{\cdot}40 \times 10^{2}\ ms^{-1}$). (4)

9. A pipe open at both ends and a pipe closed at one end both resonate to a tuning fork of $1{\cdot}70 \times 10^{2}$ Hz. Given that the length of the first pipe is 2·00m, the length of the second pipe is 1·50m, and that the velocity of sound in air is $3{\cdot}40 \times 10^{2}\ ms^{-1}$, determine the mode of ribration in each tube. (4)

TOTAL: 28.

11 PHYSICS TERM 3 TEST 1

1. Laws of reflection: (a) incident angle equals reflected angle
   (b) incident ray, reflected ray and normal are in the same plane. (2)

2. Reflected pulse is upright, and contains little energy. Most energy is transmitted (or absorbed) (2)

3. Frequency remains the same.
   Wavelength increases, and waves are refracted away from the normal. (3)

4. Standing waves: two waves of equal speed, wavelength and amplitude moving in opposite directions through the same medium. (3)

5. The doorway has approximately the same width as the wavelength of the sound, so diffraction occurs inside the room. Also, reflection from hard surfaces inside the room means the sound reaches every part. (2)

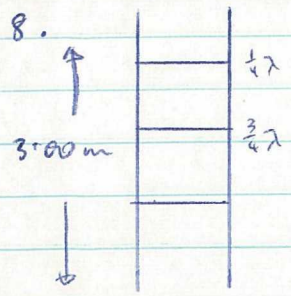
6. (a) 
   3rd harmonic

   (b) 
   5th harmonic (2)

7. 
   $\ell = \frac{1}{4}\lambda$

$$\lambda = \frac{c}{f}$$
$$= \frac{3.40 \times 10^2}{512}$$
$$= 0.6641 \text{ m}$$

∴ shortest length is 0.166 m. (3)

8. 

$$\lambda = \frac{c}{f}$$
$$= \frac{3.40 \times 10^2}{4.50 \times 10^2}$$
$$= 0.7556 \text{ m}$$

∴ 1st position = $\frac{1}{4}\lambda$ = 0.1889 m from the top.

Number positions after the first is given by:

$$\frac{3.00 - 0.1889}{2(0.1889)}$$ since $\frac{1}{2}\lambda$ between positio

$$= 7.44.$$

∴ total number of positions = 7 + 1 (4)

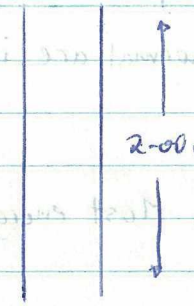
= 8.

9.

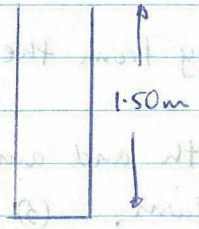
$$\lambda = \frac{c}{\nu}$$

$$= \frac{3.40 \times 10^2}{1.70 \times 10^2}$$

$$= 2.00\ m.$$



Since $\ell = 2.00\ m = \lambda$, then open pipe resonates to its second harmonic.



Since $\ell = 1.50\ m = \frac{3}{4}\lambda$, then the closed pipe resonates to its 3rd harmonic.

(4)

TOTAL: 25

YEAR 11 PHYSICS TERM 3 TEST 2

W-85

1. (a) What is meant by the dual nature of light? (2)

   (b) Why do scientists accept a dual nature for light? Explain fully. (2)

2. Arrange the following in order of increasing frequency: infra-red radiation, X-rays, visible light, gamma rays, ultraviolet radiation. (2)

3. Draw a diagram to show the dispersion of white light by a triangular glass prism. Include the colours that can be seen on a screen placed behind the screen, and state why this dispersion occurs. (4)

4. An object 10·0 cm high is placed 20·0 cm in front of a plane mirror.

   (a) Draw a ray diagram to show where the image is formed. (2)

   (b) Describe the size, nature and position of the image. (3)

5. A child standing 45·0cm in front of a 15·0cm wide plane mirror notices a horizontal line of cars in the mirror. The cars are actually part of a wallpaper pattern on which there are 4 cars per metre. If the wall is 1·35m behind the child, how many cars can the child see in the mirror? (4)

6. A 5·00cm tall object is placed 12·0cm in front of a concave mirror with radius of curvature of 30·0cm.

   (a) Draw a ray diagram to show where the image will be formed. (2)

   (b) Show, by calculation, the size, nature and position of the image. (5)

P.T.O.

7. A pin is set up 30·0 cm in front of a convex mirror. It is found that if a plane mirror is placed between the pin and the convex mirror 20·0 cm from the pin (so that it covers only half the convex mirror) the images of the pin in both mirrors coincide. Find the focal length of the convex mirror. (4)

TOTAL: 30.

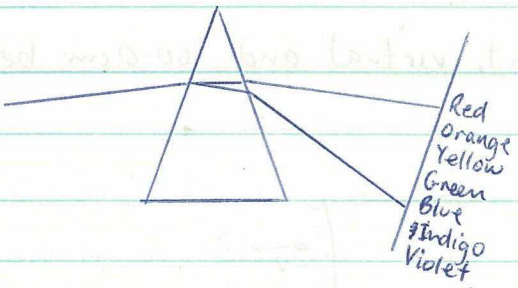
YEAR 11 PHYSICS TERM 3 TEST 2

1. (a) Dual nature: light has properties like waves and particles (2)

(b) Scientists can't totally disprove one theory or the other. Light can be refracted and diffracted like waves, but the photoelectric effect can only be explained by light being particle in nature (or made up of energy packets). (2)

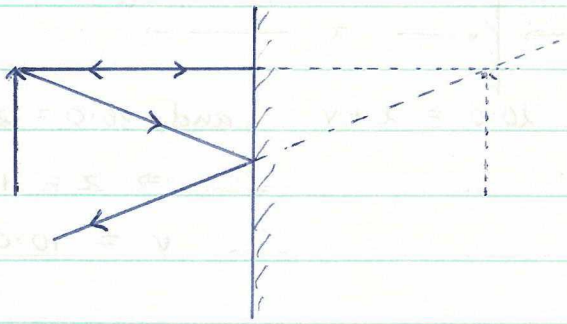
2. infra-red, visible, ultraviolet, X-ray, gamma. (2)

3.



Each light has a different wavelength, and so each, on entering the optically more dense glass, will be refracted differing amounts. Hence dispersion occurs. (4)

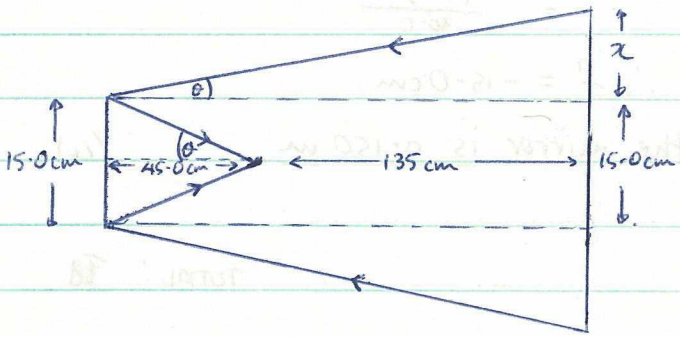
4. (a)



(2)

(b) Image is upright, virtual, 10·0 cm high and 20·0 cm behind the mirror. (2)

5.



$$\tan\theta = \frac{7.50}{45.0} = \frac{x}{180}$$

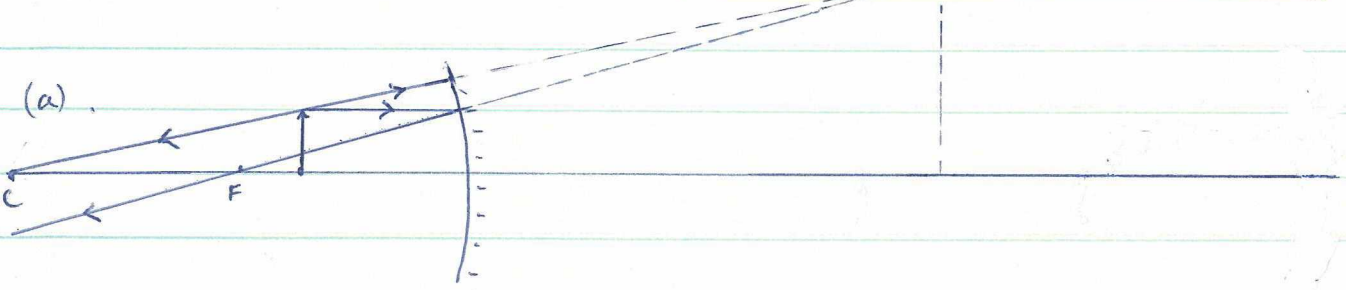
$$\therefore x = \frac{(7.50)(180)}{45.0}$$

$$= 30.0 \text{ cm}.$$

$\therefore$ total width of wall = 75·0 cm

Since 4 cars occur in 1·00 m, he can see 3 cars in the mirror. (4)

6. (a).



(2)

(b) $f = 15.0\,cm$

$u = 12.0\,cm$

$v = ?$

$h_o = 5.00\,cm$.

$$\frac{1}{f} = \frac{1}{u} + \frac{1}{v}$$

$$\Rightarrow \frac{1}{15.0} = \frac{1}{12.0} + \frac{1}{v}$$

$$\Rightarrow \frac{1}{v} = \frac{1}{15.0} - \frac{1}{12.0}$$

$$= \frac{4-5}{60.0}$$

$$= -\frac{1}{60.0}$$

$$\therefore v = -60.0\,cm.$$

$$m = \left|\frac{v}{u}\right| = \frac{h_i}{h_o}$$

$$\Rightarrow \frac{60.0}{12.0} = \frac{h_i}{5.00}$$

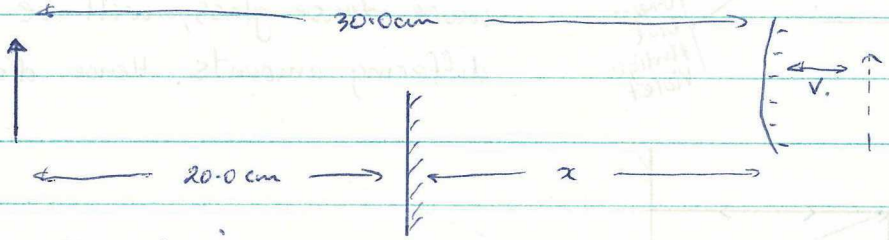
$$\Rightarrow h_i = \frac{(60.0)(5.00)}{12.0}$$

$$= 25.0\,cm.$$

(5)

$\therefore$ image is 25.0 cm high, upright, virtual and 60.0 cm behind the mirror.

7.



From the diagram: $20.0 = x + v$ and $30.0 = 20.0 + x$.

$$\Rightarrow x = 10.0\,cm.$$

$$\therefore v = 10.0\,cm.$$

For the convex mirror:

$$\frac{1}{f} = \frac{1}{u} + \frac{1}{v}$$

$$= \frac{1}{30.0} - \frac{1}{10.0}$$

$$= \frac{1-3}{30.0}$$

$$\therefore f = -15.0\,cm.$$

i.e. the focal length of the mirror is 0.150 m. (4)

TOTAL: 10.

YEAR 11 PHYSICS TERM 3 TEST 3

W-85

Constants to use: velocity of sound (air) = $3.40 \times 10^2 \text{ ms}^{-1}$

1. A narrow vertical tube, open at the top and 1.00m long, is filled with water which is allowed to run out gradually from the bottom. For what positions of the water surface will it be possible to obtain resonance with a tuning fork of 336 Hz? (4)

2. Two open organ pipes of lengths 2.00m and 2.125m respectively, when sounding at their fundamental tones simultaneously, produce 25 beats in 5.00s. Determine the velocity of sound in air and the frequencies of the two notes. (5)

3. Determine the size, nature and position of an image produced when a 3.00cm high object is placed:
   (a) 45.0 cm from a concave mirror of 15.0cm focal length;
   (b) 60.0 cm from a convex mirror of 40.0 cm radius of curvature. (4)

4. Draw ray diagrams for each of the situations in Question 3. (2)

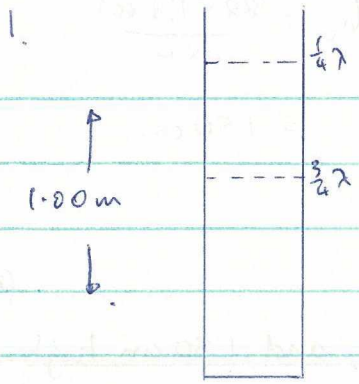
5. A convex mirror and a plane mirror are placed facing each other and 28.0cm apart. Midway between them and on the principal axis of the convex mirror a small luminous object is placed. If the distance between the two images observed on looking in the plane mirror is 24.0cm, calculate the radius of curvature of the convex mirror. (4)

6. A motorist drives along a road between two factories on a still day. Both factories sound their 500 Hz whistles at the same time. If the motorist was driving towards factory A at the time, what would he hear? (Hint: consider how he would hear each note, and remember that both are heard at the same time). (4)

TOTAL: 23

YEAR 11 PHYSICS TERM 3 TEST 3

1.

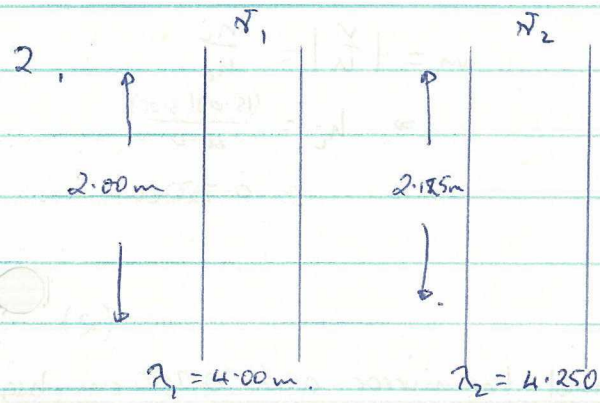


$$\lambda = \frac{c}{\nu}$$
$$= \frac{3.40 \times 10^2}{336}$$
$$= 1.012 \text{ m}.$$

$\therefore$ 1st position is at $\frac{1.012}{4} = 0.253$ m, from the top.

2nd position is at $\frac{3(1.012)}{4} = 0.759$ m from the top. (4)

2.



$$\nu_{beat} = 5 \text{ Hz} = \nu_1 - \nu_2$$
$$\Rightarrow \nu_1 = \nu_2 + 5 \quad \text{— (1)}$$

$\lambda_1 = 4.00$ m. $\lambda_2 = 4.250$ m (since fundamental length $= \frac{1}{2}\lambda$).

Since c is constant for both: $c = \nu_1 \lambda_1 = \nu_2 \lambda_2$

i.e. $(4.00)\nu_1 = (4.250)\nu_2$

Sub for $\nu_1 = \nu_2 + 5$

$$\Rightarrow (4.00)(\nu_2 + 5) = 4.250\,\nu_2$$
$$\Rightarrow 4.00\,\nu_2 + 20.0 = 4.250\,\nu_2$$
$$\Rightarrow \nu_2 = \frac{20.0}{0.250}$$
$$= 80.0 \text{ Hz}.$$

Sub. in (1) $\Rightarrow \nu_1 = 85.0$ Hz.

$$c = \nu_1 \lambda_1$$
$$= (85.0)(4.00)$$
$$= 3.40 \times 10^2 \text{ ms}^{-1}.$$

$\therefore$ velocity of sound is 3.40×10^2 ms^{-1}, $\nu_1 = 85.0$ Hz and $\nu_2 = 80.0$ Hz. (5)

3 (a). $u = 45.0\,cm$

$v = ?$

$f = 15.0\,cm$

$h_o = 3.00\,cm$

$\frac{1}{f} = \frac{1}{u} + \frac{1}{v}$

$\Rightarrow \frac{1}{15.0} = \frac{1}{45.0} + \frac{1}{v}$

$\Rightarrow \frac{1}{v} = \frac{3-1}{45.0}$

$= \frac{2}{45.0}$

$\therefore v = 22.5\,cm$.

$m = \left|\frac{v}{u}\right| = \frac{h_i}{h_o}$

$\Rightarrow h_i = \frac{(22.5)(3.00)}{45.0}$

$= 1.50\,cm$.

(2)

$\therefore$ image is real, inverted, 22.5 cm in front of the mirror, and 1.50 cm high.

(b). $u = 60.0\,cm$

$v = ?$

$f = -20.0\,cm$

$h_o = 3.00\,cm$

$\frac{1}{f} = \frac{1}{u} + \frac{1}{v}$

$\Rightarrow -\frac{1}{20.0} = \frac{1}{60.0} + \frac{1}{v}$

$\Rightarrow \frac{1}{v} = \frac{-3-1}{60.0}$

$= \frac{-4}{60.0}$

$\therefore v = -15.0\,cm$.

$m = \left|\frac{v}{u}\right| = \frac{h_i}{h_o}$

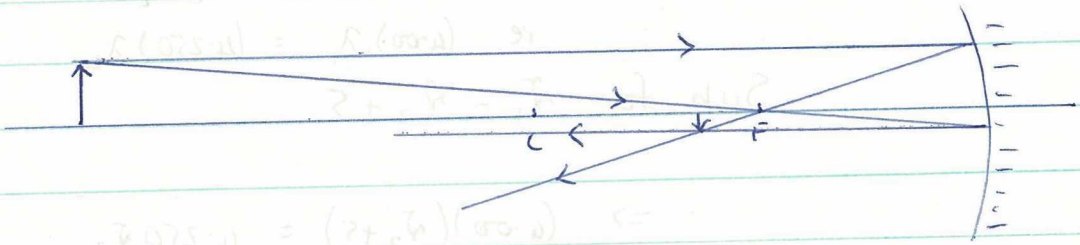
$\Rightarrow h_i = \frac{(15.0)(3.00)}{60.0}$

$= 0.750\,cm$

(2)

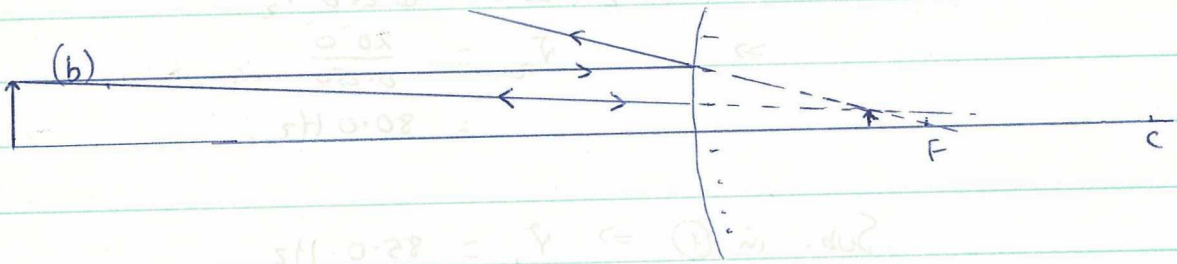
$\therefore$ image is virtual, upright, 15.0 cm behind the mirror and 0.750 cm high.

4. (a).



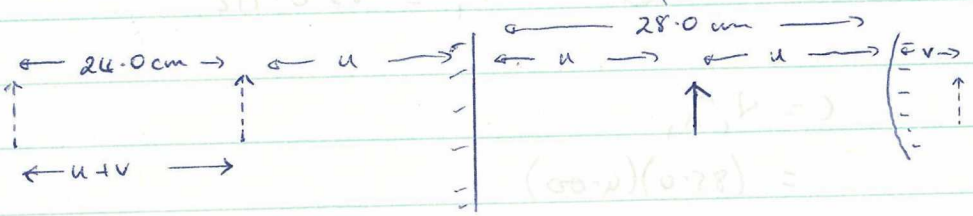
(1)

(b)



(1)

5.



From the diagram: $u + v = 24.0\,cm$ and $2u = 28.0\,cm$

$\therefore u = 14.0\,cm$ and $v = 10.0\,cm$

$\frac{1}{f} = \frac{1}{u} + \frac{1}{v}$

$\Rightarrow \frac{1}{f} = \frac{1}{14.0} - \frac{1}{10.0}$

$= \frac{5-7}{70.0}$

$= -\frac{2}{70.0}$

$\therefore f = -35.0\,cm.$

$\therefore$ radius of curvature $= 70.0\,cm.$ (4)

6. Factory A's whistle sounds a higher pitch, while B's sounds lower; both are due to the Doppler Effect since the observer is moving relative to the observers. Since both are heard at the same time, they form beats. Therefore the observer would hear the amplitude flutter in accordance with the beat frequency. (4)

TOTAL: 23.