Affix label with Candidate Number here.

If transfer candidate, enter number if known, or name here.

(Supervisor's use only)

No. 262/1

New Zealand Qualifications Authority

University Entrance and Bursaries Examination, incorporating The National Bank of New Zealand Ltd Scholarships

PHYSICS: 1996

ANSWER BOOKLET

INSTRUCTIONS

All answers are to be written in this Answer Booklet.

All questions should be answered.

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

If you need more space for any answer, ask the Supervisor for extra paper. Answers on extra paper should be clearly numbered. Write your 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:

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, and
- expressed to an appropriate number of significant figures.

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

Check that this booklet contains pages 2 — 19 in the correct order.

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

(Turn over

The following formulae may be of use to you:

$\Delta p = Ft$

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

$m_1x_1 = m_2x_2$

$m_1x_1 = m_2(d - x_1)$

$L = mvr$

$L = I\omega$

$\theta = \omega_0 t + \frac{1}{2}\alpha t^2$

$\omega = \omega_0 + \alpha t$

$\omega^2 = \omega_0^2 + 2\alpha\theta$

$y = A\sin(\omega t + \phi)$

$v = A\omega\cos(\omega t + \phi)$

$a = -A\omega^2 \sin(\omega t + \phi)$

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

$V_{rms} = \frac{V_0}{\sqrt{2}}$

$X_L = \omega L$

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

LINEAR AND ROTATIONAL MECHANICS

(36 marks; 43 minutes)

FUN PARKS

QUESTION ONE: DODGEMS AND THE LOG FLUME (18 marks)

(a) _____

_____

_____

momentum = _____ (2 marks)

(b) _____

_____

_____ (2 marks)

(c) _____

_____

_____

energy = _____ (2 marks)

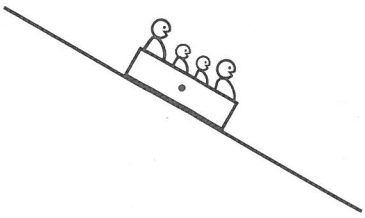
(d) _____ (1 mark)

(e) (i) _____

maximum velocity = _____ (3 marks)

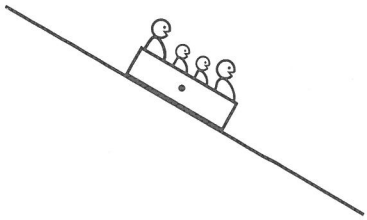
(ii) _____ (1 mark)

(f)



(3 marks)

(g)



(1 mark)

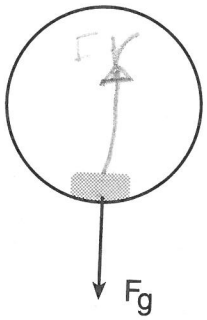
(h) _____

average force = _____ (3 marks)

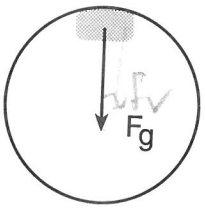
P2 6 P3 12 Q1 18

QUESTION TWO: THE ROLLER COASTER AND BUMPER BOATS (18 marks)

(a) (i)



(ii)



(2 marks)

(b) $F_c = F_g + R_T$

(1 mark)

(c) $F = \frac{mv^2}{r}$ minimum $R_T = 0$

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

minimum speed = _____ (3 marks)

(d) $\frac{m_1 r + m_2 v}{m_1 + m_2}$ 52 x 1.

(2 marks)

(e) boat and passenger move in a anticlockwise direction

(3 marks)

(f) $L = mvr$

$= 58 \times 2 \times 0.16$

angular momentum = _____ (3 marks)

(g) $t = 6 \quad \alpha = ? \quad \omega_f = 0 \quad \omega_i = 3.16$

$\omega = \omega_i + \alpha t$

$0 = 3.16 + \alpha 6$

angular deceleration = -0.53 rad s^{-2} (2 marks)

(h) $\tau = I\alpha$

$I = \frac{\tau}{\alpha} = \frac{4.11}{0.53}$

rotational inertia = 7.8 kg m^2 (2 marks)

P4 11 P5 7 Q2 18

OSCILLATIONS AND WAVE MOTION

(44 marks; 52 minutes)

QUESTION THREE: OSCILLATIONS (14 marks)

(a) $\omega = 2\pi f$ $\quad f = \frac{1}{7.5} =$

$= 2\pi \times 0.133$

angular frequency = $0.84\ rads^{-1}$ (2 marks)

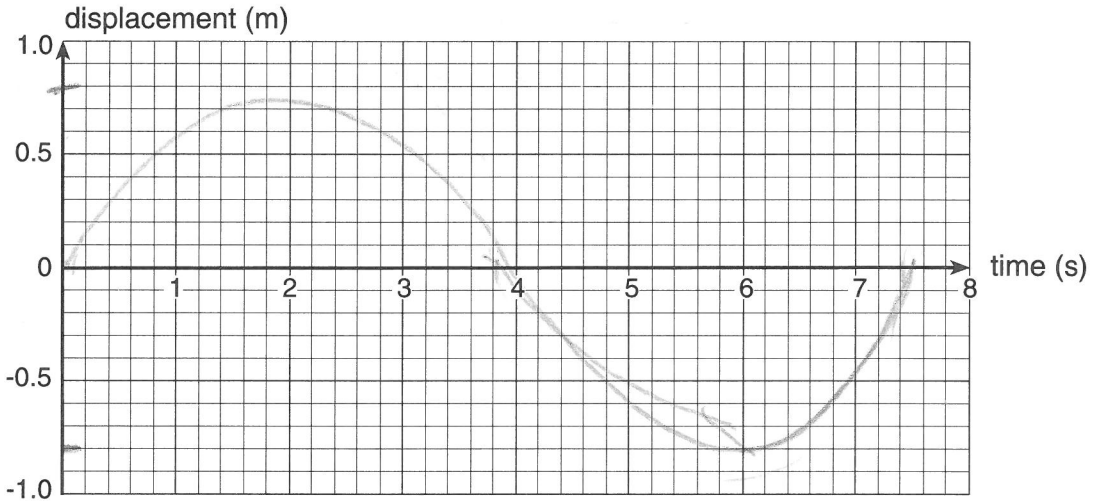
(b) $a = -\omega^2$

$= 0.8 \times 0.84^2$

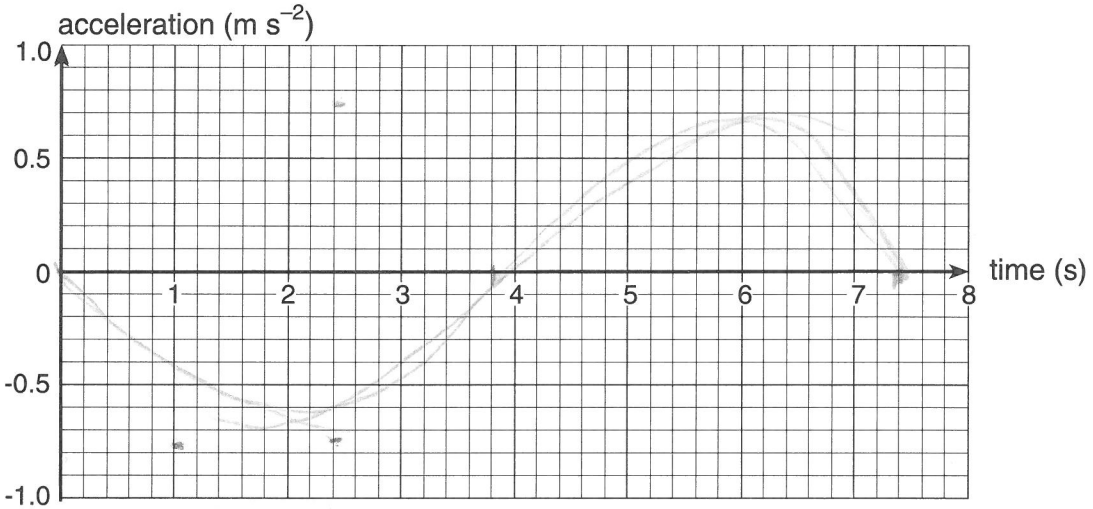
$= 0.56 ms^{-2}$

(2 marks)

(c) (i)



(ii)

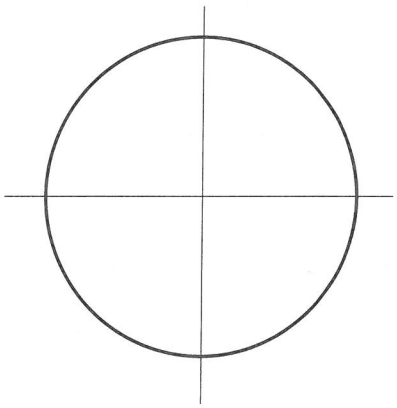


(6 marks)

(d) A decrease.

(1 mark)

(e)



time per oscillation = _____ (3 marks)

P6 10 P7 4 Q3 14

QUESTION FOUR: WAVES (16 marks)

(a) The incident wave will be reflected and travel back through itself. (1 mark)

(b) Transverse. (1 mark)

(c) i. Strength of wind
ii. Frequency of wind. (2 marks)

(d) primary and secondary transverse and longitudinal waves in earthquake (1 mark)

(e) First helps with transverse as in these the vibration are perpendicular. Second helps with longitudinal as here vibration is same direction [illegible] (2 marks)

(f) Signal A - radio - bigger λ
Signal B - microwave - shorter λ (2 marks)

(g) (forced oscillation of earthquake is very different from natural frequency of sky to no resonance. (2 marks)

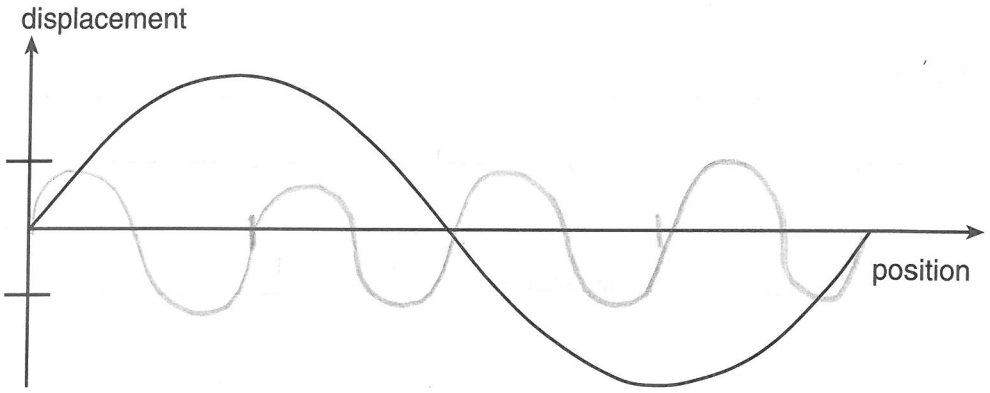
(h) B – more deflection around the bend as wavelength is smaller.

(2 marks)

(i) no crossing over of the signals occurs as too different

(1 mark)

(j)



(2 marks)

QUESTION FIVE: INTERFERENCE (14 marks)

(a) $f = \frac{1}{T}$ v $f = \frac{3 \times 10^8}{6 \times 10^{-7}}$

$f\lambda$

$=$

frequency = 5×10^{14} Hz (2 marks)

(b) they must be $\frac{1}{2}$ wavelength out of phase. (1 mark)

(c) $5.\cancel{0} \times 6 \times 10^{-7}$

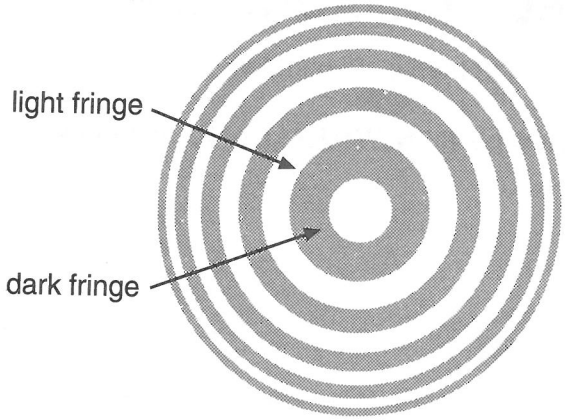
distance = $3.\cancel{0} \times 10^{-6}$ m (2 marks)

(d) Distance = 2 × thickness

$\frac{3 \times 10^{-6}}{2}$

air film thickness = 1.5×10^{-6} m (1 mark)

(e) Black. (1 mark)



(f) The thickness not uniform

(1 mark)

(g) Rate of change of thickness not constant.

(1 mark)

(h) (i) width of each fringe would ↑

(1 mark)

(ii) fringes would be distorted and not even all around the circle.

(1 mark)

(i) wavelength.

(1 mark)

(j) red. the light would be red shifted as it is moving away so wavelength looks as if it is increasing.

(2 marks)

ELECTROMAGNETISM

(48 marks; 57 minutes)

QUESTION SIX: ELECTRICITY SUPPLY IN NEW ZEALAND (34 marks)

Generation (12 marks)

(a) From gravitational potential

to kinetic. (1 mark)

(b) $0.5m \times 0.5 = 0.25m^2$

area = $0.25m^2$. (1 mark)

(c) B and D - perpendicular to magnetic field

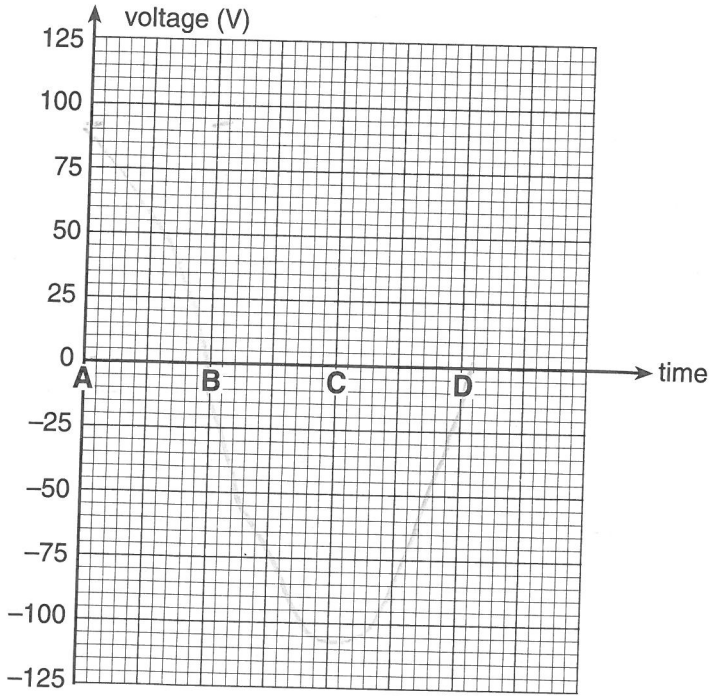
(2 marks)

(d) $\Phi = BA$

$= 0.25 \times \times 1.2$

maximum magnetic flux = 0.30 Wb (3 marks)

(e)



(3 marks)

(f)

$V_{rms} =$ _____ (2 marks)

Distribution (11 marks)

(g) Copper (has) high conductivity.

(2 marks)

(h) It has a low density.

(1 mark)

(i)

percentage uncertainty in radius = 1% (1 mark)

(j) $\Delta R = \Delta L\% + \Delta A\%$

$= 5\% + 2 \times 1.0\%$

$= 7\%$

percentage uncertainty in resistance = 7% (2 marks)

(k) $0.7437294 \times 7\%$

$= 0.05$

0.74 ± 0.05

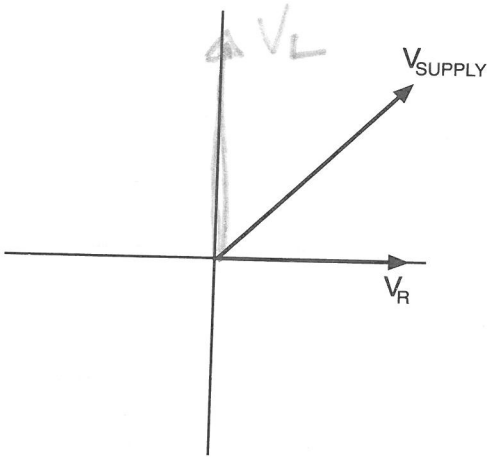
(3 marks)

(l) The loss energy is lost as heat through resistance because current in it is low.

(2 marks)

Use (11 marks)

(m)



(2 marks)

(n) $V^2 = V_L^2 + V_V^2$

(1 mark)

(o) $V = IRT$ $I = \frac{V}{R}$ $\frac{150}{14.5}$

current = 10A (2 marks)

(p) $X_L = WL = \left[X_L = \frac{V_L}{I_L}\right]$

$W = \frac{200}{10.35}$

reactance = 19.32 (2 marks)

(q) Capacitor must have same reactance as the inductor.

(2 marks)

(r) (i) decreased (1 mark)

(ii) increase. (1 mark)

P12 & 13	P14	P15	Q6
12	11	11	34

QUESTION SEVEN: THE ELECTRICAL SYSTEM OF A CAR (14 marks)

The starter motor (10 marks)

(a) _____

_____

_____ (2 marks)

(b) _____

_____

_____

_____

current = _____ (2 marks)

(c) _____

_____ (1 mark)

(d) _____

_____

_____ (1 mark)

(e) _____

_____

_____ (2 marks)

(f) _____

_____

_____

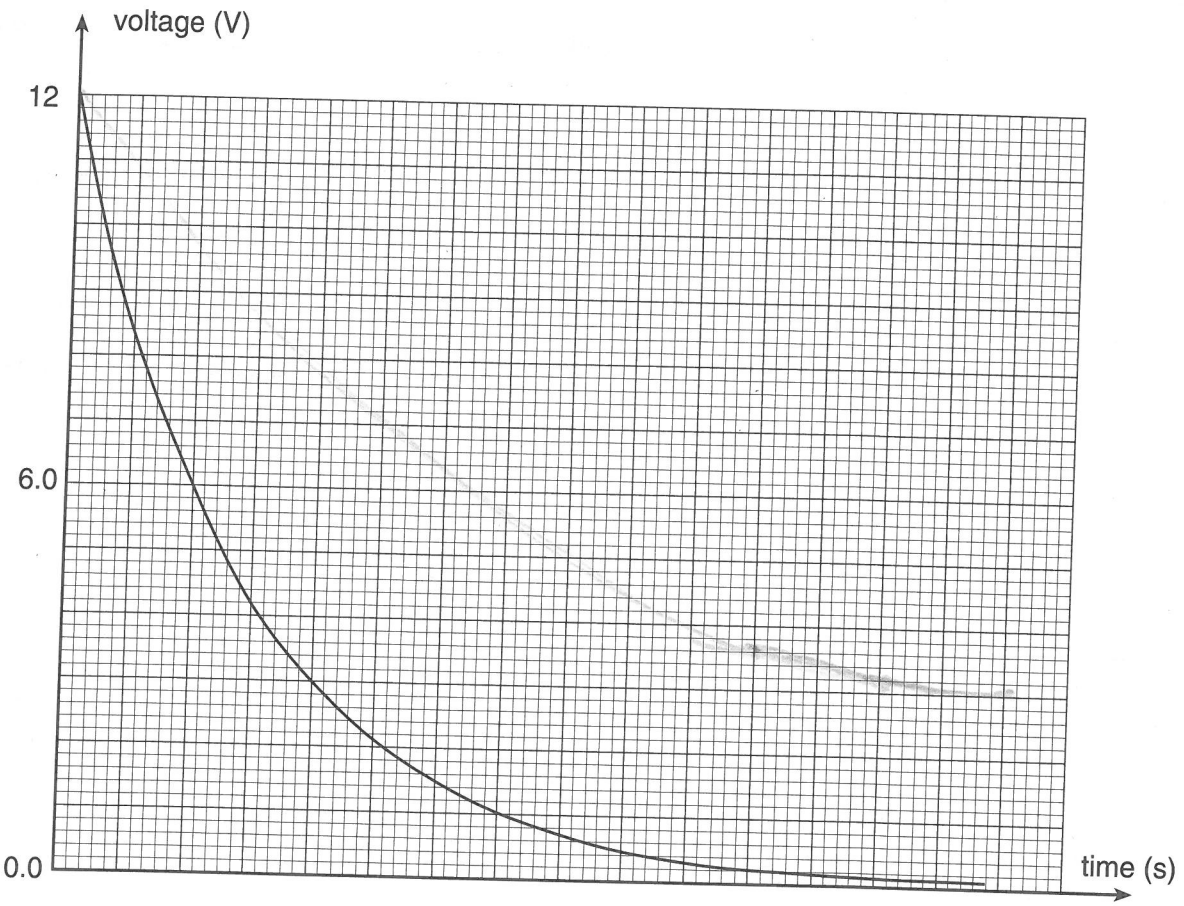
_____ (2 marks)

The distributor (4 marks)

(g) Q = CV ∴ 12 × 0.2 × 10⁻⁶

charge = 2.4 × 10⁻⁶ C (2 marks)

(h)



(2 marks)

PHOTONS, ATOMS AND NUCLEI

(24 marks; 28 minutes)

QUESTION EIGHT: COSMIC RAYS (24 marks)

(a) _____

_____

_____

time = _____ (2 marks)

(b) _____

_____

_____

_____ (2 marks)

(c) _____

_____

_____

_____

wavelength = _____ (2 marks)

(d) _____

_____

_____ (2 marks)

(e) _____

_____

_____

colour is _____ (3 marks)

(f)

part (d)

_____ second higher state energy =

_____ first higher state energy =

part (e)

_____ ground state energy = -2.18×10^{-18} J (3 marks)

(g) L = _____ (1 mark)

(h) _____

_____

_____

wavelength = _____ (2 marks)

(i) _____ (1 mark)

(j) _____

_____ (1 mark)

(k) a = _____ (1 mark)

b = _____ (1 mark)

X = _____ (1 mark)

(l) _____

_____

_____

_____ (2 marks)

P18 11 P19 13 Q8 24

Whatever your future holds, we want to be there for you.

(And for today... good luck.)

Peering into the future can be a bit scary. Who knows where you'll be in five or ten years..?

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