

Suggested Solutions to 2006 JC1 Physics Lecture Test 1

1. Unit of $F = \text{kg m s}^{-2}$

$$\eta = \frac{F}{6\pi rV}$$

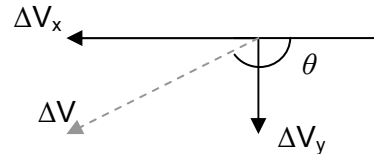
$$\text{unit of } \eta = \text{unit of } \frac{F}{6\pi rV} = \frac{\text{kg m s}^{-2}}{\text{m} \times \text{m s}^{-1}} = \text{kg m}^{-1} \text{ s}^{-1}$$

[1] for correct unit of F
 [1] for correct unit of η
 [1] for use of phrase "unit of.."

2. $\Delta V_x = -25 \sin 60^\circ - 25 = -46.65 \text{ m s}^{-1}$
 $\Delta V_y = -25 \cos 60^\circ - 0 = -12.5 \text{ m s}^{-1}$
 $\Delta V = \sqrt{(-46.65)^2 + (-12.5)^2} = 48.3 \text{ m s}^{-1}$

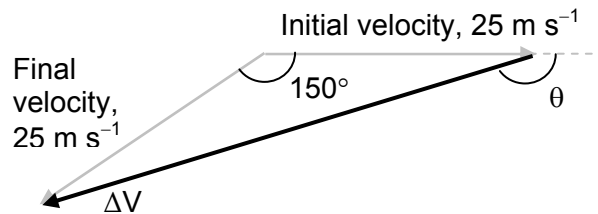
$$\tan(180 - \theta) = \frac{12.5}{46.65}$$

$$\theta = 165^\circ$$



The change in velocity is 48.3 m s^{-1} at an angle of 165° clockwise to the original direction.

OR



$$\text{By cosine rule, } \Delta V = \sqrt{25^2 + 25^2 - 2(25)(25)\cos 150^\circ} = 48.3 \text{ m s}^{-1}$$

$$\text{By sine rule, } \frac{48.3}{\sin 150^\circ} = \frac{25}{\sin(180 - \theta)}$$

$$\theta = 165^\circ$$

[1] for cosine rule working
 [1] for sine rule working
 [1] for correct magnitude of ΔV , angle and units

The change in velocity is 48.3 m s^{-1} at an angle of 165° clockwise to the original direction.

3. (a) $S = \pi \times 4.10 \times 6.80 = 87.588 \text{ cm}^2$

$$\frac{\Delta S}{S} = \frac{\Delta d}{d} + \frac{\Delta h}{h}$$

$$\frac{\Delta S}{87.588} = \frac{0.01}{4.10} + \frac{0.01}{6.80}$$

$$\Delta S = 0.34 = 0.3 \text{ cm}^2$$

$$S = (87.6 \pm 0.3) \text{ cm}^2$$

[1] for correct working for ΔS
 [1] for correct working for S
 [1] for correct s.f. of ΔS
 [1] for correct d.p. and units of S

(b) $X = \pi \frac{d^2}{4}$

$$\frac{\Delta X}{X} = 2 \frac{\Delta d}{d} = 2 \frac{0.01}{4.10} = 4.878 \times 10^{-3} = 0.488\%$$

[1] for correct working
 [1] for correct answer

(c) $X = \pi \frac{4.10^2}{4} = 13.203 \text{ cm}^2$

$$\Delta X = 4.878 \times 10^{-3} \times 13.203 = 0.064 \text{ cm}^2$$

$$A = 2X + S$$

$$\Delta A = 2 \times 0.064 + 0.34 = 0.468 = 0.5 \text{ cm}^2$$

[1] for correct working for ΔX
 [1] for correct working for ΔA
 [1] for correct s.f. and unts for ΔA