(ii) Let the total surface area of the closed cylindrical tank be S, given by

$$S = \frac{539}{r} + 2\,\pi\, r^2$$

If the total surface area of the tank is minimum, then the value of r will be:

(a) $r = 7\ cm$
(b) $r = 14\ cm$
(c) $r = 49\ cm$
(d) $r = \frac{7}{2}\ cm$

Answer: _____**(d)**_____

Solution: $S = \frac{539}{r} + 2\,\pi\, r^2 \Rightarrow \frac{ds}{dr} = -\frac{539}{r^2} + 4\,\pi r \Rightarrow \frac{d^2S}{dr^2} = \frac{2\times 539}{r^3} + 4\pi > 0$

$\therefore$ for minimum total surface area, $\frac{ds}{dr} = 0 \Rightarrow -\frac{539}{r^2} + 4\pi\, r = 0$

$$\Rightarrow \frac{539}{r^2} = 4\,\pi r \Rightarrow r^3 = \frac{539 \times 7}{4 \times 22} = \frac{7^3}{2^3} \Rightarrow r = \frac{7}{2}\ cm$$

(iii) The height of the tank h is equal to:

(a) $h = 7\ cm$
(b) $h = 14\ cm$
(c) $h = 28\ cm$
(d) $h = 2\ cm$

Answer: _____**(a)**_____

Solution: $h = \frac{539}{2\,\pi\, r^2} = \frac{539\times 7\times 2\times 2}{2\times 22\times 7\times 7} = 7\ cm$

(iv) The minimum total surface area of the tank S will be:

(a) 231 sq.cm
(b) 321 sq.cm
(c) 230 sq.cm
(d) 221 sq.cm

Answer: _____**(a)**_____

Solution: $S = \frac{539}{r} + 2\,\pi\, r^2 = \frac{539\times 2}{7} + 2 \times \frac{22}{7} \times \left(\frac{7}{2}\right)^2 = 231$ sq.cm