See back cover for an English translation of this cover

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L3–PHYSMR

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NZQA
NEW ZEALAND QUALIFICATIONS AUTHORITY
MANA TOHU MĀTAURANGA O AOTEAROA

Ahupūngao, Kaupae 3, 2014

2.00 i te ahiahi Rātū 25 o Whiringa-ā-rangi 2014

PUKAITI RAUEMI
mō te 91523M, te 91524M me te 91526M

Tirohia tēnei pukaiti hei whakautu i ngā pātai o ō Pukapuka Whakautu, Pātai hoki.

Tirohia mehemea kei roto nei ngā whārangi 2–5 e raupapa tika ana, ā, kāore hoki he whārangi wātea.

KA TAEA TĒNEI PUKAITI TE PUPURI HEI TE MUTUNGA O TE WHAKAMĀTAUTAU.

Tērā pea he āwhina kei ngā raraunga me ngā ture tātai e whai ake nei ki a koe.

91523 Te whakaatu māramatanga ki ngā pūnaha ngaru

$$d\sin\theta = n\lambda \qquad n\lambda = \frac{dx}{L} \qquad f' = f\frac{v_{\mathrm{W}}}{v_{\mathrm{W}} \pm v_{\mathrm{S}}} \qquad v = f\lambda \qquad f = \frac{1}{T}$$

91524 Te whakaatu māramatanga ki ngā pūnaha pūkahakaha

$$F = ma \qquad p = mv \qquad \Delta p = F\Delta t \qquad \Delta E_{\mathrm{p}} = mg\Delta h$$

$$W = Fd \qquad E_{\mathrm{K(LIN)}} = \frac{1}{2}mv^2 \qquad x_{\mathrm{COM}} = \frac{m_1x_1 + m_2x_2}{m_1 + m_2}$$

$$d = r\theta \qquad v = r\omega \qquad a = r\alpha \qquad \omega = \frac{\Delta\theta}{\Delta t}$$

$$\alpha = \frac{\Delta\omega}{\Delta t} \qquad \omega = 2\pi f \qquad f = \frac{1}{T} \qquad E_{\mathrm{K(ROT)}} = \frac{1}{2}I\omega^2$$

$$\omega_{\mathrm{f}} = \omega_{\mathrm{i}} + \alpha t \qquad \theta = \frac{\omega_{\mathrm{f}} + \omega_{\mathrm{i}}}{2}t \qquad \omega_{\mathrm{f}}^{\,2} = \omega_{\mathrm{i}}^{\,2} + 2\alpha\theta \qquad \theta = \omega_{\mathrm{i}}t + \frac{1}{2}\alpha t^2$$

$$\tau = I\alpha \qquad \tau = Fr \qquad L = mvr \qquad L = I\omega$$

$$F_{\mathrm{g}} = \frac{\mathrm{G}Mm}{r^2} \qquad F_{\mathrm{c}} = \frac{mv^2}{r}$$

$$F = -ky \qquad E_{\mathrm{p}} = \frac{1}{2}ky^2 \qquad T = 2\pi\sqrt{\frac{l}{g}} \qquad T = 2\pi\sqrt{\frac{m}{k}}$$

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

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

You may find the following data and formulae useful.

91523 Demonstrate understanding of wave systems

$$d\sin\theta = n\lambda \qquad n\lambda = \frac{dx}{L} \qquad f' = f\frac{v_{\mathrm{W}}}{v_{\mathrm{W}} \pm v_{\mathrm{S}}} \qquad v = f\lambda \qquad f = \frac{1}{T}$$

91524 Demonstrate understanding of mechanical systems

$$F = ma \qquad p = mv \qquad \Delta p = F\Delta t \qquad \Delta E_{\mathrm{p}} = mg\Delta h$$

$$W = Fd \qquad E_{\mathrm{K(LIN)}} = \frac{1}{2}mv^2 \qquad x_{\mathrm{COM}} = \frac{m_1x_1 + m_2x_2}{m_1 + m_2}$$

$$d = r\theta \qquad v = r\omega \qquad a = r\alpha \qquad \omega = \frac{\Delta\theta}{\Delta t}$$

$$\alpha = \frac{\Delta\omega}{\Delta t} \qquad \omega = 2\pi f \qquad f = \frac{1}{T} \qquad E_{\mathrm{K(ROT)}} = \frac{1}{2}I\omega^2$$

$$\omega_{\mathrm{f}} = \omega_{\mathrm{i}} + \alpha t \qquad \theta = \frac{\omega_{\mathrm{f}} + \omega_{\mathrm{i}}}{2}t \qquad \omega_{\mathrm{f}}^{\,2} = \omega_{\mathrm{i}}^{\,2} + 2\alpha\theta \qquad \theta = \omega_{\mathrm{i}}t + \frac{1}{2}\alpha t^2$$

$$\tau = I\alpha \qquad \tau = Fr \qquad L = mvr \qquad L = I\omega$$

$$F_{\mathrm{g}} = \frac{\mathrm{G}Mm}{r^2} \qquad F_{\mathrm{c}} = \frac{mv^2}{r}$$

$$F = -ky \qquad E_{\mathrm{p}} = \frac{1}{2}ky^2 \qquad T = 2\pi\sqrt{\frac{l}{g}} \qquad T = 2\pi\sqrt{\frac{m}{k}}$$

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

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

91526 Te whakaatu māramatanga ki ngā pūnaha hiko

$$V = Ed \qquad \Delta E = Vq \qquad E = \frac{1}{2}QV \qquad Q = CV$$

$$C = \frac{\varepsilon_o \varepsilon_r A}{d} \qquad C_{\text{T}} = C_1 + C_2 + \ldots \qquad \frac{1}{C_{\text{T}}} = \frac{1}{C_1} + \frac{1}{C_2} + \ldots \qquad \tau = RC$$

$$R_{\text{T}} = R_1 + R_2 + \ldots \qquad \frac{1}{R_{\text{T}}} = \frac{1}{R_1} + \frac{1}{R_2} + \ldots \qquad V = IR \qquad P = VI$$

$$\phi = BA \qquad \varepsilon = -L\frac{\Delta I}{\Delta t} \qquad \varepsilon = -\frac{\Delta \phi}{\Delta t} \qquad f_0 = \frac{1}{2\pi\sqrt{LC}}$$

$$\frac{N_{\text{p}}}{N_{\text{s}}} = \frac{V_{\text{p}}}{V_{\text{s}}} \qquad E = \frac{1}{2}LI^2 \qquad \tau = \frac{L}{R} \qquad I = I_{\text{MAX}} \sin \omega t$$

$$V = V_{\text{MAX}} \sin \omega t \qquad I_{\text{MAX}} = \sqrt{2}\, I_{\text{rms}} \qquad V_{\text{MAX}} = \sqrt{2}\, V_{\text{rms}} \qquad X_C = \frac{1}{\omega C}$$

$$X_L = \omega L \qquad V = IZ \qquad \omega = 2\pi f \qquad f = \frac{1}{T}$$

Raraunga whaitake

Tere o te tūrama	$= 3.00 \times 10^{8}$ m s^{-1}
Whana ki te irahiko	$= -1.60 \times 10^{-19}$ C
Te whakaterenga nā te tō ā-papa o Papatūānuku	$= 9.81$ m s^{-2}
Aumou hiko	$= 8.85 \times 10^{-12}$ F m^{-1}
Te uara pūmau tō ā-papa tukupū	$= 6.67 \times 10^{-11}$ N m^2 kg^{-2}

91526 Demonstrate understanding of electrical systems

$$V = Ed \qquad \Delta E = Vq \qquad E = \frac{1}{2}QV \qquad Q = CV$$

$$C = \frac{\varepsilon_o \varepsilon_r A}{d} \qquad C_{\mathrm{T}} = C_1 + C_2 + \ldots \qquad \frac{1}{C_{\mathrm{T}}} = \frac{1}{C_1} + \frac{1}{C_2} + \ldots \qquad \tau = RC$$

$$R_{\mathrm{T}} = R_1 + R_2 + \ldots \qquad \frac{1}{R_{\mathrm{T}}} = \frac{1}{R_1} + \frac{1}{R_2} + \ldots \qquad V = IR \qquad P = VI$$

$$\phi = BA \qquad \varepsilon = -L\frac{\Delta I}{\Delta t} \qquad \varepsilon = -\frac{\Delta \phi}{\Delta t} \qquad f_0 = \frac{1}{2\pi\sqrt{LC}}$$

$$\frac{N_{\mathrm{p}}}{N_{\mathrm{s}}} = \frac{V_{\mathrm{p}}}{V_{\mathrm{s}}} \qquad E = \frac{1}{2}LI^2 \qquad \tau = \frac{L}{R} \qquad I = I_{\mathrm{MAX}} \sin \omega t$$

$$V = V_{\mathrm{MAX}} \sin \omega t \qquad I_{\mathrm{MAX}} = \sqrt{2}\, I_{\mathrm{rms}} \qquad V_{\mathrm{MAX}} = \sqrt{2}\, V_{\mathrm{rms}} \qquad X_C = \frac{1}{\omega C}$$

$$X_L = \omega L \qquad V = IZ \qquad \omega = 2\pi f \qquad f = \frac{1}{T}$$

Useful data

Speed of light	$= 3.00 \times 10^{8}$ m s^{-1}
Charge on the electron	$= -1.60 \times 10^{-19}$ C
Acceleration due to gravity on Earth	$= 9.81$ m s^{-2}
Permittivity of free space	$= 8.85 \times 10^{-12}$ F m^{-1}
Universal gravitational constant	$= 6.67 \times 10^{-11}$ N m^2 kg^{-2}

English translation of the wording on the front cover

L3-PHYSMR

Level 3 Physics, 2014

2.00 pm Tuesday 25 November 2014

RESOURCE BOOKLET
for 91523, 91524 and 91526

Refer to this booklet to answer the questions in your Question and Answer Booklets.

Check that this booklet has pages 2–5 in the correct order and that none of these pages is blank.

YOU MAY KEEP THIS BOOKLET AT THE END OF THE EXAMINATION.