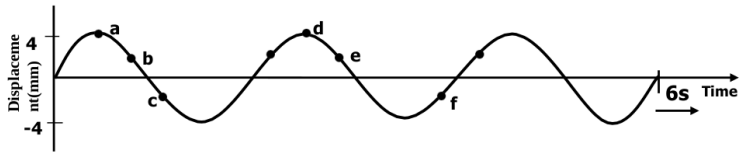
8. Waves I

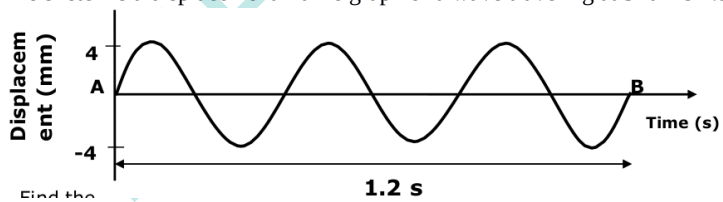
1. Explain the following terms and state their SI units
   (i) Wavelength
   (ii) Amplitude
   (iii) Periodic time
   (iv) Frequency
2. Differentiate between;
   (i) Mechanical and electromagnetic waves. Give an example of each
   (ii) Longitudinal and transverse
3. State ONE difference between mechanical and electromagnet waves.
4. Define the term progressive waves
5. Name two types of progressive wave motion
6. State two differences between sound waves and electromagnetic waves
7. Name a property of light that shows it is a transverse wave.
8. State THREE differences between light waves and sound waves.
9. Explain the term 'phase' as used in waves
10. Water waves are observed as they pass a fixed point at a rate of 30 crests per minute. A particular wave crest takes 2 second to travel between two fixed points 6 m apart. Determine the frequency and the wave length of the wave. ***ANS 6 m***
11. A source generates **40** waves in a second. If the wavelength is **8.5 cm**. Calculate the time taken to reach a wall **102 m** from the source. ***ANS 30 s***
12. ***HERO radio*** broadcasts on a frequency of **60 MHz** and the velocity of its signals is **3 x 10 ^{8} m/s** find the wavelength of radio waves. ***ANS 5 m***
13. Radio **X** is broadcast on wavelength **150 m** at a frequency of **200 kHz**. Calculate the velocity of the radio waves. ***ANS 3.0 x 10^{7} m/s***
14. KASS FM station broadcasts on a frequency of **250 kHz** and the wavelength of its signals is **1200 m**. Calculate
    (i) The speed of radio waves in m/s ***ANS 3.0 x 10^{8} m/s***
    (ii) The wavelength of the signal of another station that broadcasts on a frequency of **200 kHz**. ***ANS 1500 m***
15. A radio wave speed **3 x 10 ^{8} m/s** is transmitted at a wavelength of **2 x 10 $^{-6}$ m**. Calculate its frequency ***ANS 1.5 x 10^{14} Hz***
16. Calculate the wavelength of the KBC FM radio waves transmitted at a frequency of 95.6 Mega Hertz. (V = 3.0 x 10 ^{8} m/s) ***ANS 3.138***
17. Determine the resultant amplitude for two waves out of phase if one wave has an amplitude of **0.5 m** and the other **3.0 m** ***ANS 2.5***
18. One range of frequencies used in broadcasting varies from **5 x 10^{6} Hz** to **2.0 x 10^{7} Hz**. What is the longest wavelength of this range? Velocity of light air **=3 x 10 ^{8} m/ s** ***ANS 60 m***

WAVE PROFILES

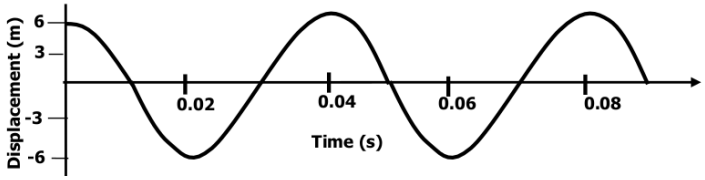
1. The figure below shows a wave profile



   (a) Name **two** sets of points that are
      (i) One wavelength apart
      (ii) In phase
      (iii) Out of phase
   b) Determine the frequency of the wave. ***ANS 0.5 Hz***
2. The sketch is a displacement – time graph of a wave traveling at 320 ms^{-1} .the wave takes 1.2 seconds to move from point **A** to **B**.



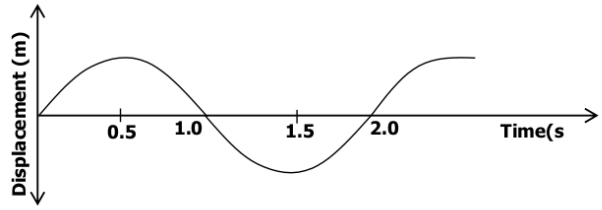
   Find the
      (i) Amplitude ***ANS 4 mm***
      (ii) Frequency ***ANS 2.5 Hz***
      (iii) The wavelength ***ANS 128 m***
3. The Figure below shows a wave profile of moving at a velocity of **150 m/s.**



   Determine:
      (i) Amplitude ***ANS 6 m***
      (ii) Period. ***ANS 0.04 s***
      (iii) Frequency. ***ANS 25 Hz***
      (iv) Wavelength. ***ANS 6 m***

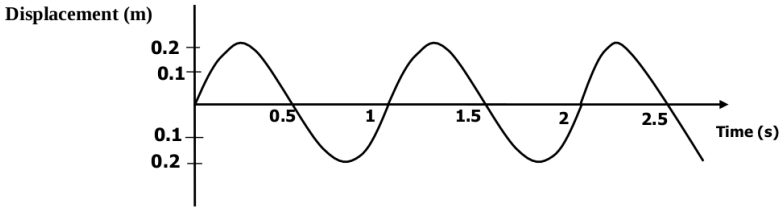
(V) On the same axis of the wave above, sketch a wave with ***half*** the amplitude and ***double*** the period.

4. Determine the frequency of the wave shown below. ***ANS 0.5 Hz***



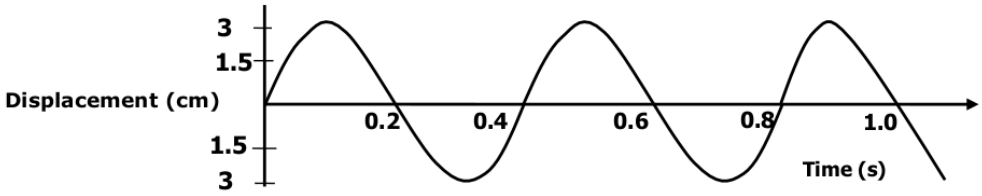
State **one** reason why ultrasound is preferred to audible sound in echo-sounding.

5. Figure below shows how the displacement varies for a certain wave.



Determine the frequency of the wave ***ANS 1 Hz***

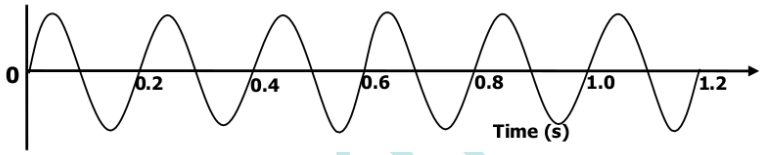
6. The graph below is a displacement – time graph of a wave traveling at **250 m/s**



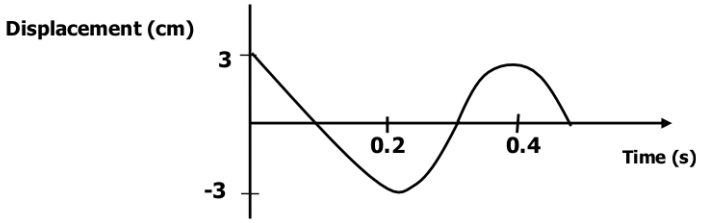
Find the

(ii) Amplitude ***ANS 3 cm***
(iii) Frequency ***ANS 2.5 Hz***
(iii) The wavelength ***ANS 100 m***

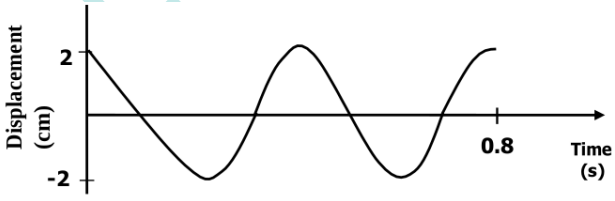
7. The figure below shows a wave profile. The distance between the 2nd and the 4th crest is 60 cm. Determine the velocity of the wave in m/s. ***ANS 1.5 m/s***



8. The fig. shows a wave profile. Determine the frequency of the wave. ***ANS 2.5 Hz***



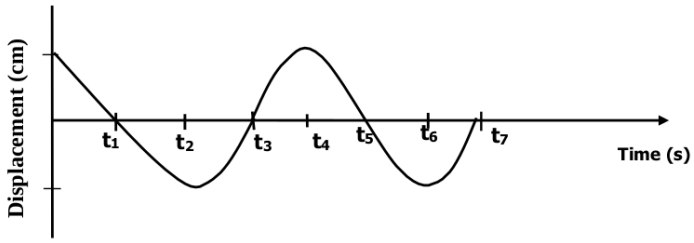
9. The figure below show the displacement time graph of a wave traveling at 400 cm/s.



Determine for the wave the:

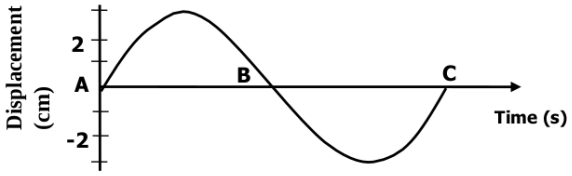
(i) Amplitude ***ANS 2 cm***
(ii) Period ***ANS 0.4 s***
(iii) Frequency ***ANS 2.5 Hz***
(iv) Wavelength ***ANS 1.6 m***

10. a) Figure below shows a wave profile for a wave whose frequency is 4 Hz



Determine the value of t_5 (s) *ANS 0.3125 s*

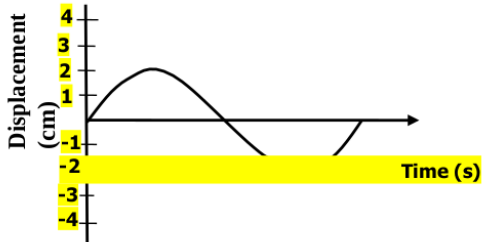
b) Fig below shows a wave of water ripples



i) What is the amplitude of its wave *ANS 2 cm*

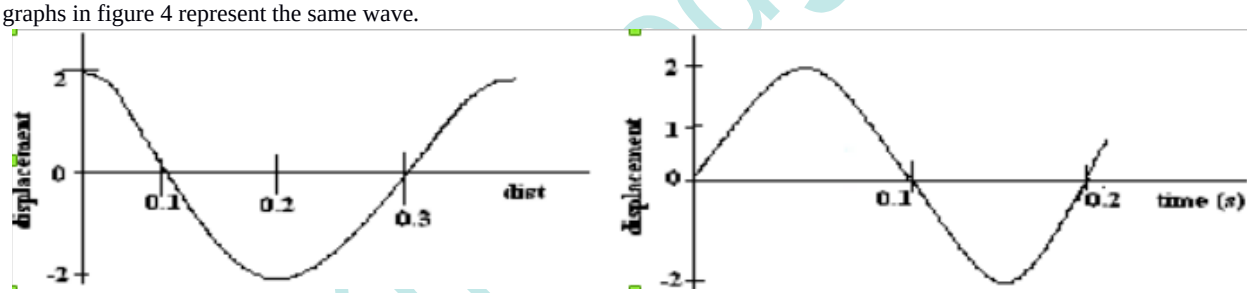
ii) If the speed of the ripple is 30 cms $^{-1}$ and the distance A to B is 3 cm, find the periodic time of the wave *ANS 0.2 s*

11. Fig below shows the displacement – time graph for a certain wave.



Sketch on the same axes, a wave of both frequency and amplitude double that of the wave.

12. The graphs in figure 4 represent the same wave.



Determine the velocity of the wave. *ANS 2.0 m/s*

13. Sketch a displacement-time graph of a wave of amplitude 0.5 cm and frequency 4 Hz over a time interval of 1.25 s

14. Figure shows air molecules in front of a hollow, wooden box B set vibrating by a tuning fork.

i) State the reason of mounting the tuning fork on the box which is open at one end

ii) What is the name given to this kind of wave?

iii) What are the sections **X** and **Y** called?

(iv) A wave front takes 0.03 seconds to travel from X to Z. The velocity of sound in air is 330 m/s. Calculate:

(a) the frequency of wave produced. *ANS 100 Hz*

(b) the wavelength of the wave. *ANS 3.30 m*

15. The figure below shows sound waves in air produced by a vibrating tuning fork. R is an air molecule on the path of the waves.

i) Using a line, indicate on the diagram a distance **d** equal to one wavelength of the wave.

ii) In the space provided below, show with an arrow the direction of motion of the air molecule **R** as the waves pass.

iii) Explain the reason for the answer (ii)

16. The figure below shows a longitudinal wave that takes 0.32 s to move from point X to Y and at a speed of 50 m/s.

(a) Show on the wave a region of

(i) Rarefaction

(ii) Compression

(b) Calculate

(i) the frequency of the wave ***ANS 12.5 Hz***

(ii) the wavelength of the wave ***ANS 4 m***

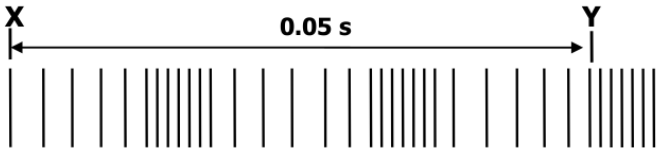
17. The figure below shows a longitudinal wave that takes 0.5 s to move from point A to B and at a speed of 36 m/s.

Calculate

(i) The frequency of the wave ***ANS 5 HZ***

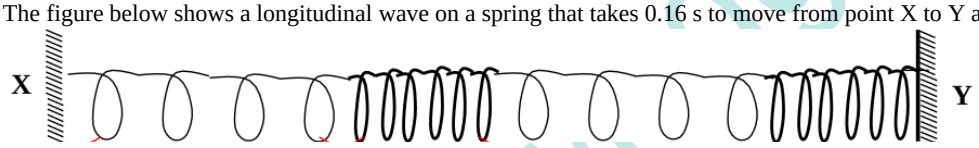
(ii) The wavelength of the wave ***ANS 7.2 m***

18. The figure below shows a longitudinal wave on a spring that takes **0.05 s** to move from point **X** to **Y**.



Calculate the frequency of the wave. ***ANS 50 Hz***

19. The figure below shows a longitudinal wave on a spring that takes 0.16 s to move from point X to Y and at a speed of 80 m/s.



(a) Show on the wave a region of

i) Rarefaction

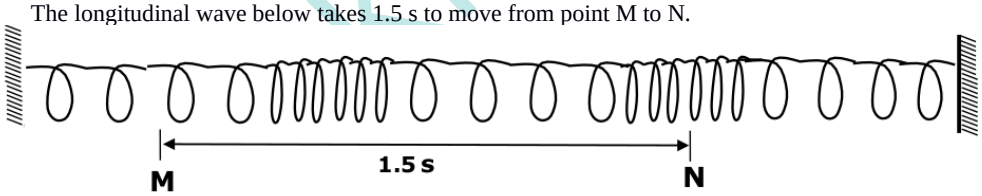
ii) Compression

b) Calculate

i) the frequency of the wave ***ANS 12.5 Hz***

ii) the wavelength of the wave ***ANS 6.4 m***

20. The longitudinal wave below takes 1.5 s to move from point M to N.



Calculate

(i) The frequency of the wave ***ANS 1 Hz***

(ii) The speed of the wave if it has a wavelength of 60 cm ***ANS 0.60 m/s***