LIMPOPO
PROVINCIAL GOVERNMENT
REPUBLIC OF SOUTH AFRICA

DEPARTMENT OF
EDUCATION

NATIONAL SENIOR CERTIFICATE

GRADE 10

PHYSICAL SCIENCES

CONTROL TEST 1

17 MARCH 2025

MARKS: 100
TIME: 2 hours

This question paper consists of 12 pages and 2 data sheets.

INSTRUCTIONS AND INFORMATION:

Read the following instructions carefully before answering the questions.

1 Write your name and surname on the ANSWER BOOK.
2 This question paper consists of 7 questions. Answer ALL the questions in the ANSWER BOOK
3 Start EACH question on a NEW page in the ANSWER BOOK.
4 Number the answers correctly according to the numbering system used in this question paper.
5 Leave ONE line between two sub-questions, e.g. between QUESTION 2.1 and QUESTION 2.2.
6 You may use a non-programmable calculator.
7 You may use appropriate mathematical instruments.
8 You may use appropriate mathematical instruments.
9 Round off your FINAL numerical answers to a minimum of TWO decimal places.
10 Give brief motivations, discussions, etc. where required.
11 You are advised to use the attached DATA SHEETS.
12 Write neatly and legibly

QUESTION 1: MULTIPLE CHOICE QUESTIONS

Four options are provided as possible answers to the following questions. Each question has only ONE correct answer. Write down only the letter (A – D) next to question number (1.1 – 1.7) in the answer book. For example, 1.10 D

1.1. The frequency of a wave is defined as the…

A. Lowest point on a wave
B. Time taken for one complete wave
C. Number of complete waves per second
D. Number of points in phase in a wavelength (2)

1.2. When two waves' crests overlap, the increase in amplitude is due to…

A. Cancellation
B. Two waves in phase
C. Destructive interference
D. Constructive interference (2)

1.3. A tuning fork is made to vibrate by striking it gently on a rubber stopper. The sound waves produced are…

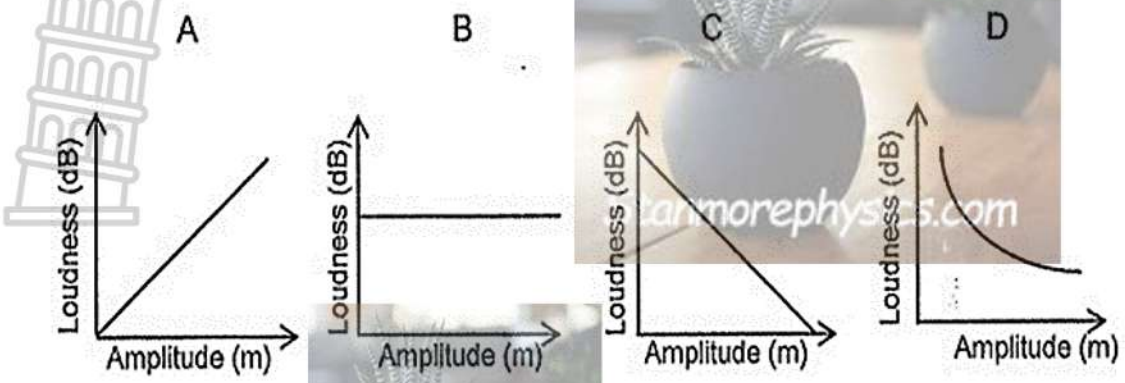
A. Transverse waves and requires a medium of propagation
B. Transverse wave and do not require a medium of propagation
C. Longitudinal waves and requires a medium of propagation
D. Longitudinal waves and do not require a medium for propagation (2)

1.4. A wave in which the particles of the medium vibrate at right angles to the path which the wave travels through the medium, is produced by…

A. a bat.
B. a car's hooter.
C. an ambulance.
D. an X -ray machine.

(2)

1.5. Which ONE of the graphs below best describes the relationship between loudness and the amplitude of a wave?

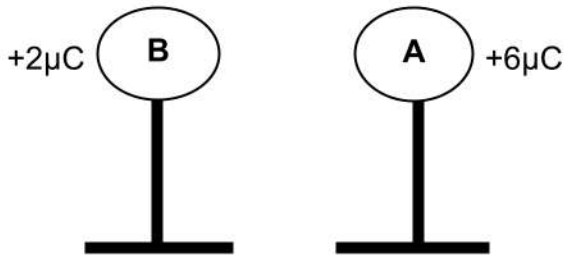


(2)

1.6. A negative charged plastic comb is brought close to, but does not touch a small piece of paper. If the comb and the paper are now attracted to each other, then the original charge on the paper was…

A. positive only.
B. negative only.
C. negative or neutral.
D. positive or neutral. (2)

1.7. Two identical spheres **A** and **B** placed on insulated stands, carry charges of +2μC and +6μC, respectively as shown below



In which direction do electrons move when the spheres are brought into contact*?

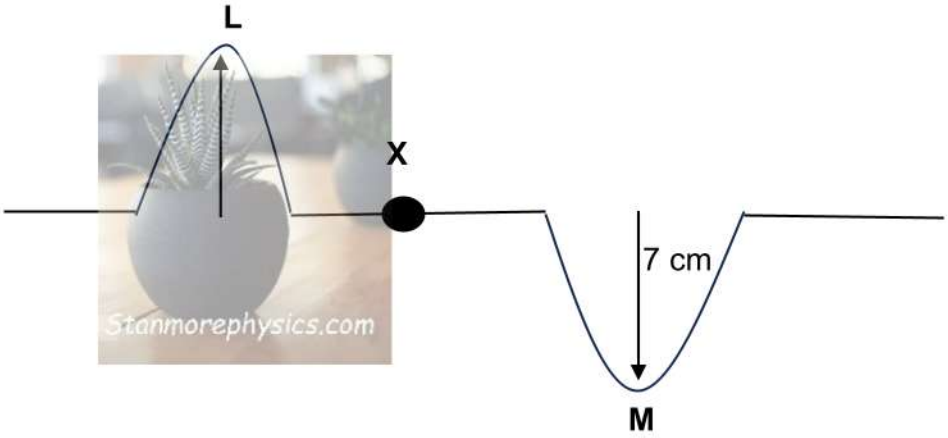
A. From A to B
B. From B to A
C. No movement as both spheres are positively charged
D. No movement, electrons remain in A (2)

[14]

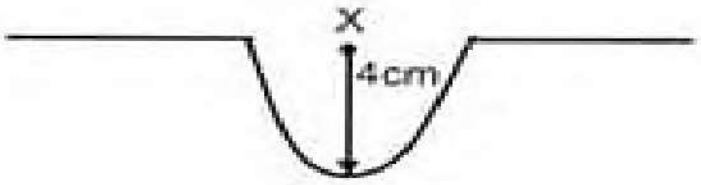
QUESTION 2 (Start on a new page)

2.1. Define the term *pulse*. (2)

2.2. The diagram below shows two pulses **L** and **M,** travelling in opposite directions in a rope. The amplitude of pulse **L** is UNKNOWN and that of pulse **M** is 7 cm.
Note: diagrams are not to scale.



The two pulses meet at point **X** and the resulting amplitude is as shown below.



2.2.1. What type of interference takes place at point **X**? (1)

2.2.2. Define the type of interference mentioned in QUESTION 2.2.1. (2)

2.2.3. Determine the amplitude of pulse **L**. (2)

2.2.4. In which direction does pulse **M** move after the two pulses pass each other? Write either **TO THE RIGHT** or **TO THE LEFT**. (1)

2.3. The frequency of a point source is 50 Hz and the speed of the water waves is 20 $m \cdot s^{-1}$.

2.3.1. Calculate the wavelength of the waves. (3)

2.3.2. The amplitude of the vibrations is doubled.

2.3.2.1 How does this affect the frequency of the vibration? (1)

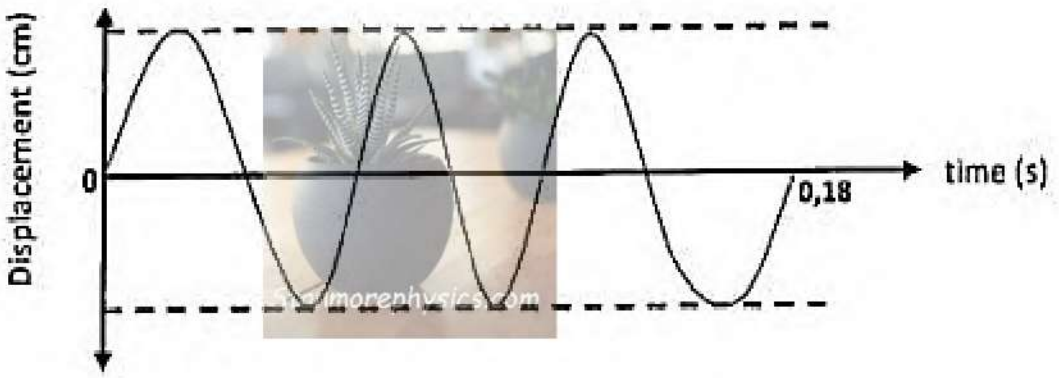
2.3.2.2 How does this affect the wavelength of the waves through the water? (1)

2.3.2.3 Briefly explain your answer to QUESTION 2.3.2.1. (1)

[14]

QUESTION 3 (Start on a new page)

3.1. A transverse wave is travelling along a string. A point on the medium carrying the wave was observed. A graph of distance versus time of the point is shown. The distance between two consecutive troughs is 21 cm.



3.1.1. Define the term *period of a wave*. (2)

3.1.2. Calculate the frequency of this wave. (3)

3.1.3. Calculate the speed of this wave. (3)

3.1.4. If the wave speed calculated in QUESTION 3.1.3. is kept constant and the frequency is doubled, what happens to the wavelength?
Choose from **HALVED, DOUBLED or REMAINS THE SAME.** (1)

3.1.5. Explain your answer to QUESTION 3.1.4. (3)

3.2. Ships and boats can determine the depth of the water beneath them using an "echo-sounding" method known as ultrasound.

3.2.1. Define the term *ultrasound*. (2)

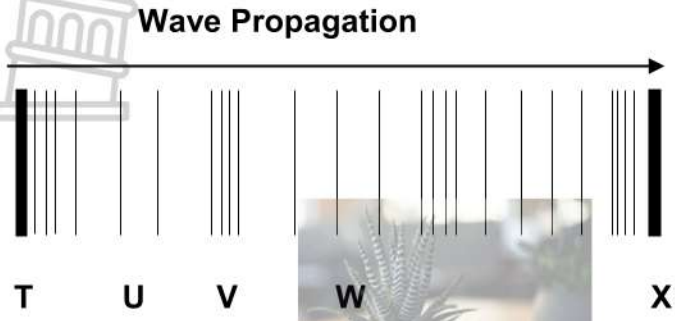
3.2.2. Ships transmit a sound wave which is reflected off the seabed.
Explain why the reflected sound is **softer** than the original sound. (2)

3.2.3. Name ONE animal that uses ultrasound when navigating through its natural habitat. (1)

[17]

QUESTION 4 (Start on a new page)

The diagram shows a longitudinal wave produced from a musical instrument.



4.1. Define a *longitudinal wave.* (2)

4.2. Write down the **name** and **define** the parts marked:

4.2.1. U (3)

4.2.2. V (3)

4.3. Describe the motion of the particle at point **U** as the wave propagates to the right. (2)

4.4. **T** and **V** are two points that are in phase and the distance between them is 5 cm. Wave particles at point **U** make 410 vibrations in 2 seconds. Calculate the:

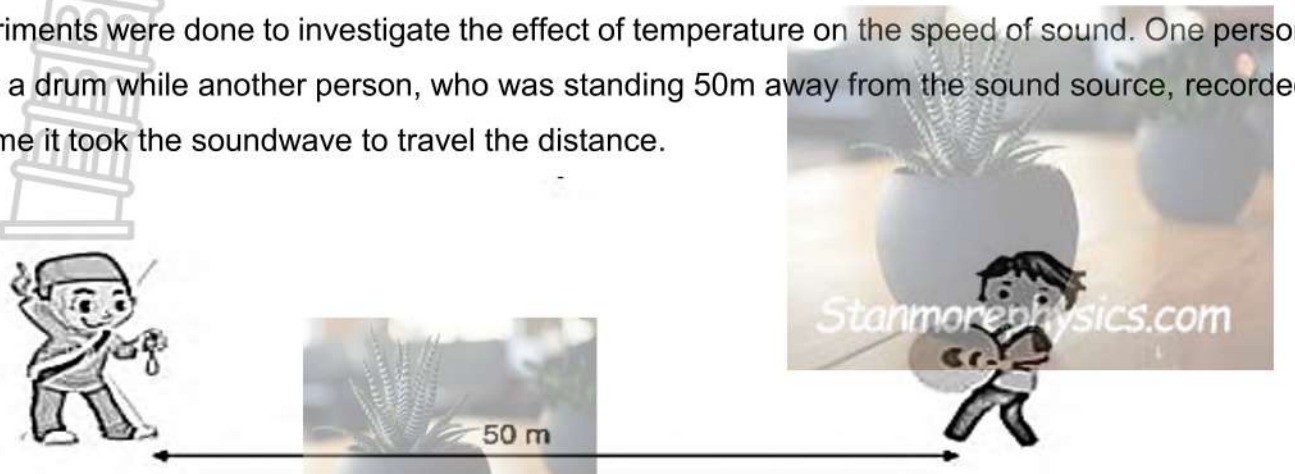
4.4.1. Frequency of the wave. (3)

4.4.2. Speed of the wave particles. (3)

[16]

QUESTION 5 (Start on a new page)

Experiments were done to investigate the effect of temperature on the speed of sound. One person beats a drum while another person, who was standing 50m away from the sound source, recorded the time it took the soundwave to travel the distance.



They performed the experiment at different temperatures during different times of the day. They recorded their findings in the table below.

TEMPERATURE (^{0}C)	TIME(s)
0	0,151
5	0,150
10	0,148
15	0,147
20	0,146
25	0,145

5.1. For the investigation write down the:

5.1.1. Investigation question (2)

5.1.2. Independent variable (1)

5.1.3. Dependent variable (1)

5.2. Calculate the speed of sound at 20 ^{0}C (3)

5.3. Write down a conclusion for the investigation. (2)

The person who beats the drum, noticed that the sound reflected back after a while.

5.4. Name the term used to describe the reflection of sound waves. (1)

[10]

QUESTION 6 (Start on a new page)

The electromagnetic spectrum includes amongst others, radio waves, ultraviolet light, gamma rays, visible rays and x – rays.

6.1. List **ONE** property of all electromagnetic waves. (1)

6.2. Briefly explain what is meant by the **DUAL** nature of electromagnetic radiation. (2)

6.3. Radio stations broadcast to listeners by means of electromagnetic radiations called radio waves.

Listed below is information about TWO different radio stations:

Radion Station 1 – broadcasts at a frequency of 97,60 MHz

Radion Station 2 – broadcast at a wavelength of $1,50 \times 10^3$ m

6.3.1. What is a photon? (2)

6.3.2. Calculate the energy of a photon associated with radio station 1. (3)

6.3.3. The owner of radio station 2 claims that his transmitter operates at a frequency of 2 MHz.

Use a calculation to help explain why his claim is **INCORRECT**. (4)

6.3.4. How will the energy of a photon transmitted from radio station 2 be affected if its wavelength was decreased?

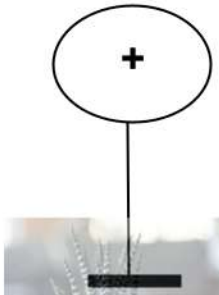
Choose from **INCREASES, DECREASES or REMAINS THE SAME**.

(1)

[13]

QUESTION 7

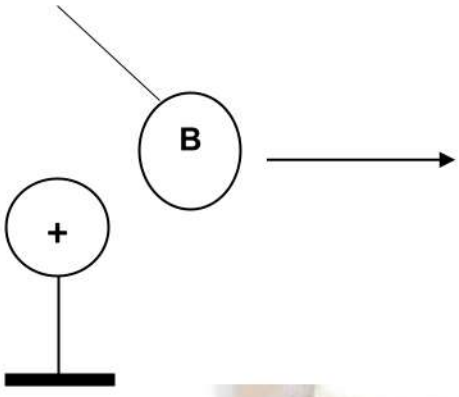
7.1. A glass ball stands on an insulated stand and is made positively charged by rubbing it with a woollen cloth.



7.1.1. Explain the term *tribo–electric charging*. (2)

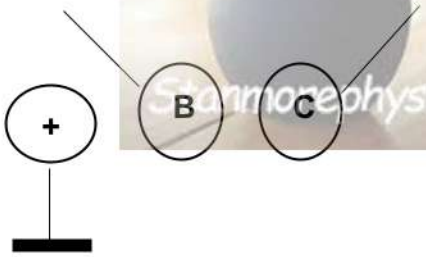
7.1.2. Describe the movement of charges between the glass ball and the woollen cloth. (2)

7.1.3. A learner now hangs a polystyrene ball, marked **B**, by a thin piece of string near the glass ball. The polystyrene ball **B** experiences a force to the right as shown below.



Is ball **B POSITIVELY** or **NEGATIVELY** charged? (1)

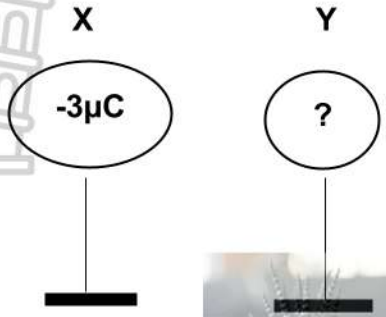
7.1.4. A second uncharged polystyrene ball, marked **C**, hanging by a thin piece of string, is placed near ball **B** as shown below.



What happens to ball **C**? Write only MOVE TO THE LEFT, MOVE TO THE RIGHT or REMAINS STATIONARY? (1)

7.2. **X** and **Y** are now identical spheres mounted on insulated stands that are close to each other.

The charge on **X** is – 3 μC while the charge on **Y** is unknown.

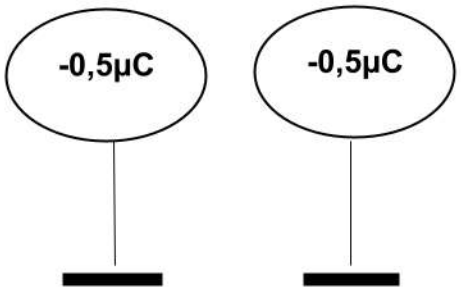


Before contact

7.2.1. Calculate the number of excess electrons on sphere **X**. (3)

7.2.2. State the principle of *conservation of charge*. (2)

X is now brought into contact with **Y** for a moment and the spheres are then placed back at their original positions.



After contact

The charge on both **X** and **Y** is now **– 0,5 μC**.

7.2.3. Calculate the original charge of sphere **Y**. Show all workings. (3)

7.2.4 Did **Y** LOOSE or GAIN electrons? (1)

TOTAL MARKS: 100

DATA FOR PHYSICAL SCIENCES GRADE 10
PAPER 1 (PHYSICS)
GEGEWENS VIR FISIESE WETENSKAPPE GRAAD 10
VRAESTEL 1 (FISIKA)

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

NAME/*NAAM*	SYMBOL/*SIMBOOL*	VALUE/*WAARDE*
Acceleration due to gravity *Swaartekragversnelling*	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	$6,63 \times 10^{-34}\ J{\cdot}s$
Charge on electron *Lading op elektron*	e	$-1,6 \times 10^{-19}\ C$
Electron mass *Elektronmassa*	m_e	$9,11 \times 10^{-31}\ kg$

TABLE 2: FORMULAE/*TABEL 2: FORMULES*

MOTION/*BEWEGING*

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

WORK, ENERGY AND POWER/*ARBEID, ENERGIE EN DRYWING*

$U = mgh$ or/*of* $E_P = mgh$	$K = \frac{1}{2}mv^2$ or/*of* $E_k = \frac{1}{2}mv^2$
$E_M = E_k + E_p$. or/*of* $E_M = K + U$	

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

$v = f\lambda$	$T = \frac{1}{f}$
$E = hf$ or/*of* $E = h\frac{c}{\lambda}$	

ELECTROSTATICS/*ELEKTROSTATIKA*

$n = \frac{Q}{e}$	$Q = \frac{Q_1 + Q_2}{2}$

ELECTRIC CIRCUITS/*ELEKTRIESE STROOMBANE*

$Q = I\Delta t$	$\frac{1}{R_p} = \frac{1}{R_1} + \frac{1}{R_2} + \ldots$
$R_s = R_1 + R_2 + \ldots$	$V = \frac{W}{q}$

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GRADE/*GRAAD* 10

PHYSICAL SCIENCES/*FISIESE WETENSKAPPE*

CONTROL TEST 1/*KONTROLE TOETS 1*

17 MARCH/*MAART* 2025

MARKING GUIDELINES/*NASIENRIGLYNE*

MARKS/*PUNTE*: 100

TIME/*TYD*: 2 hours/*ure*

This marking guidelines consists of 7 pages/

Hierdie nasienriglyne bestaan uit 7 bladsye

QUESTION 1/*VRAAG 1*

1.1. C✓✓
1.2. D✓✓
1.3. C✓✓
1.4. D✓✓
1.5. A✓✓
1.6. D✓✓
1.7. B✓✓ **[14]**

QUESTION 2/*VRAAG 2*

2.1. Pulse is a single disturbance in a medium. ✓✓/ *Puls is 'n enkele versteuring in 'n medium* (2)

2.2. 2.2.1. Destructive interference✓/ *Destruktiewe interferensie* (1)

2.2.2. Two pulses meet at a point and sum up to no pulse or smaller pulses. ✓✓ / *Twee pulse ontmoet op 'n punt en tel op tot geen puls of kleiner pulse* (2)

2.2.3. Amplitude of pulse L/*amplitude van puls L* + (-7 cm) = - 4 cm✓
Amplitude of pulse L/*amplitude van puls L* = 3 cm✓ (2)

2.2.4. TO THE LEFT✓/*NA LINKS* (1)

2.3. 2.3.1. V= f x λ✓
20 = 50 x λ✓
λ = 0.4m✓ (3)

2.3.2.1 The same✓/*Dieslfde* (1)

2.3.2.2 The same✓/*Dieselfde* (1)

2.3.2.3 Change in amplitude influences the energy of the particles and not the number of waves that pass a fix point in one second✓ /*Verandering in amplitude beïnvloed die energie van die deeltjies en nie die aantal golwe wat 'n vaste punt in een sekonde verbygaan nie.* (1)

[14]

QUESTION 3

3.1.1. Time taken for one complete wave to pass a fix point. ✓✓ /*Tyd wat dit neem vir een volledige golf om by 'n vaste punt verby te beweeg.* (2)

3.1.2. $f = \frac{1}{T}$ ✓

$= \frac{1}{0,06}$ ✓

$= 16,67\ Hz$ ✓

OR/*OF*

3 waves in 0,18 s✓/*3 golwe in 0.18s*

X waves in 1 s✓/*X golwe in 1s*

f = 16,67 s^{-1}✓ (3)

3.1.3. $V = f \times \lambda$ ✓

$= 16.67 \times 0,21$ ✓

$= 3,50\ m.s^{-1}$ ✓ (3)

3.1.4. Halved ✓/*Halveer* (1)

3.1.5. Negative Marking from 3.1.4/*Negatiewe nasien vanaf 3.1.4*

- Using/*gebruik* V=f × λ ✓
- If frequency is doubled then wavelength must be halved✓/ *As frekwensie verdubbel word, moet golflengte gehalveer word*
- In order to keep speed constant✓/ *Om spoed konstant te hou* (3)

3.1.1. Sound with a frequency range of between 20 kHz to 100 kHz✓✓/ *Klank met 'n frekwensiereeks van tussen 20 kHz tot 100 kHz* (2)

3.1.2. Part of the sound is absorbed by the seabed✓✓/ *'n Deel van die klank word deur die seebodem geabsorbeer* (2)

3.1.3. Bat ✓ or Dolphins ✓/*Vlermuis of dolfyne* (1)

[17]

QUESTION 4/*VRAAG 4*

4.1. A pulse in which the disturbance of particles in parallel to the direction of propagation. ✓✓/ *'n Puls waarin die versteuring van deeltjies parallel is met die voortplantingsrigting.* (2)

4.2. *4.2.1.* Rarefaction✓/*Verdunning*

The region of low pressure in a longitudinal wave✓✓ /*Die gebied van lae druk in 'n longitudinale golf* (3)

4.2.2. Compression✓/*verdigting*

The region of high pressure in a longitudinal wave ✓✓/ *Die gebied van hoë druk in 'n longitudinale golf* (3)

4.3. The particles move forward and backward. (parallel to direction of propagation) ✓✓/ *Die deeltjies beweeg vorentoe en agtertoe. (parallel met voortplantingsrigting)* (2)

4.4.

4.4.1. $f = \frac{1}{T}$ ✓

$f = \frac{410}{2}$ ✓

$f = 205\ Hz$ ✓ (3)

4.4.2. $v = f \times \lambda$ ✓

$v = 205 \times 0{,}05$ ✓

$v = 10{,}25\ m.s^{-1}$ ✓ (3)

[16]

QUESTION 5/*VRAAG 5*

5.1.1. How does the change/increase in temperature affect the speed of sound in air? ✓✓/ *Hoe beïnvloed die verandering/toename in temperatuur die spoed van klank in lug?* (2)

5.1.2. Temperature ✓/*Temperatuur* (1)

5.1.3. Speed of sound in air✓/*Spoed van klank in lug* (1)

5.2. $speed = \frac{distance}{time}$ ✓ / $spoed = \frac{afstand}{tyd}$

$= \frac{50}{0{,}146}$ ✓

$speed/spoed = 342.46\ m.s^{-1}$ ✓ (3)

5.3. As the temperature increases, the speed of sound also increases. ✓✓ / *Soos die temperatuur toeneem, neem die spoed van klank ook toe* (2)

5.4. Echo ✓/*Eggo* (1)

[10]

QUESTION 6/*VRAAG 6*

6.1.
- Some of its behavior is explained using wave model ✓/ *Sommige van sy gedrag word met behulp van golfmodel verduidelik*
- While other aspects of its behavior are explained using the particle model. ✓/ *Terwyl ander aspekte van sy gedrag verduidelik word deur die deeltjiemodel te gebruik* (2)

6.2. *6.2.1.* Photons are packets of energy found in light. ✓✓/ *Fotone is pakkies energie wat in lig gevind word.* (2)

6.2.2. E = hf✓ (3)
= $(6{,}63 \times 10^{34})(97{,}60 \times 106^{6})$ ✓
= $6{,}47 \times 10^{-26}$ J✓

6.2.3. $c = f \times \lambda$ ✓
3×10^{8}✓ $= f \times (1{,}50 \times 10^{3})$ ✓
$f = 200\,000Hz$
$f = 0.20\,MHz \neq 2\,MHz$ ✓
OR
$speed/spoed = f \times \lambda$ ✓
$= (2 \times 10^{6}) \times (1{,}5 \times 10^{3}$ ✓✓
$= 3 \times 10^{9} m.s^{-1} \neq 3 \times 10^{8})$ ✓ (4)

6.2.4. Increases ✓/*Neem toe* (1)

[13]

QUESTION 7/*VRAAG 7*

7.1.1. Certain materials become electrically charged after they come into contact with different materials. ✓✓/ *Sekere materiale word elektries gelaai nadat hulle met verskillende materiale in aanraking kom* (2)

7.1.2.
- Electrons move✓/*elektrone beweeg*
- From the glass ball into the cloth✓/*vanaf die glas bal na die lap* (2)

7.1.3. Positively charged✓/*positief gelaai* (1)

7.1.4. To the left✓/*na links* (1)

7.2.1. $n = \frac{Q}{Q_e}$ ✓

$= \frac{-3 \times 10^{-6}}{-1,6 \times 10^{-19}}$ ✓

$= 1,88 \times 10^{13}$ ✓ (3)

7.2.2. The net charge on an isolated system remains constant✓✓/*Die netto lading in 'n geïsoleerde sisteem bly konstant* (2)

7.2.3. $Q = \frac{Q_1 + Q_2}{2}$ ✓

$0,5$✓ $= \frac{-3 + Q_Y}{2}$ ✓

$Q_Y = +2\mu C$ ✓ (4)

7.2.4. Gain ✓/*bygekry of opgeneem* (1)

[16]

TOTAL MARKS/*TOTALE PUNTE* = 100