

Practice Question Set For A-Level
Subject : Physics
Paper-1 Topic: Further Mechanics

Name of the Student: _____

Max. Marks : 24 Marks

Time : 24 Minutes

Mark Schemes

Q1.

- (a) (i) $15 \text{ rev / s} = 30\pi \text{ rad / s}$ **or** $v = 51 / 52 \text{ m s}^{-1}$ [could appear in subst] BI
- $F = m\omega^2 r$ [or mv^2 / r & $v = \omega r$] BI
- appropriate sub leading to 7.33 kN [2+sf evaluation mandatory] BI
- (ii) to centre of rotor OWTTE BI
- (iii) $\text{stress} = F / A$ BI
- correct substitution from ai BI
- (iv) $0.55 \times 2.09 \times 10^7 / 6 \times 10^{10}$ [or $\epsilon = 3.3 \times 10^{-4}$] CI
- $= 0.192 \text{ mm}$ AI
- (v) $\frac{1}{2} \times 7.32 \times 10^3 \times 1.92 \times 10^{-4}$ [ecf] CI
- $= 0.702 \text{ J}$ AI
- (b) (i) volume pushed down [per second] = Av [mass = $\rho \times \text{volume}$] BI
- Change of momentum [per second] = mass pushed down per second $\times v$ BI
- (ii) Upward force = 900 N OWTTE [penalise use of 900g] CI
- OR area swept out by blades = $\pi \times 0.55^2$ CI
- $900 = (0.55)^2 \pi 1.3v^2$ CI
- $= 27 \text{ m s}^{-1}$ AI

Q2.

(a) $v = \omega r$ or $v = \frac{2\pi r}{T}$ or $v = 2\pi r f$ C1

$\omega = 2\pi \times 45 / 60$ or correct substitutions for v C1

0.59 ms^{-1} A1

(b) (i) radial arrow from D towards centre of disc B1

(ii) $a = \frac{v^2}{r}$ or $a = \omega^2 r$ condone $a = \omega^2 x$ **but not** $a = -(2\pi f)^2 x$

2.78 m s^{-2} **but not if shm equation clearly used** A1

(c) recognition that closer toward centre particles need smaller centripetal force B1

support for this: $v \propto r$ or $\omega = \text{constant}$ along disc B1

idea that friction / electrostatic forces are sufficient to meet the requirements of particles close to centre but not for those further away B1

[9]