Waves, sound and light: Transverse pulses and waves

Practice test and memo

Practice test
Mark allocation: 40 marks
Time allocation: 40 minutes
Refer to the formula sheet at the end of the test.

1. Four options are provided as possible answers to the following questions. Each question has only one correct answer. Write only the letter (A-D) next to the question number.

1.1 A transverse wave is a wave in which the disturbance of the medium is _____ to the direction of the propagation of the wave. **(2)**
   A. Proportional
   B. Inversely proportional
   C. Perpendicular
   D. Parallel

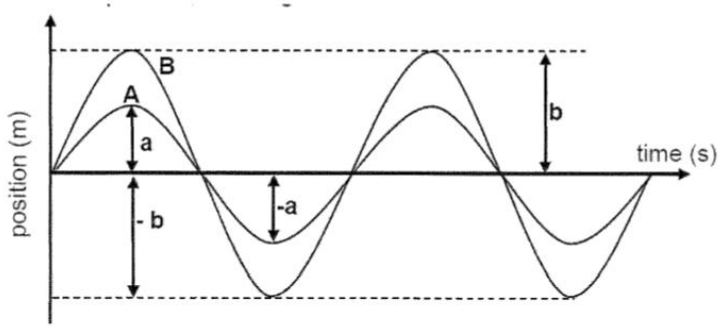
1.2 The relationship between period and frequency is: **(2)**
   A. Proportional
   B. Inversely proportional
   C. Opposite
   D. Unrelated

1.3 A wave generator produces straight, parallel waves in a shallow tank of water. As the frequency of vibration of the generator increases, which characteristic of the wave will always decrease? **(2)**
   A. Amplitude
   B. Wavelength
   C. Speed
   D. Energy

1.4 A wave generator produces straight, parallel waves in a shallow tank of water. As the frequency of vibration of the generator increases, which characteristic of the wave will never change? **(2)**
   A. Amplitude
   B. Wavelength
   C. Speed
   D. Energy

1.5 The distance between two consecutive crests in a wave is 8 cm. If two complete waves pass a point in 1 s, then the velocity of the wave is: **(2)**
   A. 16 $cm.s^{-1}$
   B. 8 $cm.s^{-1}$
   C. 4 $cm.s^{-1}$
   D. 1.25 $cm.s^{-1}$

2. The diagram below shows two waves, A and B, of the same wavelength but different amplitudes crossing each other. The amplitude of wave A is 1.5 m, while the amplitude of wave B is 3 times the amplitude of wave A.



2.1 Define the term amplitude. **(2)**
2.2 Draw the shape of the resulting wave, showing the resulting amplitude, as the two waves, A and B, cross each other. **(2)**
2.3 State and define the wave principle illustrated. **(3)**
2.4 What type of interference is represented? **(1)**

3. The distance between 19 consecutive crests of a transverse wave is 720 mm while the time it takes from one crest to the next crest is 5 s.
3.1 Define the wavelength of the wave. **(2)**
3.2 Calculate the wavelength of the wave? **(3)**
3.3 Define the frequency of the wave. **(2)**
3.4 Calculate the frequency of the wave? **(3)**
3.5 Calculate the speed of the propagation of the wave. **(3)**

4. A transverse wave passing through a uniform medium has a wavelength of 0.06 meters and a frequency of 0.01 kilohertz.
4.1 Calculate the speed of the wave. **(4)**
4.2 Calculate the period of the wave **(2)**
4.3 The frequency of the wave is doubled. Will the wavelength increase, decrease or stay the same? **(1)**
4.4 What will be the value of the new wavelength? Provide an explanation. **(2)**

TABLE/*TABEL* 1: PHYSICAL CONSTANTS/*FISIESE KONSTANTES*

NAME / *NAAM*	SYMBOL / *SIMBOOL*	VALUE / *WAARDE*
Acceleration due to gravity *Versnelling as gevolg van gravitasie*	g	9,8 $m{\cdot}s^{-2}$
Speed of light in a vacuum *Spoed van lig in 'n vakuum*	c	$3,0 \times 10^{8}$ $m{\cdot}s^{-1}$
Planck's constant *Planck se konstante*	h	$6,63 \times 10^{-34}$ J.s
Charge on electron *Lading op elektron*	e^-	-1.6×10^{-19} C

TABLE/*TABEL* 2: FORMULAE / *FORMULES*

MOTION / *BEWEGING*

$v_f = v_i + a\Delta t$	$\Delta x = v_i\Delta t + \frac{1}{2}a\Delta t^2$	$v_f^2 = v_i^2 + 2a\Delta x$	$\Delta x = \left(\frac{v_f + v_i}{2}\right)\Delta t$

WEIGHT AND MECHANICAL ENERGY / *GEWIG EN MEGANIESE ENERGIE*

$F_g = mg$	$U = E_p = mgh$	$E_k = \frac{1}{2}mv^2$	$E_m = (E_k + E_p)_i = (E_k + E_p)_f$

WAVES, LIGHT AND SOUND / *GOLWE, LIG EN KLANK*

$v = f\lambda$	$T = \frac{1}{f}$	$E = hf$ $\quad E = h\frac{c}{\lambda}$
$\Delta x = v\Delta t$	$n = \frac{c}{v}$	$c = f\lambda$

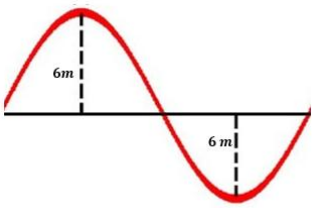
ELECTRICITY AND MAGNETISM / *ELEKTRISITEIT EN MAGNETISME*

$I = \frac{Q}{\Delta t}$	$V = \frac{W}{Q}$	$R = \frac{V}{I}$	$Q = \frac{Q_1 + Q_2}{2}$
$\frac{1}{R_p} = \frac{1}{R_1} + \frac{1}{R_2} + \ldots$	$R_s = R_1 + R_2 + \ldots$	$n = \frac{Q}{e}$	

Practice test memo

1.
1.1 C✓✓
1.2 B✓✓
1.3 B✓✓
1.4 C✓✓
1.5 A✓✓

2.
2.1 The distance of the maximum disturbance of the medium from the equilibrium (rest) position✓✓
2.2 Shape✓ amplitude✓



2.3 Superposition✓ When two pulses occupy the same space at the same time, the resulting pulse is the algebraic sum of the two amplitudes✓✓
2.4 Constructive✓

3.
3.1 The distance between any two successive points that are in phase (e.g. crest to crest or trough to trough)✓✓
3.2 18 cycles in 720×10^{-3} m (one mark for conversion)✓
$\frac{720\times10^{-3}}{18}$✓ $= 0.04\ m$✓
3.3 The number of cycles (e.g. successive crests or successive troughs) that pass a given point in one second✓✓
3.4 $f = \frac{1}{t}$✓
$f = \frac{1}{5}$✓
$f = 0.2\ Hz$✓

3.5 $v = \frac{\lambda}{t}$✓
$v = \frac{0.04}{5}$✓
$v = 0.008\ m.s^{-1}$✓
Or
$v = \lambda f$
$= 0.04 \times 0.2$
$= 0.008\ m.s^{-1}$

4.
4.1 0.01 kHz = 0.01×10^3 Hz or 10 Hz (one mark for conversion)✓
$v = \lambda f$✓
$v = (0.06)(10)$✓
$v = 6m.s^{-1}$✓

4.2 $t = \frac{1}{f}$✓
$t = \frac{1}{10}$✓
$t = 0.1\ s$✓

4.3 Decrease✓
4.4 If frequency is doubled from 10 Hz to 20 Hz, then the wavelength will be halved from 0.06 m to 0.03 m✓
This is because frequency and wavelength are inversely proportional✓