Hoërskool Johan Jurgens

Physical Science Gr. 10

November 2025

End year exam – Paper 1

Marks: 100

Time: 2 hours

Examiner: S Stoltz

Moderator: N Gertenbach

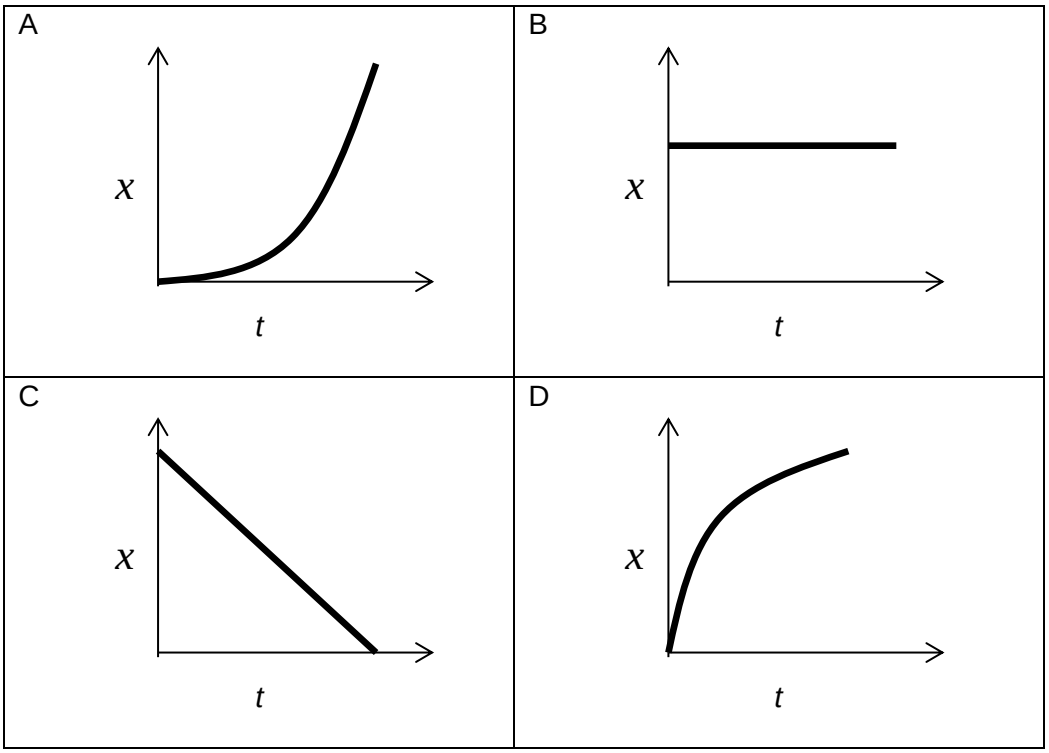
INSTRUCTIONS AND INFORMATION

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

QUESTION 1: MULTIPLE-CHOICE QUESTIONS

Four options are provided as possible answers to the following questions. Choose the answer and write only the letter (A–D) next to the question number (1.1–1.5), for example 1.10 E.

1.1 Which graph best represents a car that is slowing down with constant acceleration?



(2)

1.2 In certain equations of motion, the symbol Δ appears.
This symbol means:

A Change in

B Average of

C Time

D Heat (2)

1.3 The angle between the direction of the disturbance and the direction of propagation of a transverse wave is:

A 0°

B 45°

C 90°

D 180° (2)

1.4 The electric field lines around a positive point charge:

A Point inward

B Is circular

C Point outwards

D Is random (2)

1.5 What happens to the current in a series circuit if more resistors are added?

A Increase

B Decrease

C Remains constant

D Becomes zero (2)

[10]

QUESTION 2

A student, on her way to school from home, walks 450 m East, 100 m North, and another 400 m East. It takes her 5,5 minutes to complete the first 450 m.

School

Home

2.1 Define the term *displacement*. (2)

2.2 Construct a vector diagram to represent the displacement of the student. Include ALL the necessary information in the diagram. [Use scale 1 cm = 100 m.] (3)

2.3 Use the vector diagram to determine the resultant displacement of the learner (in meter). (2)

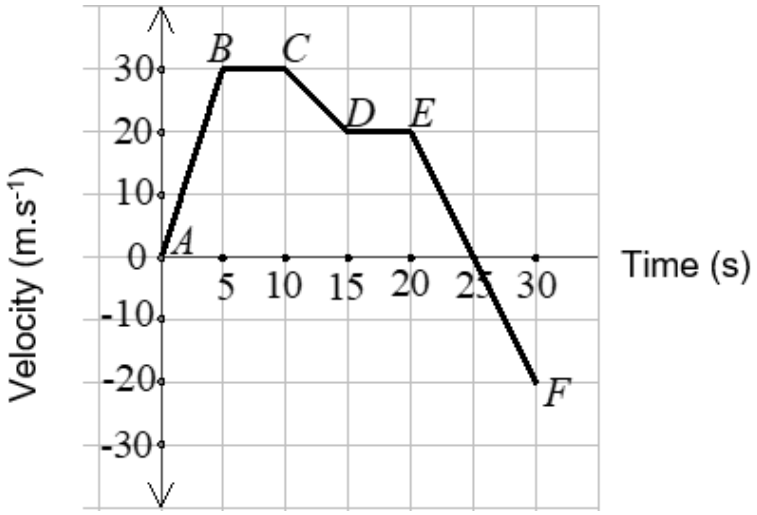
2.4 Classify displacement as a VECTOR or a SCALAR. (1)

2.5 If the average speed of the learner stays constant throughout the route, calculate how long it will take her to walk from her home to the school (in minutes). (5)

[13]

QUESTION 3

Use the following graph of a moving object to answer the questions.



3.1 Describe the movement of the object in words for intervals:

3.1.1 ***AB*** (1)

3.1.2 ***EF*** (1)

3.2 Define the term *acceleration*. (2)

3.3 WITHOUT USING EQUATIONS OF MOTION, calculate each of the following:

3.3.1 The acceleration of the moving object during interval ***EF***. (3)

3.3.2 The distance travelled by the moving object during interval ***EF***. (3)

3.4 What is the displacement of the object during interval ***EF***? (1)

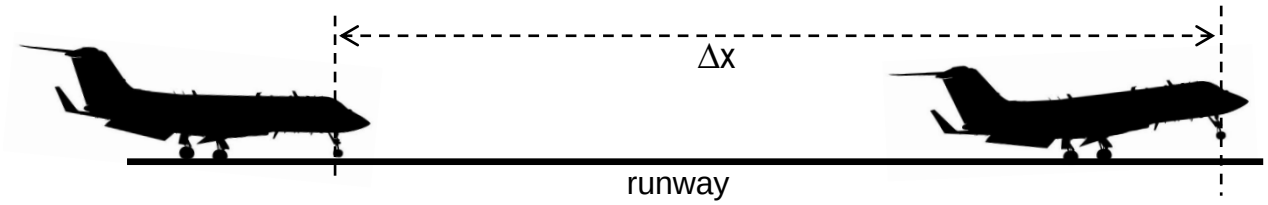
3.5 Draw the corresponding acceleration - time graph for the full motion of the object.

- Indicate the time for each interval on the graph.
- Indicate the value of the acceleration during interval ***EF***. (3)

[14]

QUESTION 4

An aeroplane accelerates uniformly from rest at a rate of 2,5 $m.s^{-2}$ and reaches a ground speed of 216 $km.h^{-1}$ before take-off.



4.1 Convert 216 $km.h^{-1}$ to $m.s^{-1}$. (1)

4.2 Calculate the:

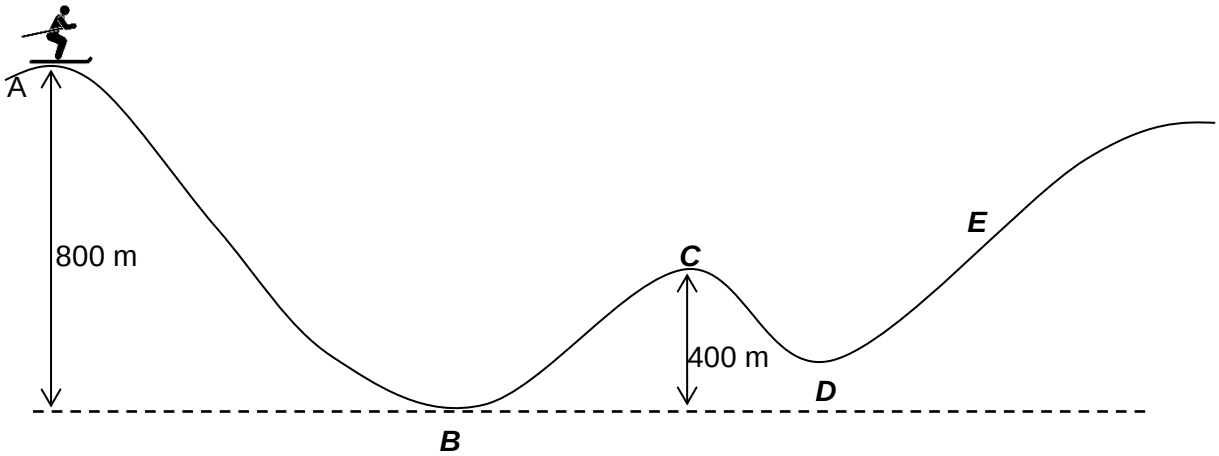
4.2.1 Time taken for the aeroplane to reach take-off speed. (4)

4.2.2 Minimum length of the runway. (4)

[9]

QUESTION 5

A skier is standing at the top of a hill, ready to descend. The skier has 744,8 kJ of energy with respect to the lowest point on the track just before he starts to move.



5.1 Define the term *kinetic energy*. (2)

5.2 What type of energy does the skier have at position ***A***? (1)

5.3 Determine the:

5.3.1 Kinetic energy of the skier at position ***B***. (1)

5.3.2 Potential energy of the skier at position ***C***. (2)

5.4 State the *law of conservation of mechanical energy*. (2)

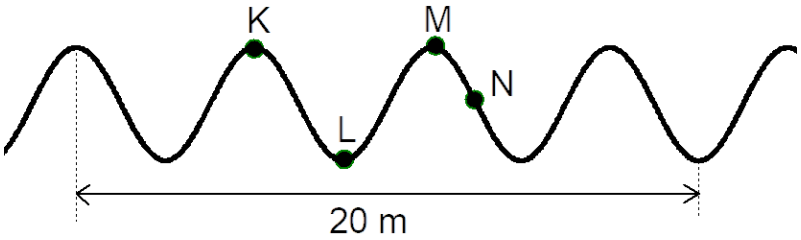
Suppose that the skier moves over a rough patch of soil at point D and loses 35 kJ of his kinetic energy.

5.5 How much potential energy will the skier have at position ***E***, where he comes to rest? (2)

[10]

QUESTION 6

Use the diagram below to answer the questions that follow.



6.1 Identify two points that are IN PHASE with each other. (1)

6.2 Calculate the wavelength of this wave. (2)

6.3 If 5 crests of the wave pass a certain point in 20 seconds, calculate the frequency of the wave. (3)

6.4 Calculate the velocity of the wave. (3)

[9]

QUESTION 7

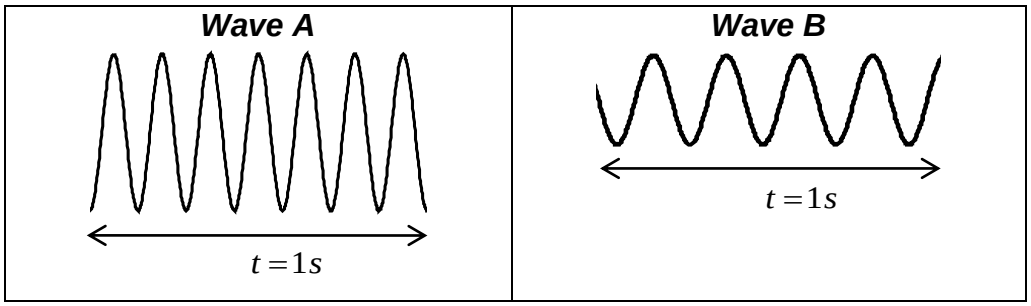
7.1 Bats send out waves at a very high frequency. These sound waves reflect from objects that are in their way. The bat uses this echo to avoid collisions with objects. $f_{bat} = 120\ kHz$

7.1.1 Are the waves produced by the bat TRANSVERSE-; LONGITUDINAL-; or EM - WAVES? (1)

7.1.2 Classify the released frequency that the bat produces as INFRA- or ULTRASOUND. (1)

7.1.3 Calculate the distance between the bat and an obstruction if the echo is received after 0,4 s. (Take the speed of sound in air as 340 $m.s^{-1}$.) (4)

7.2 Consider the following diagrams that represent sound waves as shown on an oscilloscope.



7.2.1 Identify the wave with the higher pitch. (1)

7.2.2 Identify the wave that produces the loudest sound. (1)

[8]

QUESTION 8

Tanning is the skin's response to ultraviolet (UV) radiation. As skin cells are exposed to UV radiation, they produce brown pigment to protect themselves from further UV exposure. This results in a darkening of the skin (tanning), which is the body's natural defence mechanism and attempt to prevent further damage from UV radiation.

There are three types of UV radiation, and they are classified by wavelength.

- UVA (315-400 nm)
- UVB (280-315 nm)
- UVC (180-280 nm)

8.1 Which ONE of these three types of UV radiation is more dangerous? (1)

8.2 Give a reason for your answer in QUESTION 8.1. (1)

8.3 Calculate that energy of a UVA photon with a wavelength of 350 nm. (4)

8.4 Why are electromagnetic waves unique in comparison to other waves? (2)

8.5 Explain how electromagnetic waves originate. (1)

[9]

QUESTION 9

Two charged objects (**A** and **B**), **A** with a charge of –3 nC and **B** with a charge of –12 nC are brought into contact.

9.1 In what direction will electrons be transferred during contact?
Write only FROM A TO B or FROM B TO A. (1)

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

9.3 Apply the principle of conservation of charge in order to calculate the charge on the objects after separation. (3)

9.4 Apply the principle of conservation of charge to determine how many electrons are on each object are after contact. (3)

[9]

QUESTION 10

A learner builds a circuit with the following components:

- A battery of 12 V
- Two resistors, R_1 = 6 Ω and R_2 = 3 Ω, connected in parallel
- A third resistor, R_3 = 4 Ω, connected in series with the parallel combination.

10.1 Draw a labelled circuit diagram showing this arrangement so that the current flows through the entire circuit. (3)

10.2 Calculate the:

10.2.1 Total resistance of the entire circuit. (3)

10.2.2 The current supplied by the battery. (2)

10.2.3 Calculate the potential difference across R_3. (1)

[9]

TOTAL: 100

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

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·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*

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

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

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

ELECTROSTATICS/*ELEKTROSTATIKA*

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

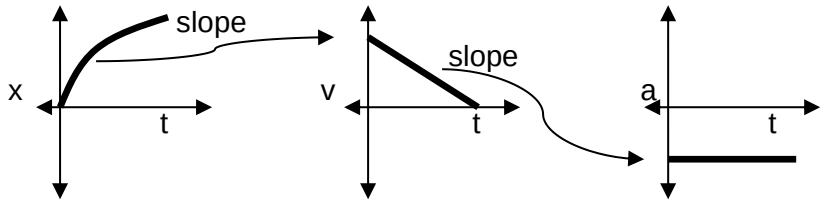
ELECTRIC CIRCUITS/*ELEKTRIESE STROOMBANE*

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

PHYSICAL SCIENCE
GRADE 10
2025 TERM 4
PHYSICS EXAM PAPER 1
MARKING GUIDELINE

QUESTION 1 Reasoning

1.1 D ✓✓

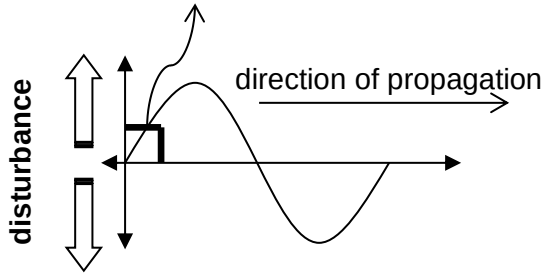


(2)

1.2 A ✓✓ (2)

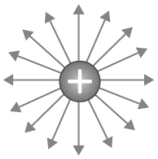
1.3 C ✓✓ 90° / perpendicular

1.6



(2)

1.4 C ✓✓



(2)

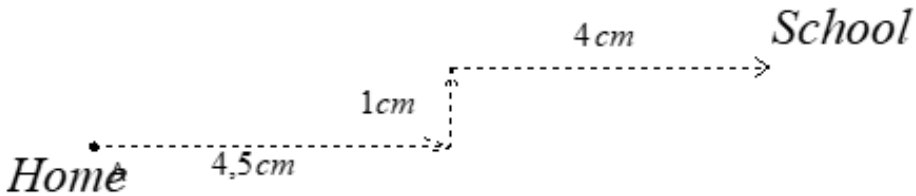
1.5 B ✓✓ R_T increases, therefore I_T decreases. $\left(R_T \; \alpha \; \frac{1}{I_T}\right)$ (2)

[10]

QUESTION 2

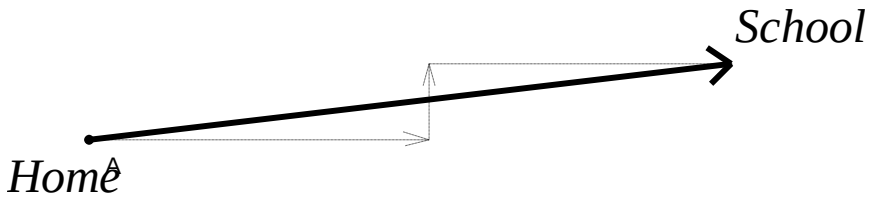
2.1 Displacement is the change in position.✓✓ /
Displacement is the difference in position in space. (2)

2.2 ***Marking guidelines:***
Each vector shown with correct length, units and arrow directions.✓✓✓
(NOTE: This sketch may not be to scale after printing due to technical shifts in computer formats/programs that vary.)



(3)

2.3 ***Marking guidelines:***
x_{res} = 850 m ✓✓



$x_{res} = 8{,}5cm$
$\therefore 850\ m$

(2)

2.4 VECTOR ✓ (1)

2.5 $v = \frac{x}{t}$ ✓

$v = \frac{450}{5{,}5}$ ✓

$v = 81{,}82\ m.minute^{-1}$ ✓

$v = \frac{x}{t}$

$81{,}82 = \frac{450+100+400}{t}$ ✓

$t = 11{,}61\ minutes$ ✓ (5)

[13]

QUESTION 3

3.1.1 The object is moving from rest, and its velocity is increasing at a constant rate in the positive direction. ✓ (1)

3.1.2 The object is slowing down, its velocity is decreasing at a constant rate, it stops and then turns around (change direction), and increases its velocity in the negative direction. ✓ (1)

3.2 Acceleration is the rate of change in velocity. ✓✓ (2)

3.3.1 $a_{EF} = gradient\ of\ v-t\ graph = \frac{\Delta v}{\Delta t}$ ✓

$= \frac{(-20-20)}{(30-20)}$ ✓

$= -4m.s^{-2} \quad \therefore 4m.s^{-2}$ ✓ (NEG DIR) (3)

3.3.2 $x_{EF} = area\ of\ v-t\ graph = \Delta v.\Delta t$ ✓

$= \frac{1}{2}b \perp h + \frac{1}{2}b \perp h$

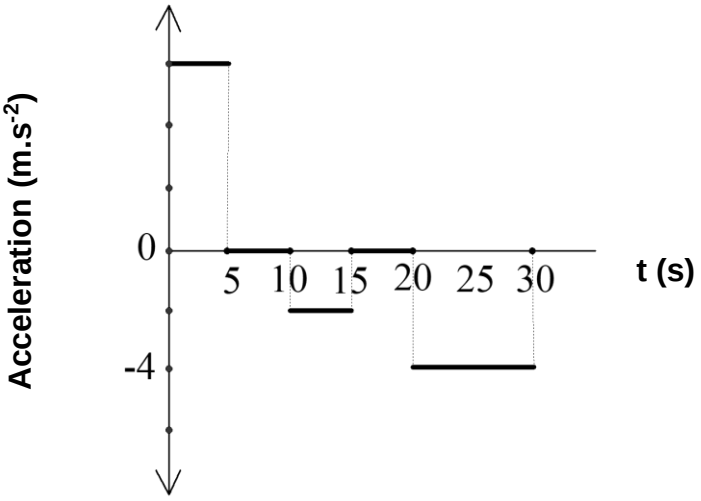
$= 0{,}5(25-20)(20-0) + 0{,}5(30-25)(20-0)$ ✓

$= 100\ m$ ✓ (3)

3.4 0 m ✓ (1)

3.5 ***Marking guidelines:***

- Time for each interval ✓
- Value of the acceleration during interval **EF**.✓
- Correct shape and axes labelled with units.✓



(3)
[14]

QUESTION 4

4.1 216 km.h^{-1} ÷ 3,6 = 60 m.s^{-1} ✓ (1)

4.2.1 $v_f = v_i + a\Delta t$✓
60✓ $= 0 + 2{,}5\Delta t$✓
$\therefore \Delta t = 24\ s$ ✓ (4)

4.2.2

OPTION 1	**OPTION 2**
$\Delta x = v_i\Delta t + \frac{1}{2}a\Delta t^2$✓ $= 0(24)$✓ $+ \frac{1}{2}(2{,}5)(24)^2$ $= 720\ m$✓	$v_f^2 = v_i^2 + 2a\Delta x$✓ $(60)^2$✓ $= (0)^2 + 2(2{,}5)\Delta x$✓ $\therefore \Delta x = 720\ m$✓

(4)
[9]

QUESTION 5

5.1 The energy that an object possesses due to its movement. ✓✓ (2)

5.2 Potential energy ✓ (1)

5.3.1 744,8 kJ ✓ (1)

5.3.2 $\frac{744{,}8}{2}$✓ $= 372{,}4\ kJ$ ✓ (2)

5.4 The total mechanical energy in an isolated system (in the absence of dissipative forces e.g. friction) remains constant ✓✓ (2)

5.5 Ep at position E = 744 800 – 35 000 ✓
= 709 800 J ✓ (2)
[10]

QUESTION 6

6.1 K, M ✓ (1)

6.2 $\lambda = \frac{distance}{number\ of\ waves}$

$= \frac{20}{3,5}$ ✓

$= 5,71\ m$ ✓ (2)

6.3 $f = \frac{number\ of\ waves}{time}$ ✓

$= \frac{4}{20}$ ✓

$= 0,20\ Hz$ ✓ (3)

6.4 $v = f\lambda$ ✓

$= 0,20(5,71)$ ✓

$= 1,14\ m.s^{-1}$ ✓ (3)

[9]

QUESTION 7

7.1.1 LONGITUDINAL ✓ (1)

7.1.2 ULTRA✓-sound (1)

7.1.3 $v = \frac{x}{t}$ ✓

340✓ $= \frac{x}{(0,4 \div 2)}$✓

$\therefore x = 68\ m$ ✓ (4)

7.2.1 A ✓ (1)

7.2.2 A ✓ (1)

[8]

QUESTION 8

8.1 UVC ✓ (180 nm – 280 nm) (1)

8.2 Smallest wavelength ✓ / Greater frequency / Greater energy (1)

8.3 $E = h\frac{c}{\lambda}$✓

$= 6,63 \times 10^{-34}\left(\frac{3 \times 10^{8}\checkmark}{350 \times 10^{-9}\checkmark}\right)$

$= 5,68 \times 10^{-19} J$✓ (4)

8.4 Wave-particle duality. ✓
No need for a medium to propagate. ✓
Speed of EM waves are constant at 3 x 10^{8}m.s^{-1} in a vacuum.
Oscillation between alternating accelerating charges cause magnetic waves.
(2)

8.5 An accelerating electric charge ✓ (1)

[9]

QUESTION 9

9.1 FROM B TO A ✓ (1)

9.2 The net charge of an isolated system remains constant during any physical process. ✓✓ (2)

9.3 $Q_{new} = \frac{Q_A + Q_B}{2}$ ✓

$= \frac{-3+(-12)}{2}$ ✓

$= -7{,}5\ nC$ ✓ (3)

9.4 $N = \frac{Q}{e^-}$ ✓

$= \frac{-7{,}5 \times 10^{-9}}{-1{,}6 \times 10^{-19}}$ ✓

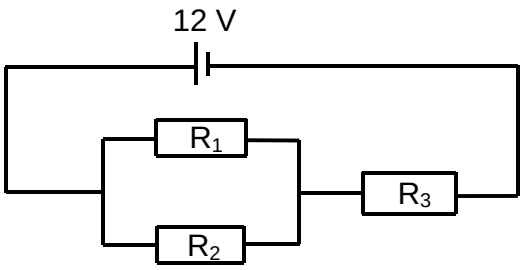
$= 4{,}6875 \times 10^{10}\ e^-$ ✓ (3)

[9]

QUESTION 10

10.1 ***Marking guidelines:***

- Correct symbols for cell, resistors, and connecting wires (conductors).✓
- Correct connection in parallel and series.✓
- Everything drawn and connected correctly.✓



(3)

10.2.1

$R_T = R_s + R_p$ $= 4 + 2$✓ $= 6\Omega$✓	$\frac{1}{R_P} = \frac{1}{R_1} + \frac{1}{R_2}$ $= \left(\frac{1}{6} + \frac{1}{3}\right)^{-1}$ ✓ $= 2\Omega$

(3)

10.2.2 $I = \frac{V}{R}$ ✓

$I = \frac{12}{6}$ ✓

$I = 2\ A$ ✓ (2)

10.2.3 $V = IR$✓

$V = 2(4)$ ✓

$V = 8\ V$✓ (1)

[9]

TOTAL: 100

TAXONOMY LEVELS					
GRADE 10					
PHYSICAL SCIENCES – PHYSICS PAPER 1					
QUESTION	**RECALL**	**COMPREHENSION**	**ANALYSIS APPLICATION**	**EVALUATION SYNTHESIS**	**TOTAL**
DESIRED %	**15%**	**35%**	**40%**	**10%**	**100%**
1.1		2			2
1.2		2			2
1.3	2				2
1.4	2				2
1.5		2			2
2.1	2				2
2.2		3			3
2.3			2		2
2.4	1				1
2.5			5		5
3.1.1		1			1
3.1.2		1			1
3.2	2				2
3.3.1			3		3
3.3.2			3		3
3.4		1			1
3.5				3	3
4.1		1			1
4.2.1			4		4
4.2.2			4		4
5.1	2				2
5.2		1			1
5.3.1				1	1
5.3.2				2	2
5.4		2			2
5.5				2	2
6.1		1			1
6.2			2		2
6.3			3		3
6.4			3		3
7.1.1		1			1
7.1.2		1			1

7.1.3			4		4
7.2.1		1			1
7.2.2		1			1
8.1		1			1
8.2		1			1
8.3			4		4
8.4		1			1
8.5	2				2
9.1		1			1
9.2	2				2
9.3			3		3
9.4			3		3
10.1				3	3
10.2.1			3		3
10.2.2			2		2
10.2.3			1		1
Total	**15**	**25**	**49**	**11**	**100**
Actual %	**15**	**25**	**49**	**11**	**100**
Desired %	**15%**	**35%**	**40%**	**10%**	**100**