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IGCSE PHYSICS 0625 · TOPICAL PAST PAPERS

General Wave Properties — Paper 1

Worked Answer Key (Multiple Choice)

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General Wave Properties — Paper 1 · Worked Answer Key

These are **Megalecture worked answers** for the topical multiple-choice compilation on **General Wave Properties (IGCSE Physics 0625, Paper 1)**. Every answer below was solved from first principles by the Megalecture team. Calculations use the standard wave relations $v = f\lambda$ and $T = 1/f$, together with the rules of reflection, refraction and diffraction, applied to the data given in each question. Remember the key idea for refraction: when a wave crosses a boundary its **frequency stays the same**, while its **speed and wavelength change together**. Use this key to mark your work and to see the one-line reasoning behind each correct letter.

Part A · Wave Speed, Frequency & Wavelength

Q #	Exam reference	Answer	Brief working / reason
1	M/J 11 P11 Q20	D	From the graphs λ = 2.0 cm (distance graph) and T = 0.04 s (time graph). v = λ/T = 2.0 / 0.04 = **50 cm/s**.
2	M/J 12 P11 Q21	A	v = fλ rearranged gives f = v/λ. With speed c and wavelength λ, f = **c/λ**.
3	M/J 12 P12 Q21	A	Frequency = waves per second, so waves per minute = f × 60 = **2 × 60** = 120.
5	M/J 13 P11 Q18	A	v = fλ must equal 10 000 Hz. Check pairs: 330 × 0.033 gives 10 000. Only row **A** (speed 330 m/s, λ 0.033 m) works.
21	M/J 18 P12 Q26	C	f = c/λ = (3.0×10^8) / 0.15 = **2.0×10^9 Hz**.
25	M/J 20 P12 Q30	C	f = 12 waves / 10 s = 1.2 Hz. First crest to third crest = 2 wavelengths = 60 cm, so λ = 30 cm. v = fλ = 1.2 × 30 = **36 cm/s**.
27	M/J 22 P11 Q19	D	T = 6.0 s (one crest every 6.0 s). Crest to adjacent trough = ½λ = 4.5 m, so λ = 9.0 m. v = λ/T = 9.0 / 6.0 = **1.5 m/s**.
33	O/N 14 P11 Q19	A	v = distance/time = 1300 / 4.0 = 325 m/s. λ = v/f = 325 / 13 000 = **0.025 m**.
44	O/N 20 P11 Q26	D	f = c/λ = (3.0×10^8) / 0.10 = **3.0×10^9 Hz**.

Part B · Wave Diagrams, Amplitude & Wavefronts

Q #	Exam reference	Answer	Brief working / reason
8	M/J 14 P11 Q22	A	f = 50 Hz so T = 1/50 = 0.020 s. A compression and the next rarefaction are ½ cycle apart, so time = ½T = **0.010 s**.
13	M/J 16 P11 Q19	A	

Q #	Exam reference	Answer	Brief working / reason
			A wavefront is **a line joining all points on the same crest** (points vibrating in phase).
14	M/J 16 P11 Q20	**D**	On a longitudinal wave one wavelength is the distance between adjacent compressions. The dense (compressed) coils sit at W, Y and Z; adjacent compressions Y and Z are exactly one wavelength apart → **Y and Z**.
16	M/J 16 P12 Q22	**C**	Wavelength = distance from one compression to the next compression. That centre-to-centre spacing is shown by length **C**.
19	M/J 17 P12 Q27	**D**	Original: amplitude 4 mm, λ = 8 cm. Twice amplitude = 8 mm; half frequency at the same speed means double wavelength = 16 cm (one full wave across the 16 cm axis). Graph **D**.
20	M/J 18 P11 Q26	**A**	Sound is longitudinal, so a molecule oscillates back and forth **along** the direction of travel (horizontally) and returns to its start after one period → diagram **A**.
24	M/J 20 P12 Q29	**B**	Amplitude = ½ × (peak − trough) = ½ × (74 − 6) = **34 cm**.
31	O/N 12 P12 Q21	**A**	Reflected circular wavefronts behave as if they came from the image of the vibrator — the same distance behind the surface as the vibrator is in front. That image point is at position **A**.
32	O/N 13 P11 Q19	**D**	For a transverse water wave the floating ball oscillates up and down (vertically) about its rest level → diagram **D**.
36	O/N 16 P11 Q22	**A**	Amplitude = crest height above the rest line = **Q**; wavelength = crest-to-crest distance = **P**. (R is peak-to-trough = 2 × amplitude; S is ½λ.)
37	O/N 17 P11 Q18	**B**	The 4.0 cm arrow runs from the rest line to a crest = amplitude = 4.0 cm. The 5.0 cm spans one trough = ½λ, so λ = **10 cm** → row **B** (4.0, 10).
42	O/N 19 P12 Q22	**A**	Amplitude is the maximum displacement from rest, i.e. **half the vertical distance between a trough and a peak**.
43	O/N 19 P12 Q23	**D**	Wavefronts from a point source are circular (statement 2) and are always perpendicular to the direction of energy movement (statement 4) → **2 and 4**.

Part C · Transverse & Longitudinal Waves; Energy Transfer

Q #	Exam reference	Answer	Brief working / reason
6	M/J 13 P12 Q22	**D**	Energy is carried by wave motion in **ripples passing across water in a ripple tank**. (Conduction, electron flow and convection are not wave transfer.)

Q #	Exam reference	Answer	Brief working / reason
7	M/J 13 P12 Q24	B	Sound is longitudinal; radio, infra-red and a side-shaken rope are transverse. So **a sound wave in a solid** is longitudinal.
10	M/J 14 P12 Q25	B	The number of waves passing a fixed point per second is the definition of **frequency**.
12	M/J 15 P12 Q24	B	A wave transfers energy but not matter; the ball bobs in place. So **energy is transferred in the wave direction but water is not**.
17	M/J 17 P11 Q26	A	Of the choices only **sound waves in water** are longitudinal; UV, X-rays and surface water waves are transverse.
22	M/J 19 P11 Q23	C	Gamma rays, light and X-rays are EM (transverse). Only **ultrasound waves** are longitudinal.
28	M/J 22 P12 Q27	B	A sound wave is longitudinal; point X lies where the molecules are spread out, which is a **rarefaction** → **longitudinal, rarefaction**.
29	O/N 11 P11 Q23	A	A source of sound makes a longitudinal wave. Pushing the spring along its length sends compressions and rarefactions along the coils → diagram **A**.
35	O/N 16 P11 Q21	C	Light is an EM wave (transverse); sound is longitudinal → **light transverse, sound longitudinal**.
38	O/N 17 P11 Q19	D	The wave travels E–W but the ground vibrates N–S — vibration perpendicular to travel — so it is a **transverse** wave.
39	O/N 17 P11 Q19	A	In a longitudinal sound wave, **all particles on one line move in the same direction at the same time**. (Compression to adjacent rarefaction is ½λ, not λ.)
40	O/N 18 P12 Q18	B	Crests passing a point per second is the definition of **frequency**.
41	O/N 18 P12 Q22	C	Speed is the horizontal distance a crest travels each second → **the speed is the horizontal distance travelled per second by a peak**. (Amplitude is ½ the peak-to-trough height; λ is crest-to-crest, not crest-to-trough.)
45	O/N 20 P11 Q30	C	Sound is a mechanical longitudinal wave: **an oscillation of particles parallel to the direction of travel** of the wave energy.
48	O/N 21 P11 Q18	B	Amplitude = **the maximum distance a particle moves from its equilibrium position**.

Part D · Reflection, Refraction & Diffraction

Q #	Exam reference	Answer	Brief working / reason
4	M/J 13 P11 Q17	C	Entering the glass block the water becomes shallower, so the wave slows. Frequency is set by the dipper and is unchanged → **frequency remains the same, speed decreases**.

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Q #	Exam reference	Answer	Brief working / reason
9	M/J 14 P11 Q23	C	At refraction frequency is unchanged; v = fλ means speed and wavelength both change → **frequency stays the same; wavelength and speed change**.
11	M/J 15 P11 Q21	D	Going from deep to shallow water the wave slows; with f fixed, λ = v/f also falls → **speed and wavelength** decrease.
15	M/J 16 P12 Q17	D	Refraction changes **speed and wavelength** while frequency stays constant.
18	M/J 17 P12 Q26	A	Region P is the deep water (waves wider apart and faster). So in P the wavelength is **larger** and the speed is **faster** than in shallow Q → row **A**.
23	M/J 19 P12 Q25	A	The boat only gains energy, so the wave loses energy: the property that changes is the **amplitude**. (Frequency, speed and wavelength are unchanged.)
26	M/J 21 P11 Q20	A	Deep → shallow: the wave slows (speed decreases) but frequency is fixed by the source → **speed decreases, frequency stays constant**.
30	O/N 12 P11 Q21	A	The incoming plane waves bounce off the barrier and overlap the incident set at the same spacing — this is **waves being reflected**.
34	O/N 15 P11 Q19	D	Reflection does not change the medium, so both the **speed and the wavelength stay the same** → row **D**.
46	O/N 20 P12 Q24	B	Light passing from air into glass slows down; frequency is unchanged and, since v = fλ, the wavelength shortens → **the speed of the light waves decreases**.
47	O/N 21 P11 Q17	A	In the slower region the waves bunch up (shorter wavelength) and then return to the original spacing in the faster region; frequency stays constant throughout → side-view **A** (close-spaced in the middle, normal at both ends).
49	O/N 21 P11 Q19	B	Moving into shallow water the wave slows → **the speed of the wavefront decreases** (and so does the wavelength; frequency is unchanged).
50	O/N 21 P12 Q22	B	Refraction needs a transverse wave changing speed at a boundary: **light waves from an object entering a magnifying glass**. (Ultrasound is longitudinal; water hitting a barrier is reflection.)

Note from Megalecture. These are original Megalecture worked solutions prepared for revision use. Keep the golden rule in mind: at every reflection and refraction the **frequency never changes** — only the speed and wavelength can. These answers were solved independently from first principles using $v = f\lambda$ and $T = 1/f$.