

STUDYNEST | CLASS 11 PHYSICS QUESTION PAPER 1

Chapter 14: Waves

Maximum Marks: 40 | Suggested time: 60 minutes

Instructions: Answer all questions. Show calculation steps and units. Original practice paper, not an official examination.

Section A 1-mark questions - $8 \times 1 = 8$ marks

1. Transverse oscillation relative to wave travel? [1]
2. Sound in air type? [1]
3. Wave speed relation? [1]
4. Wave number k ? [1]
5. Superposition principle? [1]
6. Reflection at fixed end? [1]
7. Beat frequency? [1]
8. What is amplitude? [1]

Section B 2-mark questions - $6 \times 2 = 12$ marks

9. $f=50\text{Hz}$, $\lambda=2\text{m}$: speed? [2]
10. $v=340\text{m/s}$, $f=170\text{Hz}$: wavelength? [2]
11. 256Hz and 260Hz beats? [2]
12. Wavelength halves at fixed speed: frequency? [2]
13. Reflection at free end: inversion? [2]
14. Wave $y=A \sin(kx-\omega t)$ travels which way? [2]

Section C 3-mark questions - $4 \times 3 = 12$ marks

15. $v=24\text{m/s}$, $\lambda=.8\text{m}$: f and period? [3]
16. Displacements $+3\text{ cm}$ and -1 cm overlap: resultant? [3]
17. 300Hz and 304Hz : beat frequency and period? [3]
18. How do waves transfer energy without permanent medium transport? [3]

Section D 4-mark questions - $2 \times 4 = 8$ marks

19. Wave travels 12m in $.4\text{s}$ with $f=5\text{Hz}$: speed/wavelength? [4]
20. Explain beats for 440Hz and 442Hz . [4]

End of question paper.

FORMULA AND EQUATION REFERENCE

Chapter-specific equations and relations

- Wave speed $v=f\lambda$; period $T=1/f$; angular frequency $\omega=2\pi f$; wave number $k=2\pi/\lambda$.
 - Progressive wave travelling in $+x$: $y=A\sin(kx-\omega t)$; travelling in $-x$: $y=A\sin(kx+\omega t)$.
 - For a string with tension F and linear density μ , wave speed $v=\sqrt{F/\mu}$.
 - Beat frequency $f_b=|f_1-f_2|$; beat interval $T_b=1/f_b$.
 - Superposition: resultant displacement is the algebraic sum of individual displacements.
 - For a fixed end, reflected pulse is inverted; for an ideal free end, it is not inverted.
 - Wave energy travels through the medium while particles oscillate about equilibrium; they do not undergo permanent net transport.
- Use equations only when their assumptions apply; keep units consistent.

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STEP-BY-STEP SOLUTIONS

Concept questions are answered directly; numerical problems show the governing equation and substitution.

Question 1

Principle / definition: Identify the physical quantity or law asked for, then apply the chapter definition.

Apply it here: Perpendicular.

Final answer: Perpendicular.

Question 2

Principle / definition: Identify the physical quantity or law asked for, then apply the chapter definition.

Apply it here: Longitudinal.

Final answer: Longitudinal.

Question 3

Principle / definition: Identify the physical quantity or law asked for, then apply the chapter definition.

Apply it here: $v = f\lambda$.

Final answer: $v = f\lambda$.

Question 4

Principle / definition: Identify the physical quantity or law asked for, then apply the chapter definition.

Apply it here: $2\pi/\lambda$.

Final answer: $2\pi/\lambda$.

Question 5

Principle / definition: Identify the physical quantity or law asked for, then apply the chapter definition.

Apply it here: Resultant displacement is the algebraic sum.

Final answer: Resultant displacement is the algebraic sum.

Question 6

Principle / definition: Identify the physical quantity or law asked for, then apply the chapter definition.

Apply it here: Pulse is inverted.

Final answer: Pulse is inverted.

Question 7

Principle / definition: Identify the physical quantity or law asked for, then apply the chapter definition.

Apply it here: $|f_1 - f_2|$.

Final answer: $|f_1 - f_2|$.

Question 8

Principle / definition: Identify the physical quantity or law asked for, then apply the chapter definition.

Apply it here: Maximum displacement from equilibrium.

Final answer: Maximum displacement from equilibrium.

Question 9

Working: $v = f\lambda = 50(2) = 100$ m/s.

Final answer: 100 m/s.

Question 10

Working: $\lambda = v/f = 340/170 = 2$ m.

Final answer: 2 m.

Question 11

Working: Beat frequency $= |f_1 - f_2| = |260 - 256| = 4$ Hz.

Final answer: 4 Hz.

Question 12

Working: At fixed wave speed $v = f\lambda$. If λ is halved, frequency must double to keep v constant.

Final answer: Doubles.

Question 13

Working: At an ideal free end, the reflected pulse is not inverted; it returns with the same displacement sense.

Final answer: No.

Question 14

Working: The phase is $kx - \omega t$. A point of constant phase satisfies $x = (\omega/k)t + \text{constant}$, which moves toward increasing x , so the wave travels in $+x$.

Final answer: $+x$ direction.

Question 15

Working: $f=v/\lambda=24/0.8=30$ Hz. Period $T=1/f=1/30=0.0333$ s.

Final answer: 30Hz; 1/30s.

Question 16

Working: By superposition, resultant displacement= $(+3\text{ cm})+(-1\text{ cm})=+2\text{ cm}$.

Final answer: +2 cm.

Question 17

Working: Beat frequency= $|304-300|=4$ Hz. Time between beats $T_b=1/f_b=1/4=0.25$ s.

Final answer: 4 Hz; .25 s.

Question 18

Working: The medium's particles oscillate locally about equilibrium. Their interactions pass the disturbance and energy along the medium, while particles do not travel permanently with the wave.

Final answer: Particles oscillate locally while the disturbance propagates.

Question 19

Working: Wave speed $v=\text{distance}/\text{time}=12/0.4=30$ m/s. Wavelength $\lambda=v/f=30/5=6$ m.

Final answer: 30m/s; $\lambda=6\text{m}$.

Question 20

Working: Beat frequency= $|442-440|=2$ Hz. Loudness rises and falls twice per second due to alternating constructive and destructive interference.

Final answer: Alternating loudness occurs at 2 beats per second.

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