Exercise 8D

Q. 1. (i) The centre of gravity of the cylinder is at a height $\frac{1}{2}h = \frac{1}{2}(24) = 12$ cm above the table.

(ii) The centre of gravity of the cone is at a height $\frac{1}{4}h = \frac{1}{4}(24) = 6$ cm above the table.

(iii) The centre of gravity of the solid hemisphere is at a height $\frac{3}{8}r = \frac{3}{8}(24) = 9$ cm above the table.

(iv) The centre of gravity of the hemispherical shell is at a height $\frac{1}{2}r = \frac{1}{2}(24) = 12$ cm above the table.

Q. 2. The centre of gravity of the solid hemisphere is at a height $\frac{3}{8}r = \frac{3}{8}(16) = 6$ cm above the table.
The centre of gravity of the hemispherical shell is at a height $\frac{1}{2}r = \frac{1}{2}(16) = 8$ cm above the table.
The difference in the heights of their centres of gravity above the table is $8 - 6 = 2$ cm.

Q. 3. (i) $\frac{1}{4}h = 5$

$\Rightarrow h = 20$ cm

(ii) $V = \frac{1}{3}\pi r^2 h$

$= \frac{1}{3}\pi(3^2)(20)$

$= 60\pi$ cm^3

Q. 4. (i) $\frac{3}{8}r = 3$

$\Rightarrow r = 8$ cm

(ii) $V = \frac{2}{3}\pi r^3$

$= \frac{2}{3}\pi(8^3)$

$= \frac{1{,}024\pi}{3}$ cm^3

Q. 5. (i) $\frac{1}{2}r = 3$

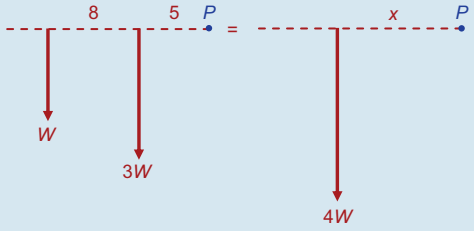
$\Rightarrow r = 6$ cm

(ii) Curved Surface Area $= 2\pi r^2$

$= 2\pi(6^2)$

$= 72\pi$ cm^2

Q. 6. W acts through a point $\frac{3}{8}r = 3$ cm from the base of the cylinder.
$3W$ acts through a point $\frac{1}{2}h = 5$ cm from the base of the hemisphere.
Let P be the point at the right extreme end of the central axis.
Here, then, is the diagram of the forces.
The total weight of the compound body is $4W$ which acts through a point which is x cm from P.



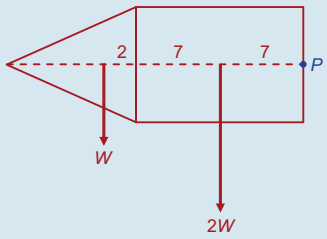
By the Principle of Moments:

$W(13) + 3W(5) = 4W(x)$ … divide by W

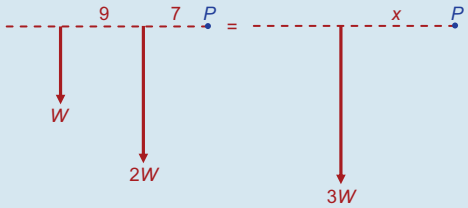
$\Rightarrow 28 = 4x$

$\Rightarrow x = 7$ cm from P

Q. 7.



$2W$ acts through a point $\frac{1}{2}h = \frac{1}{2}(14) = 7$ cm from P.
W acts through a point $\frac{1}{4}(8) = 2$ cm from the base of the cone, i.e. 16 cm from P.
Here, then, is the diagram of the forces.
The total weight of the compound body is $3W$, which acts through a point which is x cm from P.



By the Principle of Moments,

$W(16) + 2W(7) = 3W(x)$ … divide by W

$\Rightarrow 30 = 3x$

$\Rightarrow x = 10$ cm