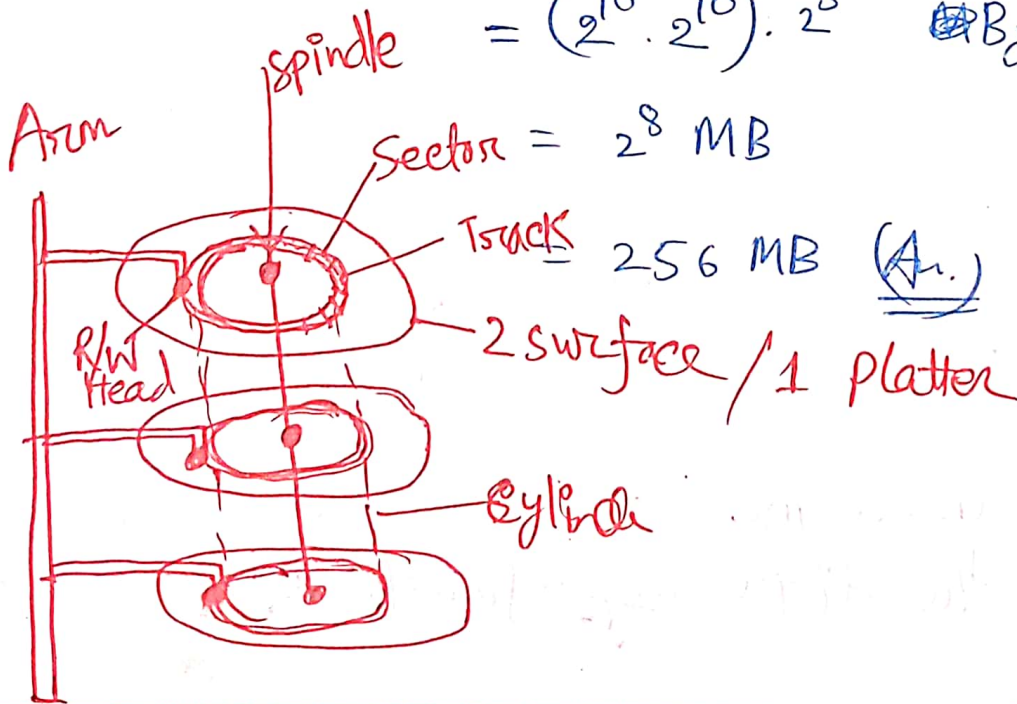# problem 1:

Consider a disk pack with the following speci-fications - 16 surfaces, 128 tracks per surface, 256 sectors per track and 512 bytes per sector.

**Q** What is the capacity of disk pack?

$$\text{Capacity} = (\text{surface} \times \text{tracks} \times \text{sectors} \times \text{bytes}) \text{ bytes}$$

$$= (16 \times 128 \times 256 \times 512) \text{ bytes}$$

$$= (2^4 \times 2^7 \times 2^8 \times 2^9)$$

$$= 2^{28} \text{ bytes}$$

$$= (2^{10} . 2^{10}) . 2^8 \text{ Bytes}$$

$$= 2^8 \text{ MB}$$

Sector

Track 256 MB (An.)

2 surface / 1 Platter

Cylinder



Arm, spindle, R/W Head

$2^{20}$ byte = 1 MB

**(II)** What is the number of bits required to address the sector?

Total sector = $(16 \times 128 \times 256)$ Sectors

$$= (2^4 \times 2^7 \times 2^8)$$

$$= 2^{19} \text{ sectors}$$

∴ required bits = 19 bits **(Ans.)**

**(III)** If the format overhead is 32 bytes per sector what is the formatted disk space?

Formatting overhead = $(16 \times 128 \times 256) \times 32$ bytes

$$= 2^{24} \text{ bytes}$$

$$= 2^4 \text{ MB}$$

$$= 16 \text{ MB}$$

∴ Formatted disk space = $(256 - 16)$ MB

$$= 240 \text{ MB} \quad \text{(Ans)}$$

format overhead includes structures & metadata required for the disk's functionality.

(IV) If the format overhead is 64 bytes per sector, how much amount of ~~money~~ Byte is lost due to formatting?

$$Formatting\ overhead = (16 \times 128 \times 256) \times 64 \ Bytes$$

$$= 2^{25} \ Bytes$$

$$= 2^{5} \ MB$$

$$= 32 \ MB \quad (lost \ सारा)$$

(V) If the diameter of innermost track is 21 cm, what is the maximum recording density?

$$capacity\ of\ track = 256 \times 512 \ bytes$$

$$= 2^{17} \ bytes$$

$$= \boxed{128\ KB}$$

$$perimeter\ \cancel{area} = 2 \times \pi \times r$$

$$= 3.1416 \times 21 \quad cm$$

$$= 65.94 \ cm$$

$$\therefore Maximum \ recording \ density = \left(128\ KB/65.94\ cm\right)$$

$$= 1.94 \ KB/cm$$

(VI) If the diameter of innermost track is 21 cm with 2 KB/cm, what is the capacity of one track?

$$\text{perimeter} = 2\pi r = 65.94 \text{ cm}$$

$$\text{capacity} = (65.94 \times 2) \text{ KB}$$

$$= 131.88 \text{ KB}$$

$$\cong 132 \text{ KB} \quad \text{(Ans.)}$$

(VII) If the disk is rotating at 3600 RPM, what is the data transfer rate?

$$\text{Rate} = 16 \times (256 \times 512) \times \frac{3600}{60}$$

$$= 2^4 \times 2^8 \times 2^9 \times 60$$

$$= 2^{21} \times 60 \quad \text{byte/sec}$$

$$= 2^{20} \times 2^1 \times 60$$

$$= 120 \text{ MBPS} \quad \text{(Ans.)}$$