

Affix label with Candidate Code Number here.

If no label, enter candidate number if known, or name here.



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(Supervisor's use only)

No. 262/1

NEW ZEALAND QUALIFICATIONS AUTHORITY  
MANA TOHU MĀTAURANGA O AOTEAROA

## University Entrance, Bursaries and Scholarships Examination

# PHYSICS: 2000

## ANSWER BOOKLET

### INSTRUCTIONS

Check that the Candidate Code Number on your admission slip is the same as the number on the label at the top of this page.

Answer **ALL** questions and write your answers in this Answer Booklet.

The spaces provided are a guide to the length of your answers, but it is **NOT** essential to use all the space available.

**A list of formulae is given on page 15 of this booklet and may be detached along the perforation for use during the examination.**

If you need more space for any answer, ask the Supervisor for extra paper. Answers on extra paper should be clearly numbered. Write your Candidate Code Number on all extra sheets used. Attach the extra sheets at the appropriate places in this booklet. Write the number of extra sheets used in the box at the top of the back flap of this booklet. Write NIL if you have used none.

Answer spaces for each part begin on the following pages:

<b>Mechanics</b>	page 2
<b>Electricity and Electromagnetism</b>	page 7
<b>Waves</b>	page 11
<b>Atomic and Nuclear Physics</b>	page 13

#### INSTRUCTIONS FOR ANSWERING ALL QUESTIONS:

To receive full marks for numerical questions:

- working should be clearly set out
- answers must be accompanied by the correct units
- answers must have an appropriate number of significant figures.

For "describe" or "explain" questions, answers must be written as complete sentences.

Check that this booklet has all of pages 2 – 15 in the correct order and that none of these pages is blank.

**YOU MUST HAND THIS BOOKLET TO THE SUPERVISOR AT THE END OF THE EXAMINATION**

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# MECHANICS

(52 marks; 62 minutes)

## QUESTION ONE: ROTATIONAL MOTION (16 marks)

(a) \_\_\_\_\_  
\_\_\_\_\_ (2 marks)

(b) \_\_\_\_\_  
\_\_\_\_\_ period = \_\_\_\_\_ (2 marks)

(c) \_\_\_\_\_  
\_\_\_\_\_ linear velocity = \_\_\_\_\_ (2 marks)

(d) \_\_\_\_\_  
\_\_\_\_\_ angle turned through = \_\_\_\_\_ (2 marks)

(e) \_\_\_\_\_  
\_\_\_\_\_ (2 marks)

(f) \_\_\_\_\_  
\_\_\_\_\_ (2 marks)

(g) \_\_\_\_\_  
\_\_\_\_\_ (2 marks)

(h) \_\_\_\_\_  
\_\_\_\_\_ rotational kinetic energy = \_\_\_\_\_ (2 marks)

<b>Q1</b>
16

**QUESTION TWO: LINEAR AND ROTATIONAL FORCES (8 marks)**

$$g = 9.8 \text{ ms}^{-2}$$

**Part 1**

(a) \_\_\_\_\_  
maximum velocity = \_\_\_\_\_ (1 mark)

(b) \_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_

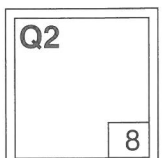
force = \_\_\_\_\_ (2 marks)

**Part 2**

(c) \_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_ (2 marks)

(d) \_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_

distance fallen = \_\_\_\_\_ (3 marks)

**(Turn over**



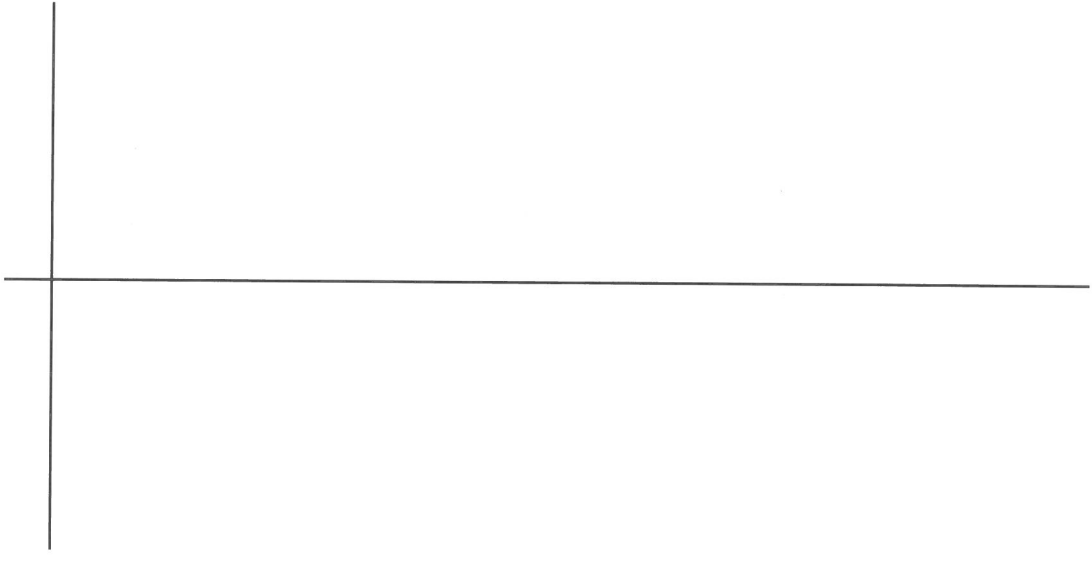
**QUESTION THREE: SIMPLE HARMONIC MOTION** (14 marks)

$g = 9.8 \text{ ms}^{-2}$

(a) \_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_ (2 marks)

(b) \_\_\_\_\_ (1 mark)

(c)



(2 marks)

(d) \_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_

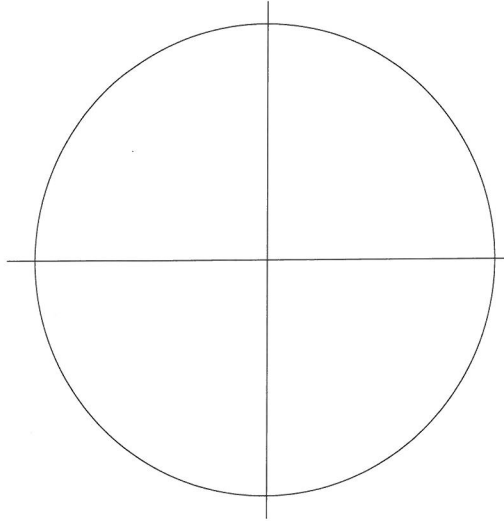
energy = \_\_\_\_\_ (2 marks)

(e) \_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_

velocity = \_\_\_\_\_ (2 marks)

5

(f)



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Position of centre of mass = \_\_\_\_\_ (3 marks)

(g)



(2 marks)



**QUESTION FOUR: GRAVITY AND CIRCULAR MOTION (14 marks)**

$g = 9.8 \text{ m s}^{-2}$

**Part 1**

(a) \_\_\_\_\_  
force = \_\_\_\_\_ (2 marks)

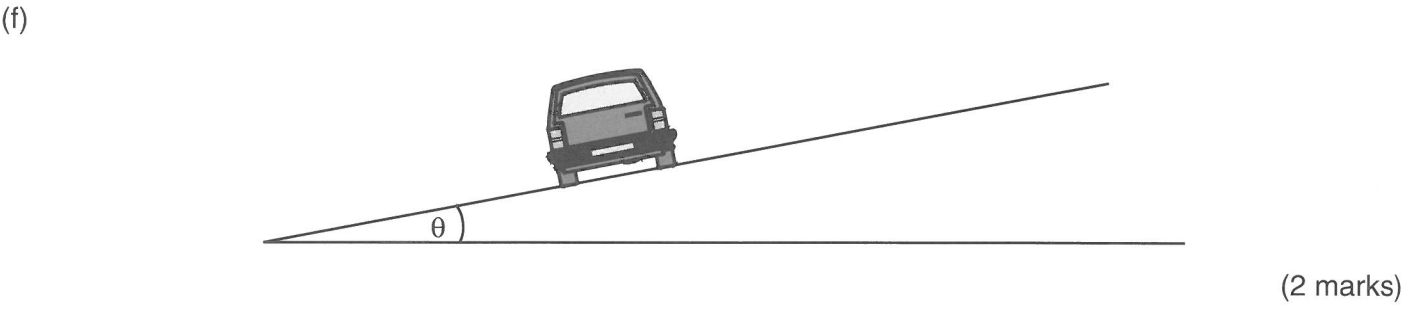
(b) \_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_ (2 marks)

(c) \_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_ (2 marks)

(d) \_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_ (2 marks)

**Part 2**

(e) \_\_\_\_\_  
\_\_\_\_\_ (2 marks)



(g) \_\_\_\_\_  
\_\_\_\_\_

angle = \_\_\_\_\_ (2 marks)

<b>Q4</b>
14

# ELECTRICITY AND ELECTROMAGNETISM

(47 marks; 56 minutes)

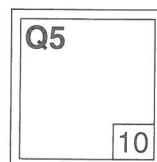
## QUESTION FIVE: DC ELECTRICITY (10 marks)

(a) \_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_ (3 marks)

(b) \_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_ current = \_\_\_\_\_ (2 marks)

(c) \_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_ voltage = \_\_\_\_\_ (3 marks)

(d) \_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_ (2 marks)



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**QUESTION SIX: CAPACITANCE** (13 marks)

(a) \_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_ (2 marks)

(b) \_\_\_\_\_  
\_\_\_\_\_  
charge = \_\_\_\_\_ (2 marks)

(c) \_\_\_\_\_  
\_\_\_\_\_  
voltage = \_\_\_\_\_ (2 marks)

(d) \_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_  
charge = \_\_\_\_\_ (2 marks)

(e) \_\_\_\_\_  
\_\_\_\_\_  
dielectric constant = \_\_\_\_\_ (1 mark)

(f) \_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_  
resistance = \_\_\_\_\_ (2 marks)

(g) \_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_  
capacitance = \_\_\_\_\_ (2 marks)

<b>Q6</b>
13



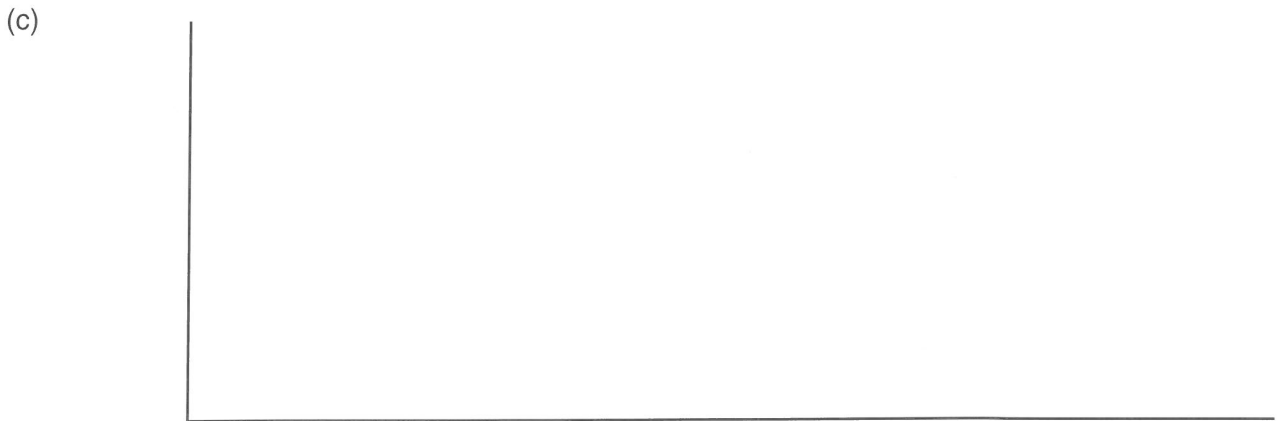
**QUESTION SEVEN: INDUCTANCE** (9 marks)

(a) \_\_\_\_\_  
\_\_\_\_\_

current = \_\_\_\_\_ (2 marks)



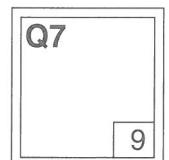
(2 marks)



(3 marks)

(d) \_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_

energy stored = \_\_\_\_\_ (2 marks)





**QUESTION EIGHT: AC ELECTRICITY** (15 marks)

(a) \_\_\_\_\_  
\_\_\_\_\_

impedance = \_\_\_\_\_ (2 marks)

(b) \_\_\_\_\_

resistance = \_\_\_\_\_ (1 mark)

(c) \_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_ (3 marks)

(d) \_\_\_\_\_

voltage = \_\_\_\_\_ (2 marks)

(e) \_\_\_\_\_

\_\_\_\_\_ (3 marks)

(f) \_\_\_\_\_

\_\_\_\_\_ (2 marks)

(g) \_\_\_\_\_

\_\_\_\_\_

(2 marks)

<b>Q8</b>
15

# WAVES

(28 marks; 33 minutes)

## QUESTION NINE: SOUND (13 marks)

### Part 1

(a) \_\_\_\_\_  
\_\_\_\_\_

wavelength = \_\_\_\_\_ (2 marks)

(b) \_\_\_\_\_  
\_\_\_\_\_

time = \_\_\_\_\_ (2 marks)

(c) \_\_\_\_\_

frequencies = \_\_\_\_\_ (2 marks)

(d) \_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_

(2 marks)

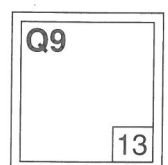
### Part 2

(e) \_\_\_\_\_  
\_\_\_\_\_

velocity = \_\_\_\_\_ (3 marks)

(f) \_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_

(2 marks)



(Turn over



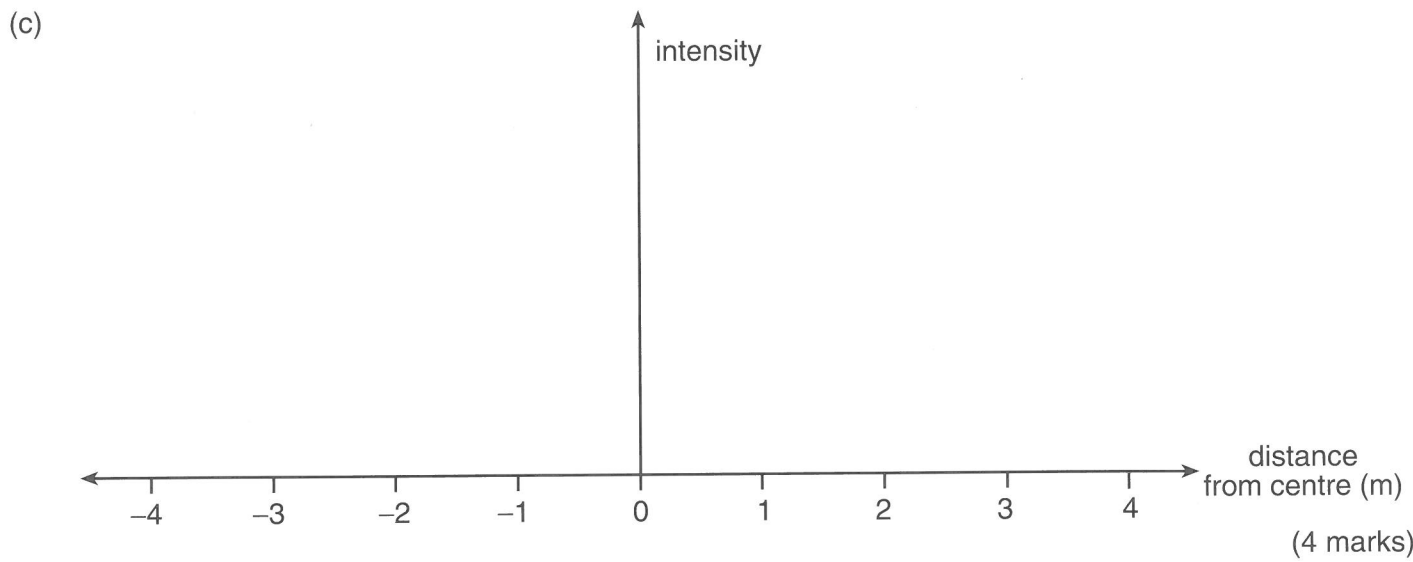
**QUESTION TEN: ELECTROMAGNETIC RADIATION** (15 marks)

(a) \_\_\_\_\_  
\_\_\_\_\_

frequency = \_\_\_\_\_ (3 marks)

(b) \_\_\_\_\_  
\_\_\_\_\_

distance = \_\_\_\_\_ (2 marks)



(d) \_\_\_\_\_ (1 mark)

(e) \_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_ (3 marks)

(f) \_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_

number of lines per cm = \_\_\_\_\_ (2 marks)

<b>Q10</b>
15

**ATOMIC AND NUCLEAR PHYSICS**

(25 marks; 29 minutes)

**QUESTION ELEVEN: ATOMIC PHYSICS (12 marks)**

(a) \_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_ (2 marks)

(b) \_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_

speed = \_\_\_\_\_ (2 marks)

(c) type of photon is: \_\_\_\_\_ (1 mark)

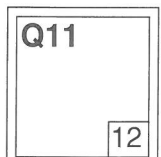
(d) \_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_ (3 marks)

(e) \_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_

change in energy = \_\_\_\_\_ (2 marks)

(f) \_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_

frequency = \_\_\_\_\_ (2 marks)

**(Turn over)**

**QUESTION TWELVE: NUCLEAR PHYSICS** (13 marks)

(a) \_\_\_\_\_  
\_\_\_\_\_ (3 marks)

(b) \_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_ energy = \_\_\_\_\_ (2 marks)

(c) \_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_ (2 marks)

(d) \_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_ energy = \_\_\_\_\_ (2 marks)

(e) \_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_ number of fissions = \_\_\_\_\_ (2 marks)

(f) \_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_ (2 marks)

The following formulae may be of use to you:

$$F_g = \frac{GMm}{r^2}$$

$$F_c = \frac{mv^2}{r}$$

$$\Delta p = Ft$$

$$\omega = 2\pi f$$

$$d = r\theta$$

$$v = r\omega$$

$$a = r\alpha$$

$$F = ma$$

$$p = mv$$

$$v = v_i + at$$

$$v^2 = v_i^2 + 2ad$$

$$d = \frac{(v_i + v)t}{2}$$

$$d = v_i t + \frac{1}{2}at^2$$

$$\omega = \frac{\Delta\theta}{\Delta t}$$

$$\alpha = \frac{\Delta\omega}{\Delta t}$$

$$L = I\omega$$

$$L = mvr_{\perp}$$

$$\tau = I\alpha$$

$$\tau = Fr$$

$$E_{K(\text{ROT})} = \frac{1}{2}I\omega^2$$

$$E_{K(\text{LIN})} = \frac{1}{2}mv^2$$

$$\omega = \omega_i + \alpha t$$

$$\omega^2 = \omega_i^2 + 2\alpha\theta$$

$$\theta = \frac{(\omega_i + \omega)t}{2}$$

$$\theta = \omega_i t + \frac{1}{2}\alpha t^2$$

$$T = 2\pi\sqrt{\frac{\ell}{g}}$$

$$T = 2\pi\sqrt{\frac{m}{k}}$$

$$E = \frac{1}{2}kA^2$$

$$a = -\omega^2 y$$

$$y = A \sin \omega t,$$

$$v = A\omega \cos \omega t,$$

$$a = -A\omega^2 \sin \omega t$$

$$y = A \cos \omega t$$

$$v = -A\omega \sin \omega t$$

$$a = -A\omega^2 \cos \omega t$$

$$\Delta E = Vq$$

$$V = Ed$$

$$Q = CV$$

$$C_{\text{TOT}} = C_1 + C_2$$

$$\frac{1}{C_{\text{TOT}}} = \frac{1}{C_1} + \frac{1}{C_2}$$

$$E = \frac{1}{2}QV$$

$$C = \frac{\epsilon_0 \epsilon_r A}{d}$$

$$\tau = RC$$

$$\frac{1}{R_{\text{TOT}}} = \frac{1}{R_1} + \frac{1}{R_2}$$

$$R_{\text{TOT}} = R_1 + R_2$$

$$\phi = BA$$

$$\epsilon = BAN\omega \sin \omega t$$

$$\epsilon = -\frac{\Delta\phi}{\Delta t}$$

$$\epsilon = -L \frac{\Delta I}{\Delta t}$$

$$\epsilon = -M \frac{\Delta I}{\Delta t}$$

$$\frac{N_p}{N_s} = \frac{V_p}{V_s}$$

$$E = \frac{1}{2}LI^2$$

$$\tau = \frac{L}{R}$$

$$I = I_{\text{MAX}} \sin \omega t$$

$$V = V_{\text{MAX}} \sin \omega t$$

$$I_{\text{MAX}} = \sqrt{2}I_{\text{rms}}$$

$$V_{\text{MAX}} = \sqrt{2}V_{\text{rms}}$$

$$X_C = \frac{1}{\omega C}$$

$$X_L = \omega L$$

$$V = IZ$$

$$n\lambda = \frac{dx}{L}$$

$$n\lambda = d \sin \theta$$

$$f = |f_1 - f_2|$$

$$f' = f \frac{V_w}{V_w \pm V_s}$$

$$E = hf$$

$$hf = \phi + E_K$$

$$E = mc^2$$

$$E_n = -\frac{hcR}{n^2}$$

$$\Delta E = |E_1 - E_2|$$

$$v = f\lambda$$

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

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