1. A lamp and a horn are turned on simultaneously. A person standing 240 metres away measures a time interval of 0.75 s between seeing the flash and hearing the sound. Calculate the speed of sound.

2. An explosion in Dundee could be heard in St Andrews, a distance of 20 km away, one minute later. Use this information to work out the speed of sound.

3. During the school sports, the timekeeper in the 80 m hurdles stands at the finishing line and starts his stopwatch on hearing the starting pistol. Calculate what error there will be in his measurement of the time for the race. Assume the speed of sound to be 340 m/s and ignore the timekeeper's reaction time.

4. A lighthouse sends out a flash of light and a siren blasts at the same instant. A person on a ship hears the blast 10 s after seeing the flash. How far is the ship from the lighthouse?

5. A boy standing 500 m from a cliff face fires a pistol with one hand, and at the same instant starts a stopwatch with the other hand. He stops the watch when he hears the echo of the shot. The watch reads 3 s. What is the speed of sound?

6. An observer stands 100 m from a low building which has a taller building 40 m behind it. When the observer shouts he hears two echoes of his shout. He hears one echo 0.25 s after the other. What value can be calculated for the speed of sound?

7. A girl stands 525 m from a cliff and claps her hands. If she hears the echo 3 s later, what value does she calculate for the speed of sound?

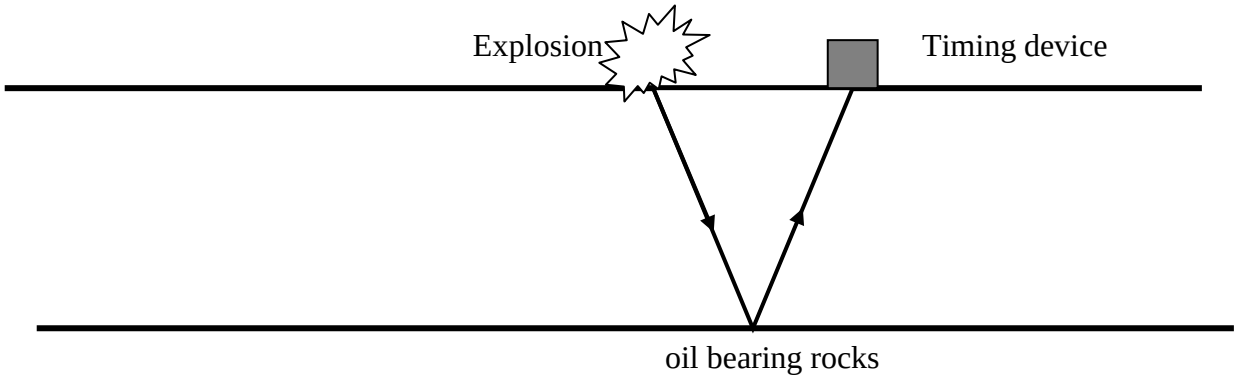
8. A ship is using an echo-sounding depth detector. If a pulse of sound takes 0.4 s to travel to the seabed and back, calculate the depth of the sea. Take the speed of sound in sea water to be 1500 m/s.

9. A girl watching a thunderstorm counts 10 s between the lightning flash and the thunder. If the speed of sound in air is 340 m/s, how far away is the storm?

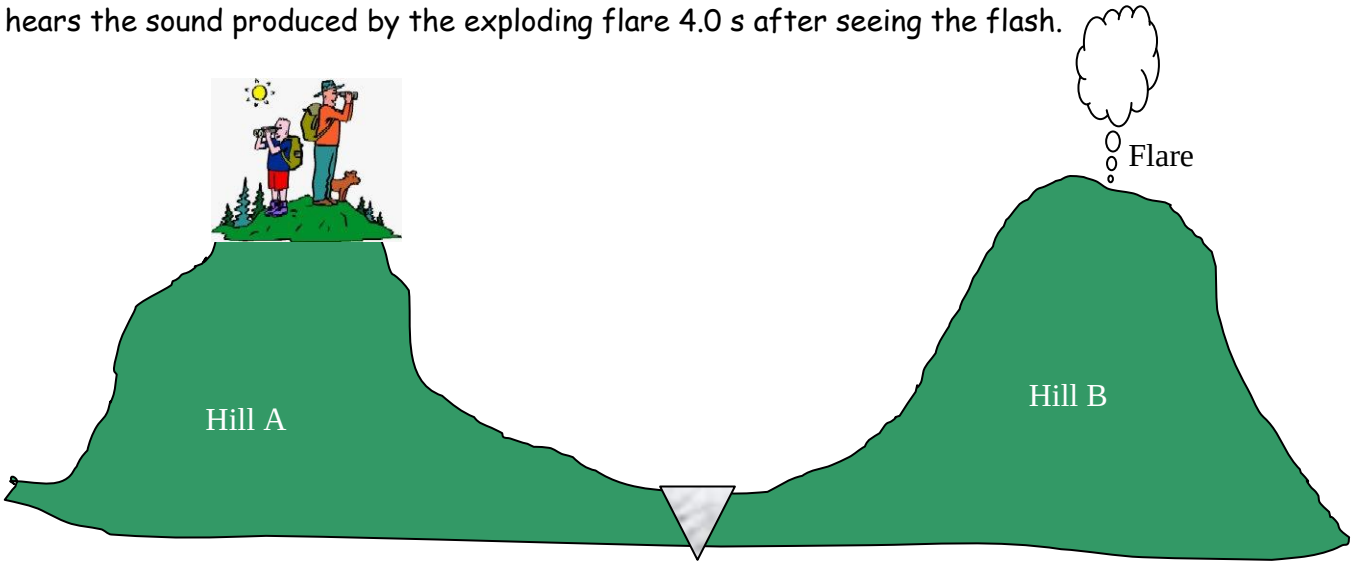
10. A pulse of sound from a ship's echo-sounding transmitter travels down through the sea water at a speed of 1500 m/s. The seabed beneath the ship is solid and the sea is 600 m deep. How long does it take the pulse to return to the ship?

11. A trawler using an echo-sounder detects a shoal of fish. If the note from the echo-sounder is received 0.2 s after it was sent, how deep was the shoal of fish? The speed of sound in water is 1400 m/s.

12. A geologist can determine the possible position of oil bearing rocks by causing a small explosion on the Earth's surface and then timing the return of the reflected pulse from the oil bearing rocks. A time interval of 2.4 s is recorded between the explosion and the arrival of the reflected pulse. If the average speed of sound in the Earth is 1800 m/s, what is the depth of the rock from which the pulse is reflected?



13. A mountaineer standing on hill A sees an emergency flare explode above hill B. The mountaineer hears the sound produced by the exploding flare 4.0 s after seeing the flash.



(a) explain why there is a delay

(b) If the speed of sound in air is 340 m/s, estimate the distance between the two summits.

14. During a medical examination, a doctor used pulses of ultrasound. If the ultrasound pulses passed through the soft body tissues and were reflected from a bone 150 mm below the patient's skin, how long did it take for the sound pulses to return to the detector? Assume the speed of sound in soft body tissues to be 1600 m/s

15. In a clap-echo experiment, a girl stood 200 m away from a wall and clapped with a steady rhythm so that she heard the echoes in between the claps. Her partner measured ten time intervals between claps. If the time for ten time intervals was 24 s, what value for the speed of sound in air is given by these results?