Affix label with Candidate Code Number here.

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

.....

(Supervisor's use only)

No. 262/1

NEW ZEALAND QUALIFICATIONS AUTHORITY
MANA TOHU MĀTAURANGA O AOTEAROA

University Entrance, Bursaries and Scholarships Examination

PHYSICS: 2001

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 17 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 not used any.

Answer spaces for each part begin on the following pages:

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 – 17 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

(Turn over

MECHANICS

(52 marks; 62 minutes)

QUESTION ONE: THE SPINNING YO-YO (14 marks)

Acceleration due to gravity = 9.80 m s^{-2}

(a) _____

_____

radians per second = _____ (2 marks)

(b) _____

_____

(2 marks)

(c) _____

_____

angular acceleration = _____ (2 marks)

(d) _____

_____

(2 marks)

(e) _____

_____

(2 marks)

(f) _____

_____

rotational inertia = _____ (2 marks)

(g) _____

_____

_____

(2 marks)

Q1 14

QUESTION TWO: LINEAR AND ROTATIONAL MOTION (21 marks)

Part 1: Collision Time

(a) _____

_____

(1 mark)

(b) _____

_____

change in momentum = _____ (2 marks)

(c) _____

_____

average force = _____ (2 marks)

(d) _____

_____

_____

(2 marks)

(e) _____

_____

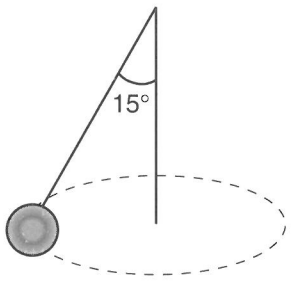
_____

(2 marks)

Part 2: The Conical Pendulum

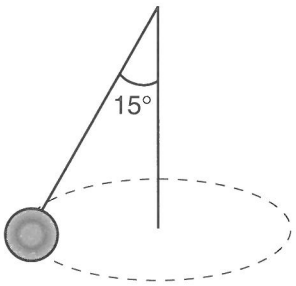
Acceleration due to gravity = 9.80 m s^{-2}

(a)



(2 marks)

(b)



(1 mark)

(c) _____

_____

(2 marks)

(d) _____

_____

linear speed = _____ (2 marks)

(e) _____

_____

_____

(2 marks)

(f) _____

_____

_____

tension = _____ (3 marks)

P3 9 P4 12 Q2 21

QUESTION THREE: SIMPLE HARMONIC MOTION (17 marks)

(a) _____

_____

(2 marks)

(b) _____

(1 mark)

(c) _____

_____

(2 marks)

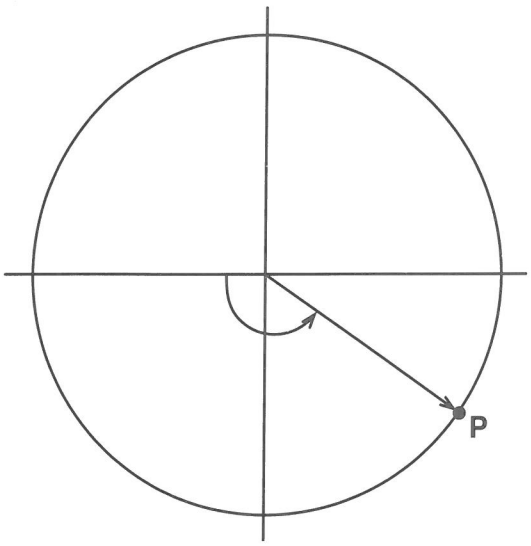
(d) _____

_____

_____

potential energy = _____ (3 marks)

(e)



(Not drawn to scale.)

P is position of pendulum after 1.00 seconds.

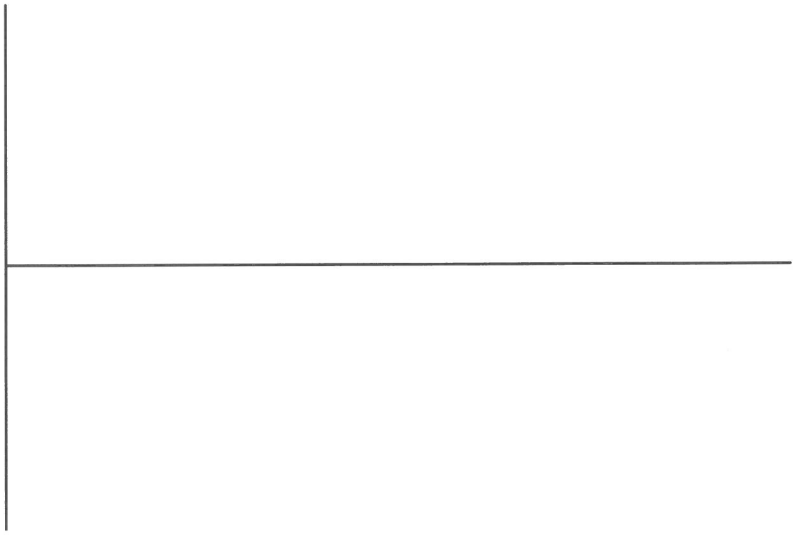
_____

_____

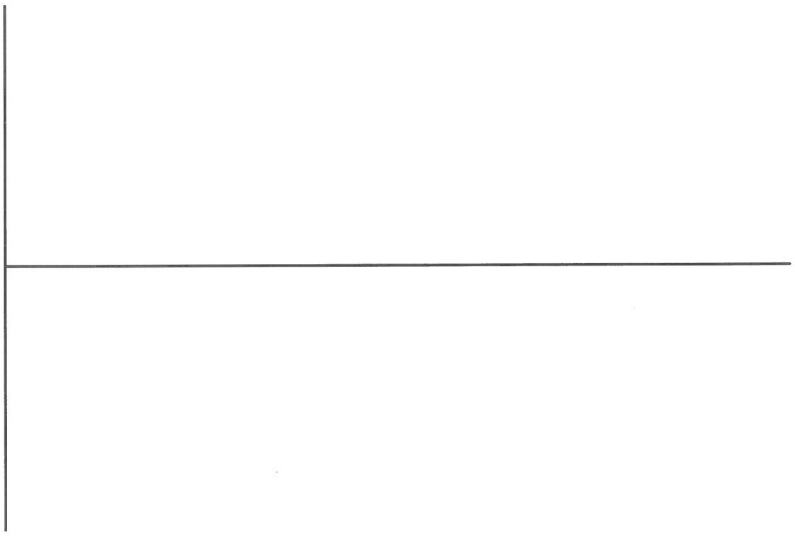
_____

horizontal distance = _____ (3 marks)

(f) (i)



(ii)



(6 marks)

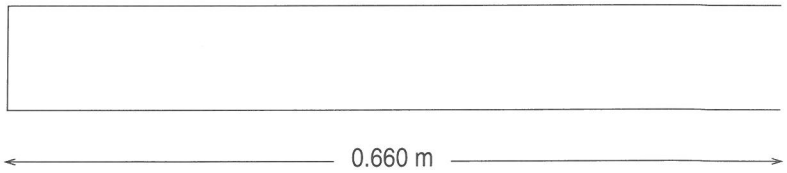
WAVES

(29 marks; 34 minutes)

QUESTION FOUR: THE ORCHESTRA (14 marks)

Speed of sound = 3.30×10^2 m s^{-1}

(a)



(3 marks)

(b) _____

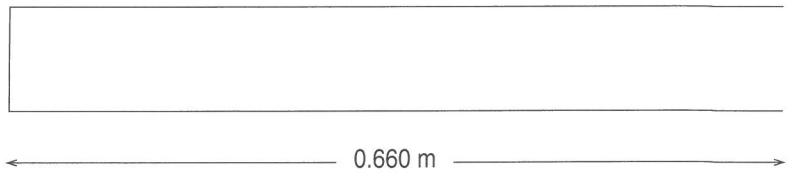
_____

wavelength = _____ (2 marks)

(c) _____

(1 mark)

(d) (i)



(1 mark)

(ii) _____

_____

_____

frequency = _____ (3 marks)

(e) _____

_____

_____

(3 marks)

(f) _____

_____

frequency of the beats = _____ (1 mark)

Q4

14

QUESTION FIVE: INTERFERENCE (9 marks)

Speed of light = 3.00×10^8 m s^{-1}

(a) _____

_____

(1 mark)

(b) _____

_____

(2 marks)

(c) _____

_____

_____

(3 marks)

(d) _____

_____

_____

distance = _____ (2 marks)

(e) _____

_____

(1 mark)

Q5

9

QUESTION SIX: EARTHQUAKES (6 marks)

(a) _____

_____

_____

_____

(2 marks)

(b) (i) _____

(ii) _____

(2 marks)

(c) _____

_____

_____

time = _____ (2 marks)

Q6

6

ELECTRICITY AND ELECTROMAGNETISM

(51 marks; 60 minutes)

QUESTION SEVEN: DC ELECTRICITY (13 marks)

(a) _____

_____

voltage = _____ (2 marks)

(b) _____

_____

_____

(2 marks)

(c) _____

_____

power = _____ (2 marks)

(d) _____

_____

power = _____ (2 marks)

(e) _____

_____

_____

_____

(3 marks)

(f) _____

_____

_____

(2 marks)

Q7

13

QUESTION EIGHT: CAPACITORS (10 marks)

$1\mu F = 1 \times 10^{-6}$ F

(a) _____

_____

_____

(2 marks)

(b) _____

_____

time constant = _____ (2 marks)

(c) (i)

(2 marks)

(ii)

(2 marks)

(d) _____

_____

energy = _____ (2 marks)

Q8 10

QUESTION NINE: THE WIND TURBINE (10 marks)

(a) _____

(1 mark)

(b) _____

_____

maximum magnetic flux = _____ (2 marks)

(c) _____

_____

angular frequency = _____ (2 marks)

(d) _____

_____

_____

(3 marks)

(e) _____

_____

rms voltage = _____ (2 marks)

Q9

10

QUESTION TEN: AC THEORY (18 marks)

(a) _____

_____

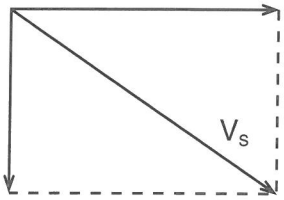
(2 marks)

(b) _____

_____

(2 marks)

(c)



(Not drawn to scale.)

(1 mark)

(d) _____

_____

impedance = _____ (2 marks)

(e) _____

_____

(2 marks)

(f) (i) _____

rms voltage across resistor = _____ (2 marks)

(ii) _____

rms voltage across capacitor = _____ (2 marks)

(g) (i) _____

(1 mark)

(ii) _____

_____

(2 marks)

(h) _____

_____

phase angle = _____ (2 marks)

Q10 18

ATOMIC AND NUCLEAR PHYSICS

(20 marks; 24 minutes)

QUESTION ELEVEN: ATOMIC PHYSICS (10 marks)

Planck's constant = 6.63×10^{-34} J s

(a) _____

_____

(2 marks)

(b) _____

_____

_____

maximum kinetic energy = _____ (2 marks)

(c) _____

_____

_____

_____

(2 marks)

(d) _____

_____

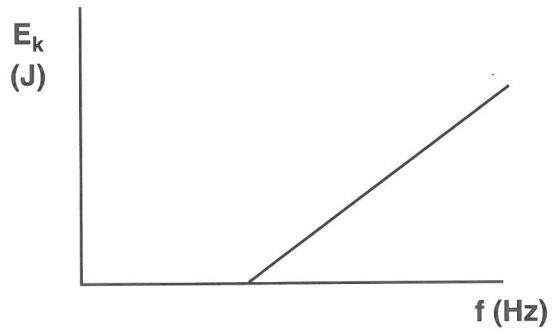
_____

_____

_____

(2 marks)

(e)



(2 marks)

Q11 10

QUESTION TWELVE: NUCLEAR PHYSICS (10 marks)

Speed of light = 3.00×10^8 m s^{-1}

Part 1: The Smoke Detector

(a) a = _____

b = _____

(2 marks)

(b) Particle X = _____

(1 mark)

(c) _____

_____

_____

_____

(2 marks)

(d) _____

_____

_____

energy released = _____ (2 marks)

Part 2: Binding Energy

(e) _____

_____

_____

_____

(3 marks)

Q12

10

This page has been deliberately left blank.

The following formulae may be of use to you:

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

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

$$\Delta p = Ft$$

$$\omega = 2\pi f$$

$$d = r\theta$$

$$v = r\omega$$

$$a = r\alpha$$

$$F = ma$$

$$p = mv$$

$$v = v_i + at$$

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

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

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

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

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

$$L = I\omega$$

$$L = mvr_\perp$$

$$\tau = I\alpha$$

$$\tau = Fr$$

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

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

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

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

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

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

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

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

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

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

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

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

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

$$\Delta E = Vq$$

$$V = Ed$$

$$Q = CV$$

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

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

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

$$C = \frac{\varepsilon_o\varepsilon_r A}{d}$$

$$\tau = RC$$

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

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

$$\phi = BA$$

$$\varepsilon = BAN\omega\sin\omega t$$

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

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

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

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

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

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

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

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

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

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

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

$$X_L = \omega L$$

$$V = IZ$$

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

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

$$f = |f_1 - f_2|$$

$$f' = f\frac{V_W}{V_W \pm V_S}$$

$$E = hf$$

$$hf = \phi + E_K$$

$$E = mc^2$$

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

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

$$\upsilon = f\lambda$$

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