

L3-PHYSR



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## Level 3 Physics 2020

2.00 p.m. Wednesday 2 December 2020

### 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 2–3 in the correct order and that none of these pages is blank.

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

You may find the following data and formulae useful.

### 91523 Demonstrate understanding of wave systems

$$d \sin \theta = n \lambda \quad n \lambda = \frac{dx}{L} \quad f' = f \frac{v_w}{v_w \pm v_s} \quad v = f \lambda \quad f = \frac{1}{T}$$

### 91524 Demonstrate understanding of mechanical systems

|   |  |   |  |
|---|--|---|--|
| $F = ma$                                  | $p = mv$                                   | $\Delta p = F \Delta t$                         | $\Delta E_p = mg \Delta h$                     |
| $W = Fd$                                  | $E_{K(LIN)} = \frac{1}{2} mv^2$            | $x_{COM} = \frac{m_1 x_1 + m_2 x_2}{m_1 + m_2}$ |  |
| $d = r \theta$                            | $v = r \omega$                             | $a = r \alpha$                                  | $\omega = \frac{\Delta \theta}{\Delta t}$      |
| $\alpha = \frac{\Delta \omega}{\Delta t}$ | $\omega = 2 \pi f$                         | $f = \frac{1}{T}$                               | $E_{K(ROT)} = \frac{1}{2} I \omega^2$          |
| $\omega_f = \omega_i + \alpha t$          | $\theta = \frac{\omega_f + \omega_i}{2} t$ | $\omega_f^2 = \omega_i^2 + 2 \alpha \theta$     | $\theta = \omega_i t + \frac{1}{2} \alpha t^2$ |
| $\tau = I \alpha$                         | $\tau = Fr$                                | $L = mvr$                                       | $\theta = \omega_f t - \frac{1}{2} \alpha t^2$ |
| $F_g = \frac{GMm}{r^2}$                   | $F_c = \frac{mv^2}{r}$                     | $L = I \omega$                                  |  |
| $F = -ky$                                 | $E_p = \frac{1}{2} ky^2$                   | $T = 2\pi \sqrt{\frac{l}{g}}$                   | $T = 2\pi \sqrt{\frac{m}{k}}$                  |
| $y = A \sin \omega t$                     | $v = A \omega \cos \omega t$               | $a = -A \omega^2 \sin \omega t$                 | $a = -\omega^2 y$                              |
| $y = A \cos \omega t$                     | $v = -A \omega \sin \omega t$              | $a = -A \omega^2 \cos \omega t$                 |  |

**91526 Demonstrate understanding of electrical systems**

$$V = Ed$$

$$\Delta E = Vq$$

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

$$Q = CV$$

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

$$C_T = C_1 + C_2 + \dots$$

$$\frac{1}{C_T} = \frac{1}{C_1} + \frac{1}{C_2} + \dots$$

$$\tau = RC$$

$$R_T = R_1 + R_2 + \dots$$

$$\frac{1}{R_T} = \frac{1}{R_1} + \frac{1}{R_2} + \dots$$

$$V = IR$$

$$P = VI$$

$$\phi = BA$$

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

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

$$f_0 = \frac{1}{2\pi\sqrt{LC}}$$

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

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

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

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

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

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

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

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

$$X_L = \omega L$$

$$V = IZ$$

$$\omega = 2\pi f$$

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

**Useful data**

Speed of light  $= 3.00 \times 10^8 \text{ m s}^{-1}$

Charge on the electron  $= -1.60 \times 10^{-19} \text{ C}$

Acceleration due to gravity on Earth  $= 9.81 \text{ m s}^{-2}$

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

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

