Neap

Final Examination 2023

NSW Year 11 Physics

General Instructions

- Reading time – 5 minutes
- Working time – 2 hours
- Write using black pen
- Draw diagrams using pencil
- Calculators approved by NESA may be used
- A data sheet and formulae sheet are provided at the back of this paper

Total Marks: 75

Section I – 15 marks (pages 2–6)

- Attempt Questions 1–15
- Allow about 30 minutes for this section

Section II – 60 marks (pages 7–22)

- Attempt Questions 16–31
- Allow about 1 hour and 30 minutes for this section

SECTION I

15 marks
Attempt Questions 1–15
Allow about 30 minutes for this section

Use the multiple-choice answer sheet for Questions 1–15.

1 In 2022, David Popovici set the world record for the men's 100-metre freestyle swimming with a time of 46.86 seconds.
What was Popovici's average speed during the race?

A. 0.469 m s^{-1}
B. 1.13 m s^{-1}
C. 2.13 m s^{-1}
D. $4.69 \times 10^{3} \text{ m s}^{-1}$

2 A cart with a mass of 51.0 kg is accelerating at 2.60 m s^{-2}.
What is the net force being applied to the cart?

A. 2.60 N
B. 19.6 N
C. 51.0 N
D. 133 N

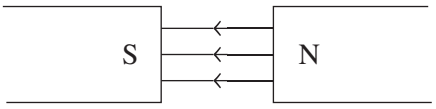
3 Which row of the table shows the appropriate units for velocity and kinetic energy?

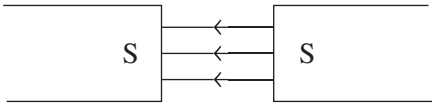
	Velocity	*Kinetic energy*
A.	m	J
B.	m s^{-1}	J
C.	J	m
D.	m s^{-1}	m s^{-2}

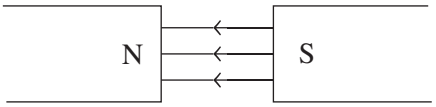
4 What is the correct term for the distance between successive crests on a sound wave?

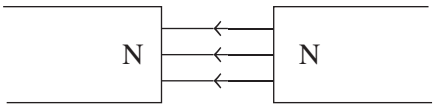
A. period
B. amplitude
C. frequency
D. wavelength

5 Which of the following diagrams shows the direction of a magnetic field that exists between the poles of two separate bar magnets?

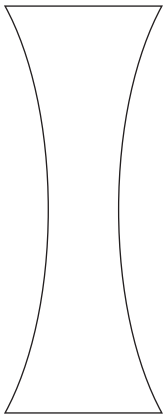
A.


B.


C.


D.


6 A concave lens is shown.



Which of the following statements about concave lenses is true?

A. They can only form virtual images.

B. They can only form enlarged, inverted images.

C. They can only reflect incident light rays, not refract them.

D. They can form both virtual and real images, depending on the location of the object.

7 1 kWh is equivalent to 3.6 MJ.
How much energy would be used if a 2000 W hairdryer were left switched on for 2.5 hours?

A. 7.2 MJ

B. 9.0 MJ

C. 18 MJ

D. 36 MJ

8 A 2.0 kg ball is held at rest in the air above a flat surface, giving the ball 14.7 J of gravitational potential energy.

How far above the flat surface is the ball being held?

A. 7.5 m

B. 29 m

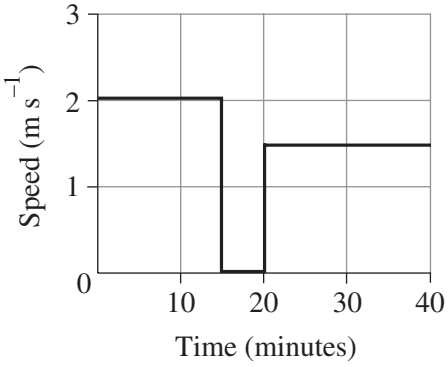
C. 75 cm

D. 90 cm

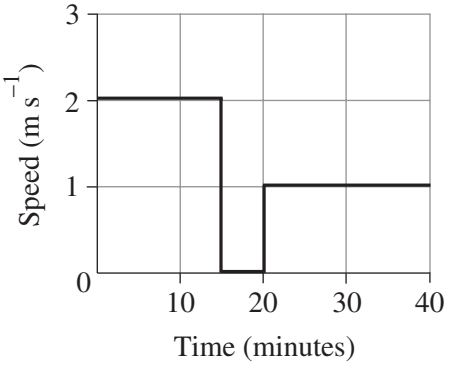
9 Sam decided to visit a local park that was 1.8 km away from her home. She left her home and walked at a consistent speed of 2 m s^{-1} until she reached the park. When she arrived, she sat down on a bench for 5 minutes before walking back home at a constant speed and arriving 20 minutes later.

Which of the following graphs shows Sam's journey?

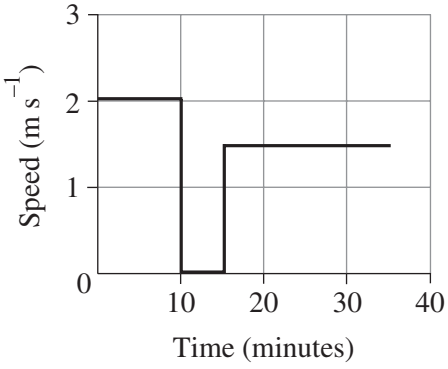
A.



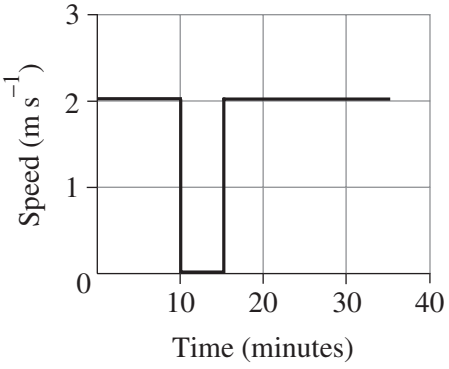
B.



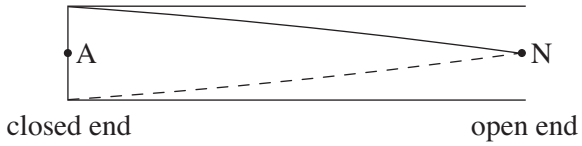
C.



D.



10 The first harmonic for a pipe that is closed at one end, such as a didgeridoo, will have one pressure node (N) and one pressure antinode (A), as shown in the diagram.



How many pressure nodes must there be for the third harmonic?

A. 1

B. 2

C. 3

D. 4

11 A container filled with water loses 1.2×10^7 J of energy as it cools from 45°C to 21°C.
What is the volume of the container?

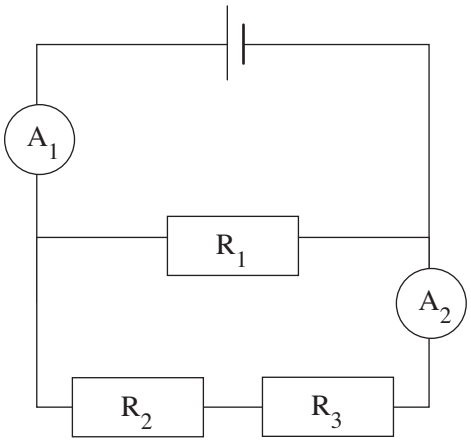
A. 24 L

B. 29 L

C. 64 L

D. 120 L

12 Consider the electric circuit shown. Each resistor has the same amount of resistance.



If the circuit operates with a constant voltage supply, which of the following statements is correct?

A. Ammeter A_2 measures a higher current than ammeter A_1.

B. Resistor R_1 has a higher voltage drop than resistors R_2 or R_3.

C. Resistors R_2 and R_3 have a higher combined voltage drop than resistor R_1.

D. The total resistance in the circuit would increase by a third if resistor R_3 was removed.

13 Cars *A* and *B* are travelling along a road. Car *A* has a mass of 1200 kg and is travelling at a speed of 30 m s^{-1} when it collides with car *B*, which has a mass of 910 kg and is travelling at a speed of 18 m s^{-1} in the same direction as car *A*. After the collision, car *B* continues in the same direction with a speed of 25 m s^{-1}.

What is the speed of car *A* after the collision?

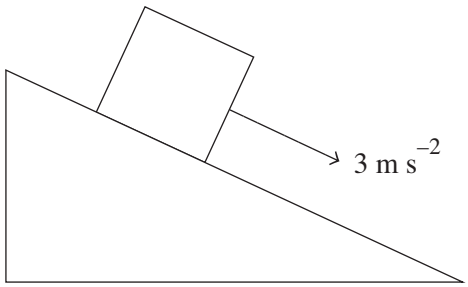
A. 12 m s^{-1}

B. 18 m s^{-1}

C. 25 m s^{-1}

D. 48 m s^{-1}

14 A box is accelerating down an inclined plane.



The magnitude of the friction force is half the magnitude of the normal force acting on the box.

The magnitude of the net force acting on the box can be determined by

A. calculating half the magnitude of the normal force.

B. calculating the component of the box's weight acting down the inclined plane.

C. calculating the component of the box's weight acting down the inclined plane, then subtracting half the magnitude of the normal force.

D. subtracting the magnitude of the box's weight from the magnitude of the normal force.

15 If the radius of an electron's orbit around a proton is 5.3×10^{-11} m, what is the strength of the electric field acting on the electron during its orbit?

A. 27 N C^{-1}

B. 54 N C^{-1}

C. 5.1×10^{11} N C^{-1}

D. 1.0×10^{12} N C^{-1}

NSW Year 11 Physics

Section II Answer Booklet

60 marks
Attempt Questions 16–31
Allow about 1 hour and 30 minutes for this section

Instructions

- Answer the questions in the spaces provided. These spaces provide guidance for the expected length of response.
- Show all relevant working in questions involving calculations.
- Extra writing space is provided at the back of this booklet. If you use this space, clearly indicate which question you are answering.

Please turn over

Question 16 (2 marks)

The diagram shows a negatively charged particle. **2**

On the diagram, draw the electric field lines associated with the particle to show the shape and direction of the electric field.

Question 17 (2 marks)

Outline what is meant by the term 'latent heat'. **2**

.....

.....

.....

.....

Question 18 (2 marks)

Using a monochromatic light source, a student passes light through a piece of glass and into water. The glass has a refractive index of 1.58, and the water has a refractive index of 1.31. **2**

How could the student attain total internal reflection within the glass? Support your answer with a relevant calculation.

.....

.....

.....

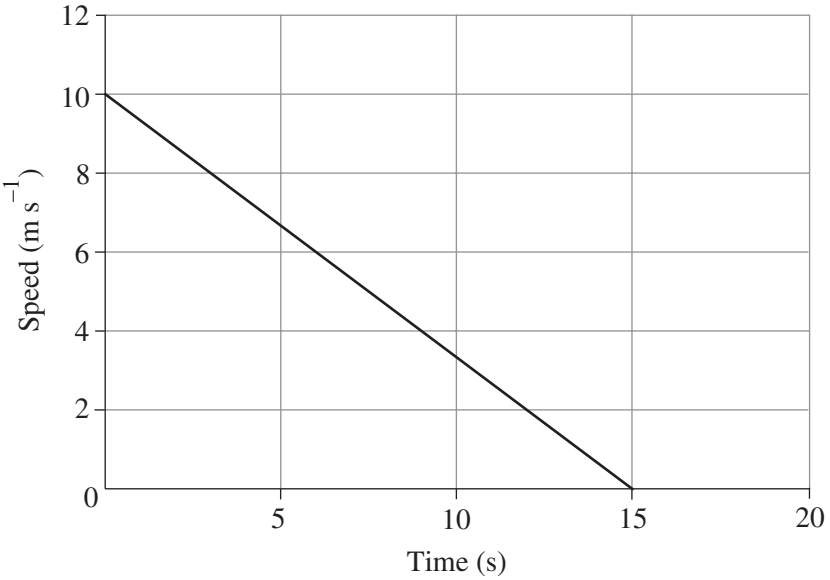
.....

.....

.....

Question 19 (3 marks)

A 1.2 kg mass slides along a rough horizontal surface and comes to rest after 15 seconds. **3**
The graph shows the mass's journey.



Calculate the magnitude of the friction force acting on the mass.

.....

.....

.....

.....

.....

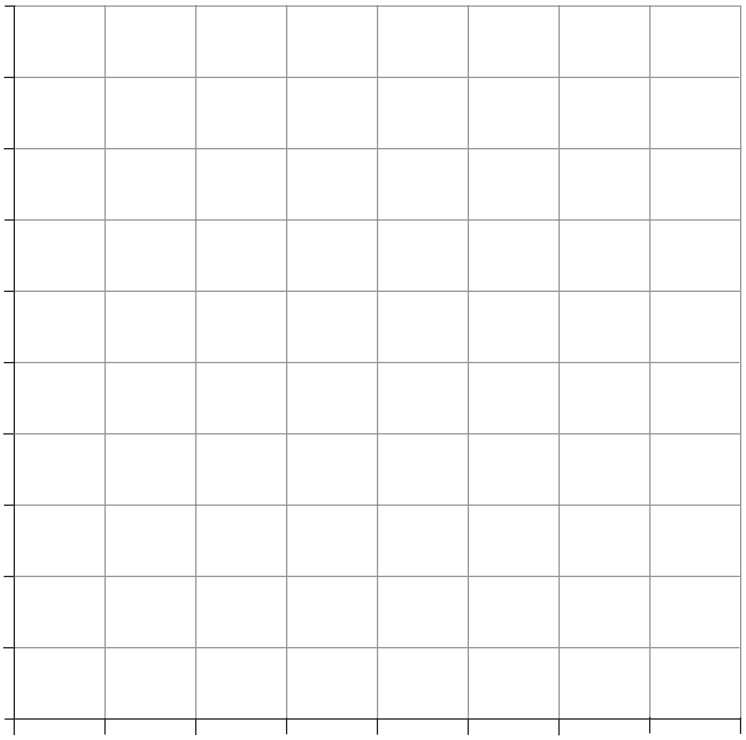
.....

Question 20 (7 marks)

A student performs an experiment to measure the intensity of light at specific distances away from a point light source. Data from the experiment is shown in the table.

Data point	*Distance from light source (cm)*	*Light intensity ($W\,m^{-2}$)*
1	5	60
2	10	30
3	20	15
4	40	7.5

(a) Plot the data points on the axes provided. Include a trendline. **4**



(b) Assess the accuracy of the data in the experiment. In your answer, refer to a mathematical model used to determine the relationship between distance and light intensity. **3**

.....

.....

.....

.....

.....

.....

Question 21 (4 marks)

With reference to the conservation of charge and energy, explain Kirchhoff's TWO electric circuit laws. **4**

.....

.....

.....

.....

.....

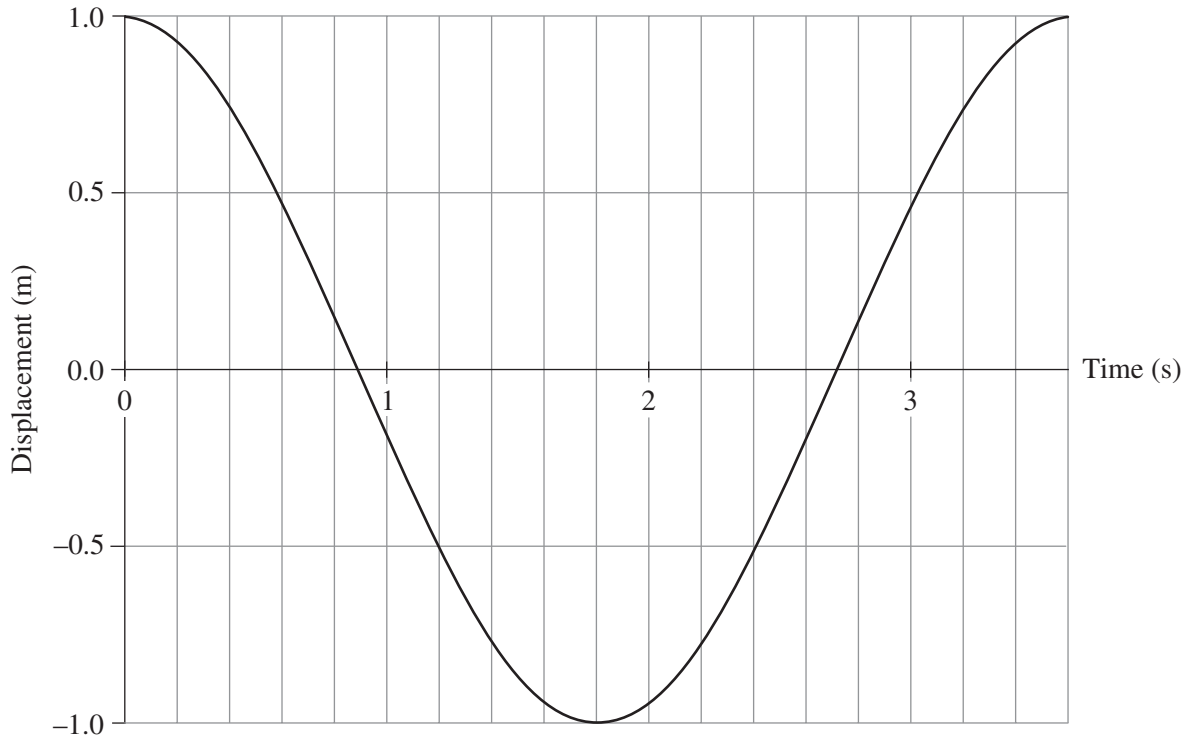
.....

.....

.....

Question 22 (4 marks)

The graph shows the displacement of a particle in a wave that has a wavelength of 3.0 m.



Determine the following properties of the wave.

(a) period **1**

.....

(b) amplitude **1**

.....

(c) speed **2**

.....

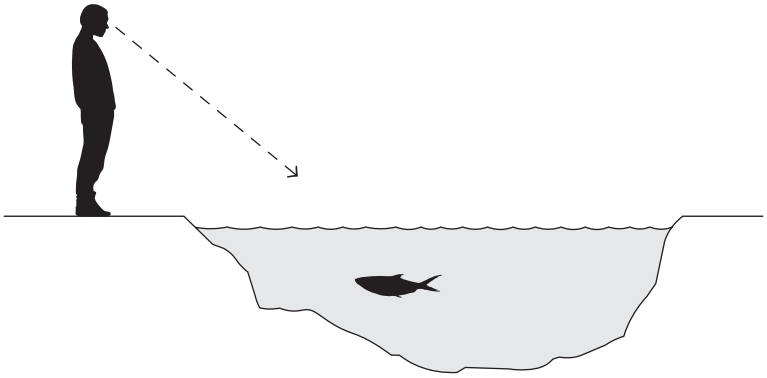
.....

.....

.....

Question 23 (3 marks)

The diagram shows a student looking at a fish that is swimming in a pool of water. **3**



Explain why the student would incorrectly determine the location of the fish. In your answer, compare the actual and apparent locations of the fish.

.....

.....

.....

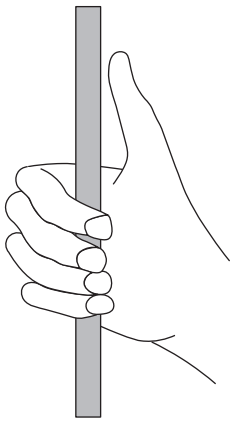
.....

.....

.....

Question 24 (2 marks)

The diagram shows a student using the right-hand grip rule. **2**



Describe how the student would use the right-hand grip rule to determine the direction of a magnetic field around a current-carrying wire.

.....

.....

.....

.....

Question 25 (4 marks)

A 65.0 g arrow is shot directly upwards into the air from the top of a 65.0 m pole at a speed of 48.0 m s^{-1}. **4**

Calculate the arrow's kinetic energy when it reaches the ground.

.....

.....

.....

.....

.....

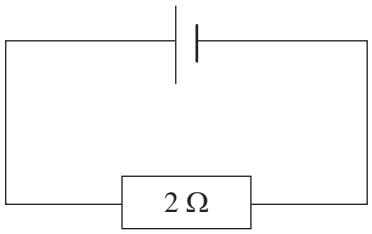
.....

.....

.....

Question 26 (5 marks)

A student set up a simple electric circuit to determine the relationship between current and voltage in ohmic resistors. They began with the circuit shown in the diagram, and also had access to a voltmeter, ammeter, a 4 Ω resistor and a 6 Ω resistor. **5**



Describe how the student could investigate the relationship between current and voltage in ohmic resistors with this equipment.

.....

.....

.....

.....

.....

.....

.....

.....

.....

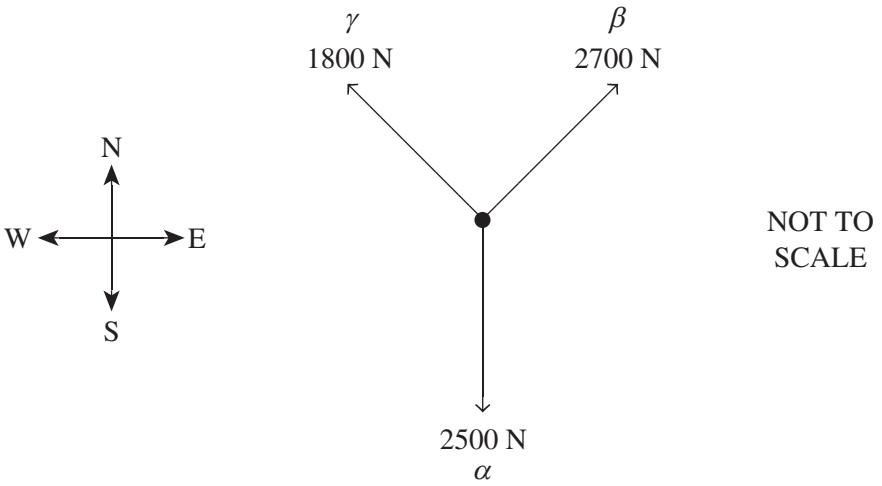
.....

.....

.....

Question 27 (6 marks)

In a game of tug of war, teams α, β and γ each pull their rope away from the knot in the centre with a horizontal force of 2500 N south, 2700 N north-east and 1800 N north-west, respectively. **6**



Calculate the magnitude and direction of the net horizontal force acting on the knot.

Question 28 (3 marks)

In terms of particle motion, compare transverse and longitudinal waves. **3**

.....

.....

.....

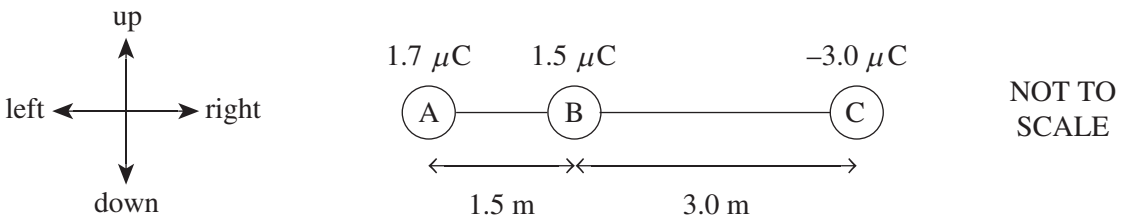
.....

.....

.....

Question 29 (4 marks)

Point charges A, B and C lie in a straight line, as shown in the diagram. **4**



Calculate the magnitude and direction of the net force acting on point charge B due to point charges A and C.

.....

.....

.....

.....

.....

.....

.....

.....

Question 30 (5 marks)

A skateboarder is riding south. They slow from a speed of 6.0 m s^{-1} to 4.0 m s^{-1} over 1.9 seconds when turning a corner to travel west. **5**

Calculate the magnitude and direction of the skateboarder's average acceleration and draw a vector diagram to support your answer.

.....

.....

.....

.....

.....

.....

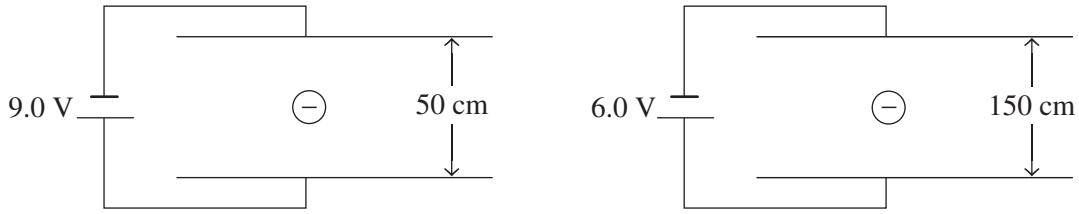
.....

.....

Question 31 (4 marks)

In two experiments, A and B, identical charged particles were released from rest at the midway point between two charged parallel plates as shown.

Experiment A *Experiment B*



NOT TO SCALE

(a) Calculate the electric field strength in each experiment. **2**

.....

.....

.....

.....

.....

.....

(b) Compare the work done on the particles in each experiment. **2**

.....

.....

.....

.....

End of paper

Section II extra writing space

If you use this space, clearly indicate which question you are answering.

Section II extra writing space

If you use this space, clearly indicate which question you are answering.

Section II extra writing space

If you use this space, clearly indicate which question you are answering.

DATA SHEET

Charge on electron, q_e	-1.602×10^{-19} C
Mass of electron, m_e	9.109×10^{-31} kg
Mass of neutron, m_n	1.675×10^{-27} kg
Mass of proton, m_p	1.673×10^{-27} kg
Speed of sound in air	340 m s^{-1}
Earth's gravitational acceleration, g	9.8 m s^{-2}
Speed of light, c	3.00×10^{8} m s^{-1}
Electric permittivity constant, ε_0	8.854×10^{-12} A^2 s^4 kg^{-1} m^{-3}
Magnetic permeability constant, μ_0	$4\pi \times 10^{-7}$ N A^{-2}
Density of water, ρ	1.00×10^{3} kg m^{-3}
Specific heat capacity of water	4.18×10^{3} J kg^{-1} K^{-1}

FORMULAE SHEET

Motion, forces and gravity

$$s = ut + \frac{1}{2}at^2$$

$$v = u + at$$

$$v^2 = u^2 + 2as$$

$$\vec{F}_{\text{net}} = m\vec{a}$$

$$\Delta U = mg\Delta h$$

$$W = F_{||}s = Fs\cos\theta$$

$$P = \frac{\Delta E}{\Delta t}$$

$$K = \frac{1}{2}mv^2$$

$$\sum \frac{1}{2}mv^2_{\text{before}} = \sum \frac{1}{2}mv^2_{\text{after}}$$

$$P = F_{||}v = Fv\cos\theta$$

$$\Delta\vec{p} = \vec{F}_{\text{net}}\Delta t$$

$$\sum m\vec{v}_{\text{before}} = \sum m\vec{v}_{\text{after}}$$

Waves and thermodynamics

$$v = f\lambda$$

$$f_{\text{beat}} = |f_2 - f_1|$$

$$f = \frac{1}{T}$$

$$f' = f\frac{(v_{\text{wave}} + v_{\text{observer}})}{(v_{\text{wave}} - v_{\text{source}})}$$

$$n_x = \frac{c}{v_x}$$

$$n_1\sin\theta_1 = n_2\sin\theta_2$$

$$Q = mc\Delta T$$

$$\sin\theta_c = \frac{n_2}{n_1}$$

$$\frac{Q}{t} = \frac{kA\Delta T}{d}$$

$$I_1r_1^2 = I_2r_2^2$$

Electricity and magnetism

$$E = \frac{V}{d}$$

$$\vec{F} = q\vec{E}$$

$$V = \frac{\Delta U}{q}$$

$$F = \frac{1}{4\pi\varepsilon_0}\frac{q_1q_2}{r^2}$$

$$W = qV$$

$$I = \frac{q}{t}$$

$$W = qEd$$

$$V = IR$$

$$B = \frac{\mu_0 I}{2\pi r}$$

$$P = VI$$

$$B = \frac{\mu_0 NI}{L}$$

Final Examination 2023

Neap NSW Year 11 Physics

DIRECTIONS:

Write your name in the space provided.
Write your student number in the boxes provided below. Then, in the columns of digits below each box, fill in the oval which has the same number as you have written in the box. Fill in **one** oval only in each column.
Read each question and its suggested answers. Select the alternative A, B, C, or D that best answers the question. Fill in the response oval completely, using blue or black pen. Mark only **one** oval per question.

A ○ B ● C ○ D ○

If you think you have made a mistake, put a cross through the incorrect answer and fill in the new answer.

A ● B ⊗ C ○ D ○

If you change your mind and have crossed out what you consider to be the correct answer, then indicate this by writing the word *correct* and draw an arrow as follows.

correct ↓

A ⊗ B ⊗ C ○ D ○

STUDENT NAME: _____

STUDENT NUMBER:

1	1	1	1	1	1	1	1	1
2	2	2	2	2	2	2	2	2
3	3	3	3	3	3	3	3	3
4	4	4	4	4	4	4	4	4
5	5	5	5	5	5	5	5	5
6	6	6	6	6	6	6	6	6
7	7	7	7	7	7	7	7	7
8	8	8	8	8	8	8	8	8
9	9	9	9	9	9	9	9	9
0	0	0	0	0	0	0	0	0

SECTION I
MULTIPLE-CHOICE ANSWER SHEET

1.	A ○	B ○	C ○	D ○
2.	A ○	B ○	C ○	D ○
3.	A ○	B ○	C ○	D ○
4.	A ○	B ○	C ○	D ○
5.	A ○	B ○	C ○	D ○
6.	A ○	B ○	C ○	D ○
7.	A ○	B ○	C ○	D ○
8.	A ○	B ○	C ○	D ○
9.	A ○	B ○	C ○	D ○
10.	A ○	B ○	C ○	D ○
11.	A ○	B ○	C ○	D ○
12.	A ○	B ○	C ○	D ○
13.	A ○	B ○	C ○	D ○
14.	A ○	B ○	C ○	D ○
15.	A ○	B ○	C ○	D ○

STUDENTS SHOULD NOW CONTINUE WITH SECTION II