

SOLUTIONS TO WHITEBOARD PROBLEMS

AT THE END OF THE NOTES IN
UNIT 5

1) A) $v = \frac{2\pi r}{T} = \frac{2\pi(25\text{m})}{4\text{s}} = 39.3\text{m/s}$

B) $a_c = \frac{v^2}{r} = \frac{(39.3\text{m/s})^2}{25\text{m}} = 61.7\text{m/s}^2$

C) $F_c = ma_c = (50\text{kg})(61.7\text{m/s}^2) = 3084\text{N}$

2 A) $v = \frac{2\pi r}{T} = \frac{2\pi(2\text{m})}{2\text{s}} = 6.28\text{m/s}$

$T = \frac{8\text{s}}{4} = 2\text{s}$

B) $a_c = \frac{v^2}{r} = \frac{(6.28\text{m/s})^2}{2\text{m}} = 19.7\text{m/s}^2$

C) $F_c = ma_c = (3\text{kg})(19.7\text{m/s}^2) = 59.2\text{N}$

3) A) $v = \frac{2\pi r}{T} = \frac{2\pi(5\text{m})}{2\text{s}} = 15.7\text{m/s}$

B) NO - MASS DOES NOT AFFECT a_c
 $(a_c = \frac{v^2}{r})$

C) YES - MASS AFFECTS F_c
 $(F_c = ma_c)$

$$4) \quad A) \quad f = \frac{1}{T} \rightarrow T = \frac{1}{f} = \frac{1}{(0.25 \text{ rev/s})} = \boxed{4 \text{ s}}$$

$$B) \quad v = \frac{2\pi r}{T} = \frac{2\pi(20 \text{ m})}{4 \text{ s}} = \boxed{31.4 \text{ m/s}}$$

$$C) \quad a_c = \frac{v^2}{r} = \frac{(31.4 \text{ m/s})^2}{20 \text{ m}} = \boxed{49.3 \text{ m/s}^2}$$

$$D) \quad F_N = F_c = m a_c = (75 \text{ kg})(49.3 \text{ m/s}^2) = \boxed{3698 \text{ N}}$$

$$5) \quad A) \quad a_c = \frac{v^2}{r} = \frac{(20 \text{ m/s})^2}{60 \text{ m}} = \boxed{6.67 \text{ m/s}^2}$$

$$B) \quad F_c = F_{fs} = m a_c = (80 \text{ kg})(6.67 \text{ m/s}^2) = \boxed{533 \text{ N}}$$

$$C) \quad \mu = \frac{F_{fs}}{F_N} = \frac{533 \text{ N}}{(80 \text{ kg})(9.81 \text{ m/s}^2)} = \boxed{0.679}$$

↑
 $F_N = F_g = mg$

$$6) \quad g = \frac{F_g}{m} = \frac{\frac{G m_1 m_2}{r^2}}{\frac{m_2}{m_1}} = \frac{(6.67 \times 10^{-11} \text{ N}\cdot\text{m}^2)}{F_g^2} (7.4 \times 10^{22} \text{ kg})}{(1.7 \times 10^6 \text{ m})^2}$$

$$g = \boxed{1.71 \text{ m/s}^2}$$

$$7) \quad F_g = \frac{G m_1 m_2}{r^2} \Rightarrow \frac{G m^2}{r^2} \rightarrow m = \sqrt{\frac{F_g r^2}{G}} = \sqrt{\frac{(1.38 \times 10^7 \text{ N})(2 \text{ m})^2}{(6.67 \times 10^{-11} \text{ N}\cdot\text{m}^2)}} = \boxed{9.10 \times 10^3 \text{ kg}}$$

$29.11 \times 10^3 \text{ kg}$