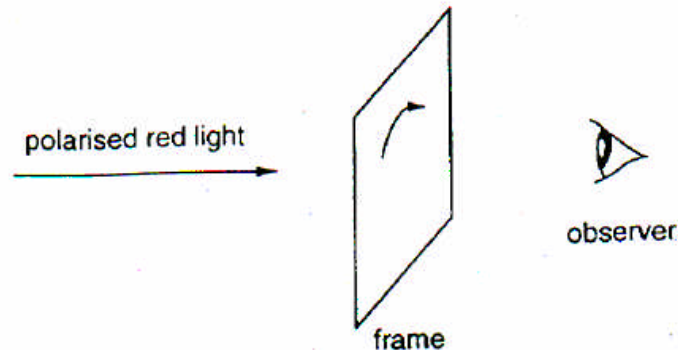


Chapter 3
Multiple choice and quick questions

1.



An observer looks through a frame at a source of polarised red light. The light appears dim. When the frame is rotated through 90° , with the plane of the frame always perpendicular to the direction of the incident light, the light appears brighter.

Which one of **A** to **E** below is mounted in the frame?

- A** a diffraction grating
- B** a single piece of Polaroid ✓
- C** two “crossed” pieces of Polaroid
- D** a narrow slit
- E** a red filter

2. If all you are told about a certain kind of wave motion is that the waves are *transverse*, which of the following *must* also be true?

- 1. It can be polarised
- 2. It is electromagnetic
- 3. It can travel through a vacuum.

A 1, 2 and 3 **B** 1 and 2 **C** 2 and 3 **D** 1 only ✓

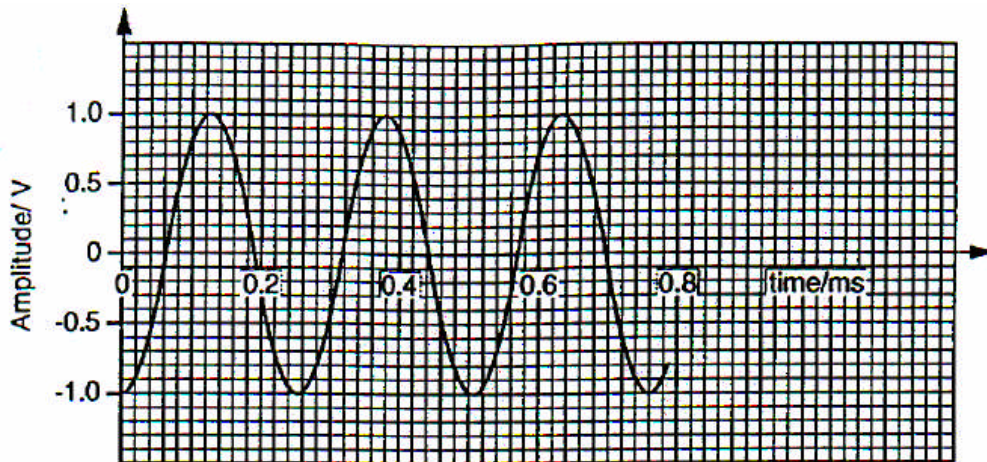
3. Here is a list of things involving oscillations.

- 1. the tide at London Bridge
- 2. the alternating mains voltage in your home
- 3. a pendulum 1 metre long
- 4. ultraviolet light
- 5. a note about the middle of the piano

Which one of the following sequences correctly places them in order of increasing frequency?

A 13254 ✓ **B** 13524 **C** 13542 **D** 13245 **E** 12354

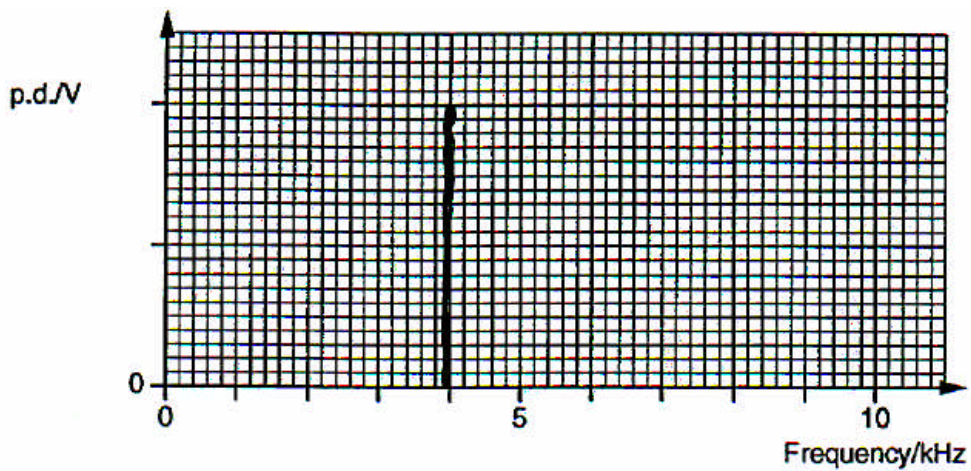
4. The diagram shows a signal in the form of a pure sine wave.



- (i) Explain what is meant by the **frequency spectrum** of a signal.

The spectrum (range) of frequencies required to define and synthesise the signal.

- (ii) Sketch the frequency spectrum of the signal.



$$f = \frac{1}{T} = \frac{1}{0.25 \times 10^{-3}} = 4000 = 4 \text{ kHz}$$

5. In testing railway lines for faults an ultrasonic probe is placed on a rail, as shown in Fig. 1.

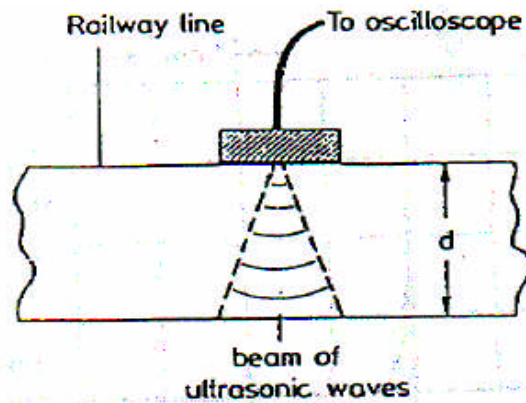


Fig. 1

The probe, which acts as both emitter and receiver, is connected to an oscilloscope. The probe emits short bursts of ultrasonic radiation of frequency 3.0 MHz each millisecond. The speed of this radiation in steel is 6000 m s^{-1} . The trace (Fig. 2) is obtained with the emitted pulse appearing on the left of the screen.

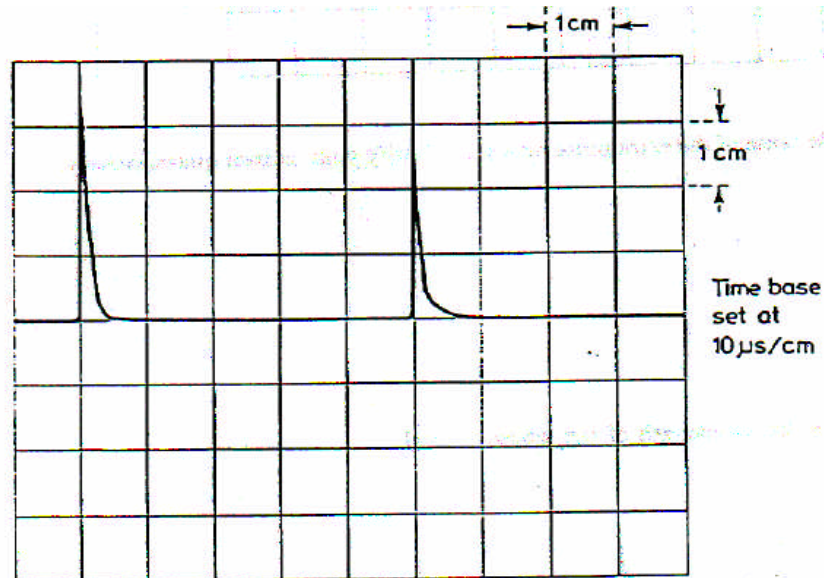


Fig. 2

Making a measurement from the diagram of the screen, calculate the depth, d , of the rail.

$$\begin{aligned} \text{time to travel } 2d &= 5 \times 10^{-6} \text{ s} \\ &= 5 \times 10^{-5} \text{ s} \end{aligned}$$

distance = speed x time

$$d = 6000 \times \frac{5 \times 10^{-5}}{2}$$

$$d = 15 \times 10^{-2} \text{ m} = 15 \text{ cm}$$