

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: 1999

ANSWER BOOKLET

INSTRUCTIONS

All answers are to be written in this Answer Booklet.

Answer **ALL** questions.

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 used none.

Answer spaces for each part begin on the following pages:

Mechanics	page 2
Waves	page 6
Electricity and Electromagnetism	page 9
Atomic and Nuclear Physics	page 14

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

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(Turn over

MECHANICS

(53 marks; 63 minutes)

THE PORTABLE CD PLAYER

QUESTION ONE: ROTATIONAL MOTION (10 marks)

(a) _____

 _____ = _____ revolutions per minute (2 marks)

(b) _____

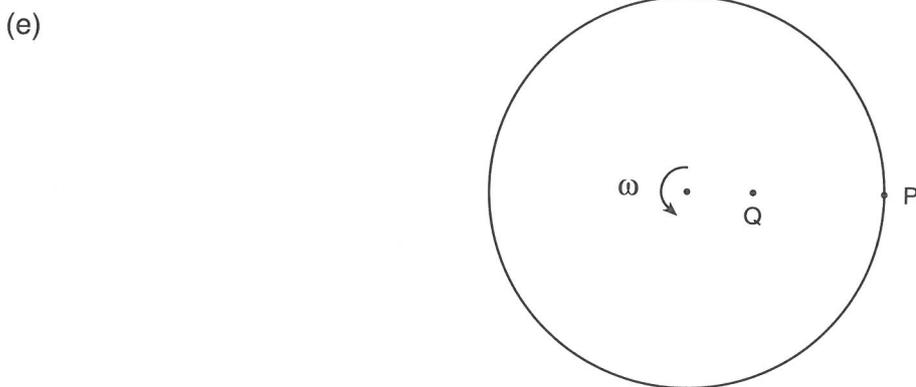
 _____ acceleration = _____ (2 marks)

(c) _____

 _____ angle turned through = _____ (2 marks)

(d) _____

 _____ linear speed = _____ (2 marks)



(1 mark)

(f) _____
 _____ (1 mark)

Q1
10

QUESTION TWO: TRANSLATIONAL AND ROTATIONAL MOTION (14 marks)Acceleration due to gravity = 9.8 m s^{-2}

(a) _____
 _____ gravitational potential energy = _____ (2 marks)

(b) _____
 _____ linear kinetic energy = _____ (2 marks)

(c) _____
 _____ rotational kinetic energy = _____ (1 mark)

(d) _____

 _____ angular velocity = _____ (2 marks)

(e) _____

 _____ rotational inertia = _____ (2 marks)

(f) _____

 _____ force = _____ (3 marks)

(g) _____
 _____ linear momentum = _____ (1 mark)

(h) _____
 _____ force = _____ (1 mark)

Q2
14

(Turn over

QUESTION THREE: SIMPLE HARMONIC MOTION (15 marks)Acceleration due to gravity = 9.8 m s^{-2}

(a) _____

 _____ period = _____ (2 marks)

(b) _____
 _____ (2 marks)

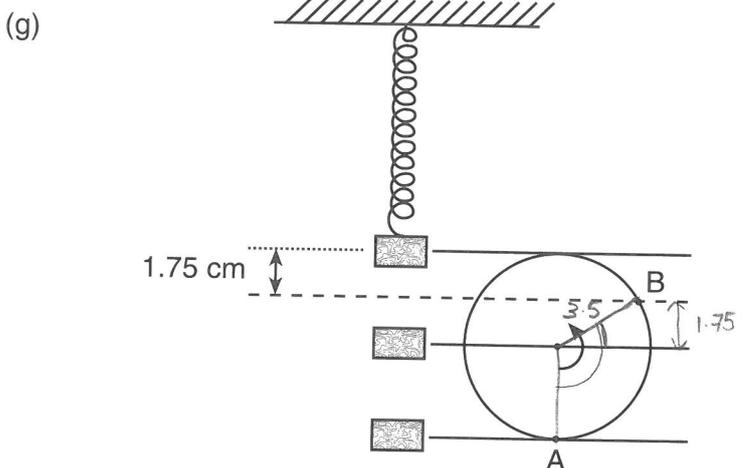
(c) _____
 _____ maximum speed = _____ (2 marks)

(d) _____ (1 mark)

(e) _____
 _____ kinetic energy = _____ (2 marks)

(f) _____

 _____ acceleration = _____ (3 marks)



$$\sin \theta = \frac{1.75}{3.5}$$

$$\theta = 30^\circ$$

total
 $= 50 + 50$
 $= 100$

time = _____ (3 marks)

Q3

15

QUESTION FOUR: GRAVITY (14 marks)

Acceleration due to gravity at sea level on Earth = 9.8 m s^{-2}

Universal gravitational constant = $6.67 \times 10^{-11} \text{ Nm}^2 \text{ kg}^{-2}$

Mass of Earth = $6.0 \times 10^{24} \text{ kg}$

Radius of Earth at sea level = $6.37 \times 10^6 \text{ m}$

(a) _____

 _____ speed = _____ (3 marks)

(b) _____

 _____ centripetal acceleration = _____ (2 marks)

(c) _____
 _____ acceleration = _____ (1 mark)

(d) _____ (1 mark)

(e) _____ period = _____ (1 mark)

(f) _____

 _____ force = _____ (3 marks)

(g) _____

 _____ (3 marks)

<p>Q4</p>

<p>14</p>

(Turn over

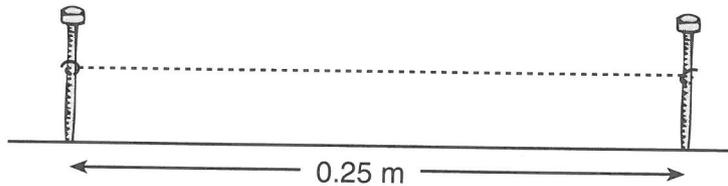
WAVES

(30 marks; 36 minutes)

QUESTION FIVE: SOUND (11 marks)

Velocity of sound in air is 330 m s^{-1}

(a)

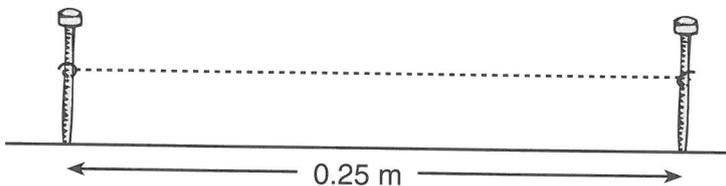


(2 marks)

(b)

_____ velocity = _____ (3 marks)

(c)



(2 marks)

(d)

_____ (2 marks)

(e)

_____ frequency = _____ (1 mark)

(f)

_____ (1 mark)

QUESTION SIX: ELECTROMAGNETIC RADIATION (19 marks)Speed of light in vacuum and air = $3.00 \times 10^8 \text{ m s}^{-1}$

(a) _____

 _____ wavelength = _____ (2 marks)

(b) _____

 _____ time = _____ (2 marks)

(c) _____ (1 mark)

(d) _____

 _____ frequency = _____ (3 marks)

(e) _____

 _____ $\lambda = 6.40 \times 10^{-7} \text{ m}$, $f =$ _____
 _____ $\lambda = 6.45 \times 10^{-7} \text{ m}$, $f =$ _____ (2 marks)

(f) _____

 _____ speed = _____ (4 marks)

(g) _____

_____ pit spacing = _____ (3 marks)

(h) _____

_____ (2 marks)

ELECTRICITY AND ELECTROMAGNETISM

(46 marks; 54 minutes)

QUESTION SEVEN: DC ELECTRICITY (10 marks)

(a) _____
_____ resistance = _____ (2 marks)

(b) _____
_____ power = _____ (2 marks)

(c) _____
_____ time = _____ (2 marks)

(d) _____
_____ current = _____ (2 marks)

(e)

(2 marks)

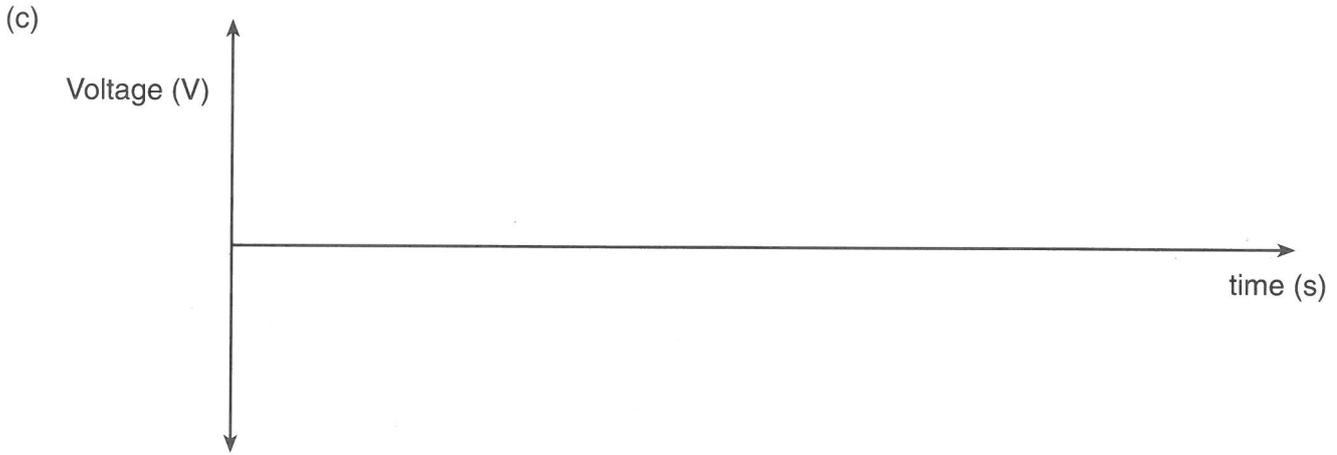
Q7
10

(Turn over

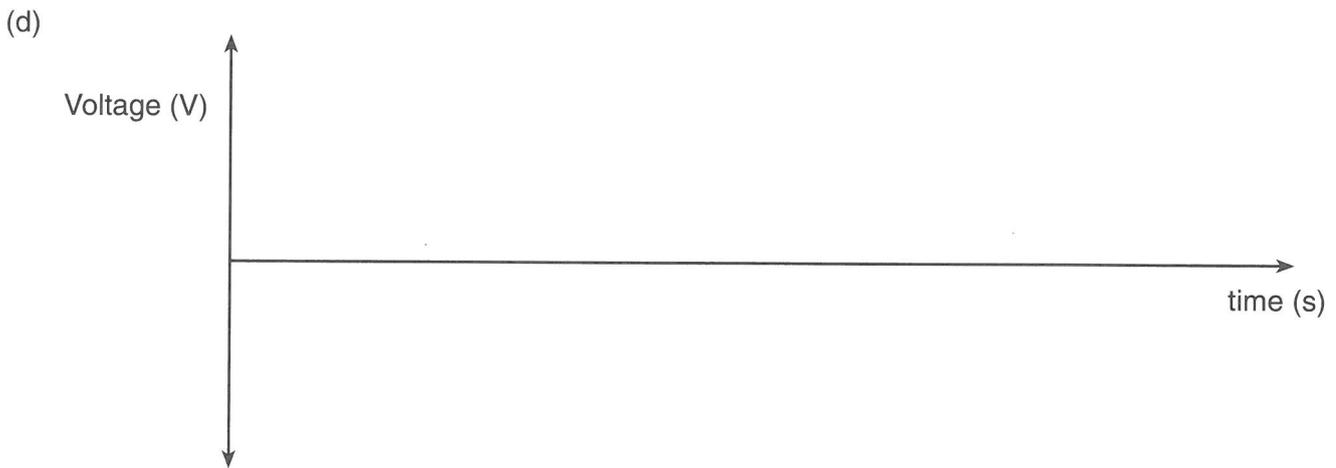
QUESTION EIGHT: AC ELECTRICITY (19 marks)

(a) _____ (1 mark)

(b) _____
_____ (2 marks)



(4 marks)

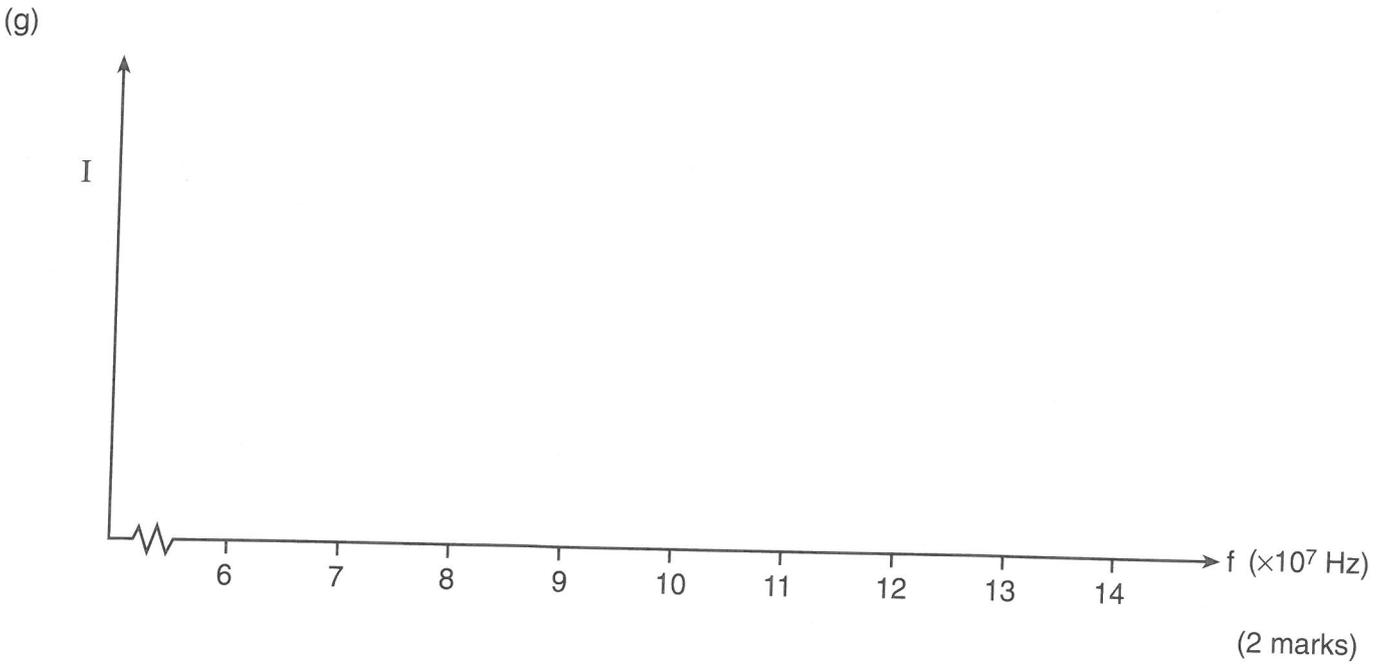


(2 marks)

(e) _____

_____ capacitance = _____ (3 marks)

(f) _____
_____ frequency = _____ (2 marks)



(h) _____

_____ phase angle = _____ radians (3 marks)

Q8
19

(Turn over



QUESTION NINE: CAPACITORS (10 marks)

Permittivity of free space = $8.85 \times 10^{-12} \text{ N}^{-1}\text{m}^{-2} \text{ C}^2$

Charge on electron = $1.6 \times 10^{-19} \text{ C}$

(a) _____
_____ thickness = _____ (3 marks)

(b) _____
_____ relative permittivity = _____ (1 mark)

(c) _____
_____ time = _____ (2 marks)



(e) _____
_____ charge = _____ (2 marks)

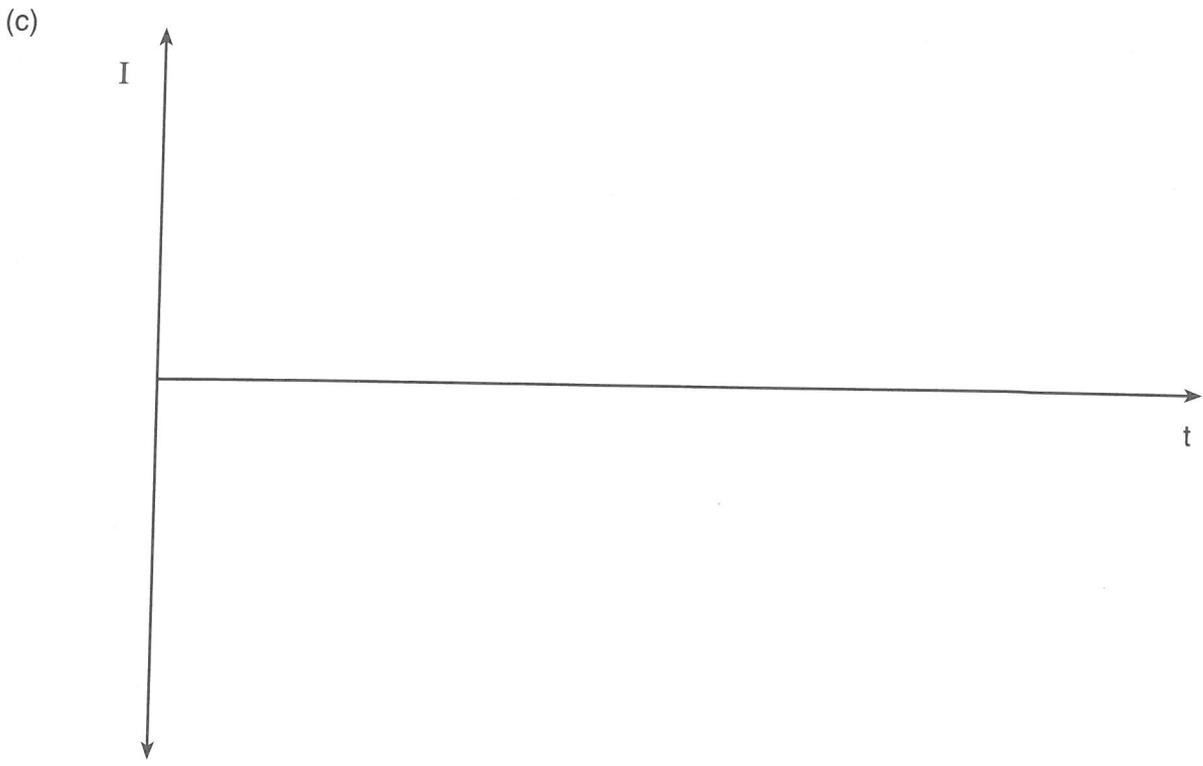
QUESTION TEN: INDUCTANCE (7 marks)

(a) _____

(2 marks)

(b) _____

(2 marks)



(3 marks)

Q10
7

(Turn over

ATOMIC AND NUCLEAR PHYSICS

(23 marks; 27 minutes)

QUESTION ELEVEN: ATOMIC PHYSICS (11 marks)

Speed of light in vacuum = $3.0 \times 10^8 \text{ m s}^{-1}$

Planck's constant = $6.63 \times 10^{-34} \text{ J s}$

Rydberg constant = $1.097 \times 10^7 \text{ m}^{-1}$

(a) _____

 _____ energy = _____ (3 marks)

(b) _____

 _____ wavelength = _____ (2 marks)

(c) _____ (1 mark)

(d) _____

 _____ (2 marks)

(e) _____

 _____ energy = _____ (2 marks)

(f) _____
 _____ work function = _____ (1 mark)

Q11

11

QUESTION TWELVE: NUCLEAR PHYSICS (12 marks)Speed of light = $3.0 \times 10^8 \text{ m s}^{-1}$ Charge on an electron = $1.6 \times 10^{-19} \text{ C}$

(a)

Common name	Symbol	Usual speed	Charge
alpha particle	α	$< 0.1 c$	
	β		-1
gamma radiation	γ	c	

(4 marks)

(b) _____ (1 mark)

(c) _____

 _____ (2 marks)

(d) _____

 number of protons = _____ number of neutrons = _____ (2 marks)

(e) _____
 _____ (1 mark)

(f) _____

 _____ mass = _____ (2 marks)

Q12
12

(Turn over



This page has been deliberately left blank.

The following formulae may be of use to you:

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

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

$$\Delta p = Ft$$

$$\omega = 2\pi f$$

$$d = r\theta$$

$$v = r\omega$$

$$a = r\alpha$$

$$F = ma$$

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

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

$$L = I\omega$$

$$L = mvr_{\perp}$$

$$\tau = I\alpha$$

$$\tau = Fr$$

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

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

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

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

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

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

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

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

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

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

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

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

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

$$\Delta E = Vq$$

$$V = Ed$$

$$Q = CV$$

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

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

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

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

$$\tau = RC$$

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

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

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

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

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

$$\phi = BA$$

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

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

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

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

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

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

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

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

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

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

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

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

$$X_L = \omega L$$

$$V = IZ$$

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

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

$$f = |f_1 - f_2|$$

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

$$E = hf$$

$$hf = \phi + E_K$$

$$E = mc^2$$

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

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

$$v = f\lambda$$

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

**Unfold this flap
and enter the
number of EXTRA
sheets used.**

**Keep this flap
FOLDED IN at
all other times.**

