

How waves carry energy without matter

Grade 7 science (Year 8 · Class 7) · Worksheet

Name: _____ Date: _____ Class: _____

These problems train you to describe waves and to use frequency, period, wavelength and speed. You will read values from diagrams and graphs, convert units, rearrange $v = f \times \lambda$ and explain why waves move energy but not matter. They suit Grade 7 science students, Year 8 learners and Class 7 pupils, and they follow the NGSS idea that a wave model describes energy transfer.

Level: Grade 7 science (Year 8 · Class 7) · **Curriculum:** MS-PS4-1

Problem 1 Parts of a wave (easy)

Mei in Singapore is describing waves in her notebook.

1. State what the wavelength of a wave means.
2. State the unit of frequency.
3. Name the kind of wave that has compressions and rarefactions.

Problem 2 Transverse or longitudinal? (easy)

Decide whether each wave is transverse or longitudinal.

1. A ripple spreading on Lake Victoria.
2. The sound of a drum travelling through air.
3. A wave sent along a skipping rope by flicking it up and down.
4. A pulse sent along a spring by pushing the end forwards and backwards.

Problem 3 Counting waves at a pier (easy)

Kofi stands on a pier in Accra and counts 45 waves passing a post in 90 s.

1. Write the formula for frequency.
2. Calculate the frequency in hertz.

Problem 4 From frequency to period (easy)

A vibrating guitar string has a frequency of 5.0 Hz when plucked gently.

1. Write the relation between period and frequency.
2. Calculate the period in seconds.

Problem 5 Converting units (easy)

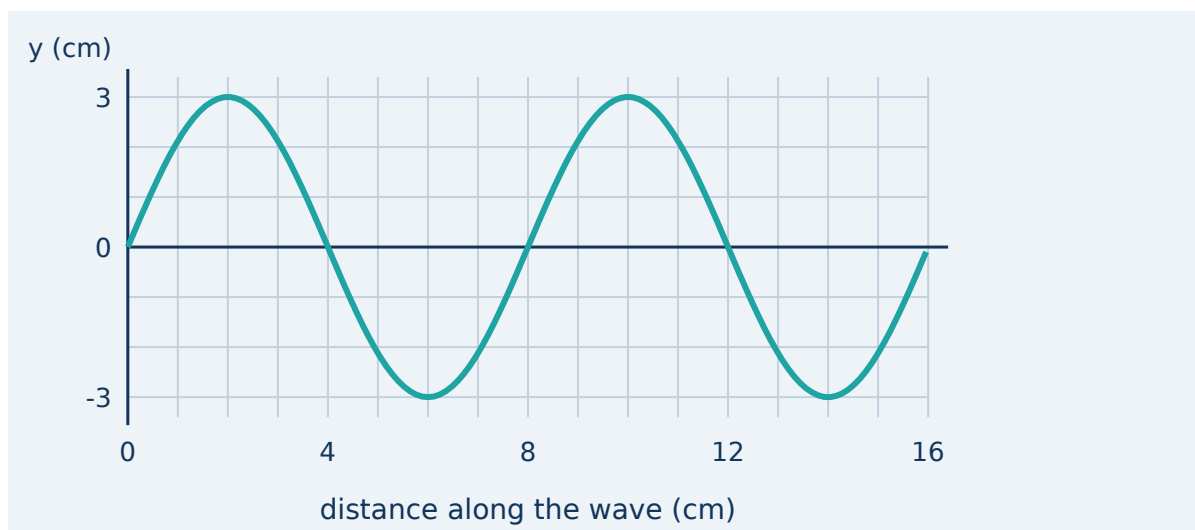
Convert each value.

1. 2.5 kHz into Hz
2. 40 cm into m
3. 0.8 m into cm

Problem 6 Reading a wave on a grid (easy)

The figure shows a wave on a centimetre grid.

1. Read the amplitude.
2. Read the wavelength.
3. Count the complete waves shown.



A wave drawn on a centimetre grid.

Problem 7 Speed of a rope wave (medium)

Aarav in Pune shakes a rope. The waves have a frequency of 5.0 Hz and a wavelength of 0.30 m.

1. Write the wave speed equation.
2. Calculate the speed of the waves.

Problem 8 Wavelength of a sound (medium)

A tuning fork in Leeds makes a note of frequency 680 Hz. Sound travels at 340 m/s in the classroom air.

1. Rearrange $v = f \times \lambda$ to find λ .
2. Calculate the wavelength.

Problem 9 Finding the frequency (medium)

Waves in a harbour in Lagos travel at 3.0 m/s and have a wavelength of 1.5 m.

1. Rearrange $v = f \times \lambda$ to find f .
2. Calculate the frequency.
3. Calculate the period.

Problem 10 The cork that stays put (medium)

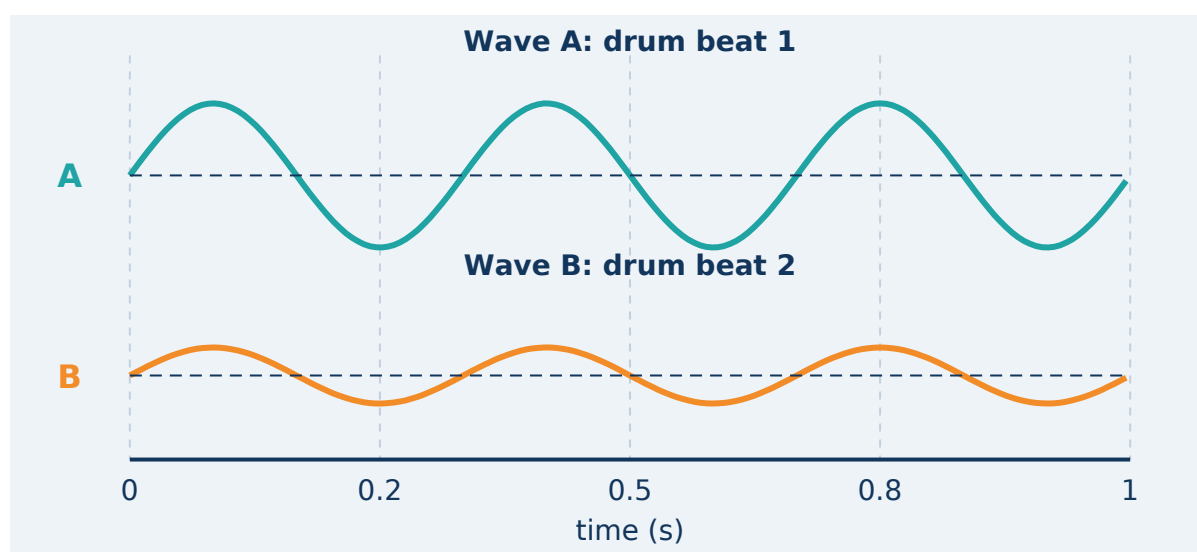
Diego drops a cork into a pool in Texas and then makes ripples. The cork bobs up and down but stays almost in the same place while the ripples spread to the edge.

1. Explain why the cork does not travel with the ripples.
2. State what the ripples do carry to the edge of the pool.

Problem 11 Loud and soft drum beats (medium)

The figure shows the vibrations from two drum beats of the same frequency.

1. State which wave has the larger amplitude.
2. State which beat is louder.
3. Explain which wave carries more energy.

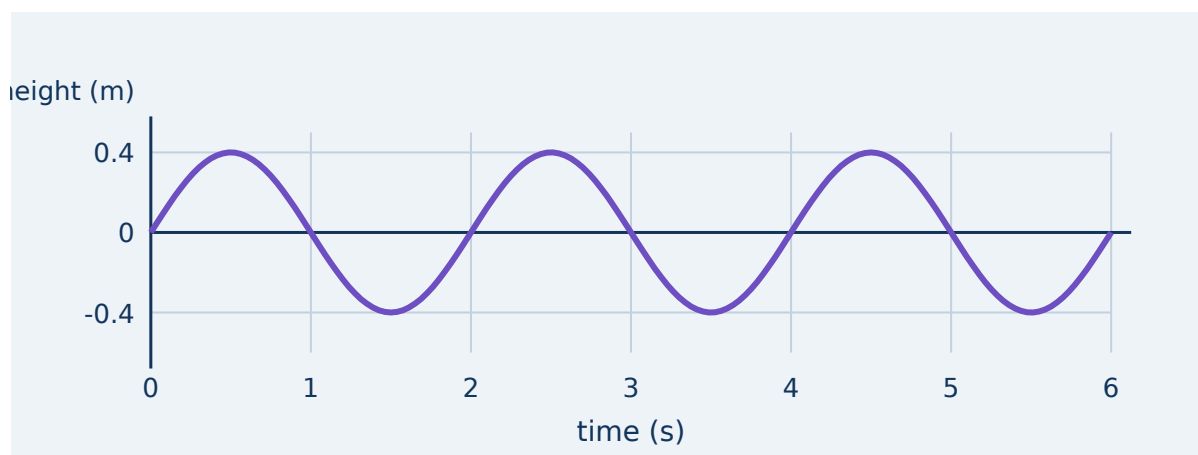


Two drum beats drawn at the same time scale.

Problem 12 The bobbing buoy (medium)

The figure shows the height of a buoy in the sea against time.

1. Read the amplitude in metres.
2. Read the period in seconds.
3. Calculate the frequency.



Height of a buoy against time.

Problem 13 Spot the mistakes (medium)

Chiamaka writes two claims about waves:

1. A wave with a frequency of 3 Hz is 3 m long.
2. An ocean wave carries water from the middle of the sea to the beach.

Explain what is wrong with each claim.

Problem 14 Pulses along a spring (medium)

Wanjiru in Nairobi sends compressions along a spring. The compressions are 12 cm apart and 5 compressions pass a mark in 2.0 s.

1. Calculate the frequency.
2. Convert the wavelength to metres.
3. Calculate the wave speed.

Problem 15 Doubling the frequency (medium)

Waves travel along a stretched rope at 2.4 m/s. Bilal in Lahore shakes it at 3.0 Hz and then at 6.0 Hz.

1. Calculate the wavelength at 3.0 Hz.
2. Calculate the wavelength at 6.0 Hz.
3. Describe what happens to the wavelength when the frequency doubles at constant speed.

Problem 16 Waves at Mombasa (hard)

Emma counts 12 wave crests passing a post in 20 s at a beach in Mombasa. The distance between neighbouring crests is 5.0 m.

1. Calculate the frequency.
2. Calculate the wave speed.
3. Calculate how long a crest takes to travel 120 m.

Problem 17 Earthquake waves (hard)

An earthquake sends fast P waves (longitudinal, 6.0 km/s) and slower S waves (transverse, 3.5 km/s) through the rock. A seismometer in Kathmandu is 2100 km from the source.

1. Calculate the arrival time of the P waves.
2. Calculate the arrival time of the S waves.
3. Calculate the gap between the two arrivals in minutes and seconds.

Problem 18 Checking a data table (hard)

Students measure wave speed on a rope with a constant tension.

f (Hz)	λ (m)
2.0	1.20
4.0	0.60
5.0	0.48
8.0	0.36

1. Calculate $f \times \lambda$ for each row.
2. Identify the row that does not fit.
3. Calculate the λ that the row should have shown.

Problem 19 Pitch and wavelength (hard)

Two tuning forks make sound at the same loudness: fork A at 256 Hz and fork B at 512 Hz. Sound travels at 340 m/s.

1. State which fork has the higher pitch.
2. Calculate the wavelength of each note to 2 decimal places.
3. Explain what you notice about the wavelengths when the frequency doubles.

Problem 20 Ocean swell (hard)

A storm 45 km from the coast sends a long swell to a beach in Cornwall. The swell has a wavelength of 60 m and a period of 8.0 s.

1. Calculate the frequency.
2. Calculate the speed of the swell.
3. Calculate the time for the swell to reach the beach, in minutes.