Example:

Consider a machine with byte addressable main memory of size 4 GB, block size of 4KB and Associative mapped cache having 1MB size.

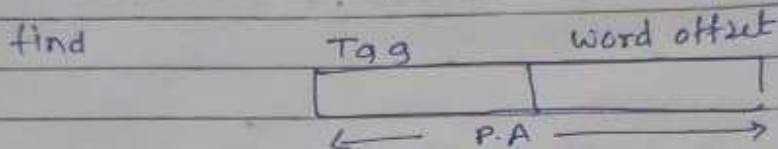find (1) P.A. split
(2) Tag directory size.

Soln:

Given

Size of M·M = 4 GB
Size of block = 4KB
Size of C·M = 1 MB.

find

Tag	word offset

← P·A →

Step1: Number of bits in Physical Address

$$P \cdot A = \log_2 (\text{size of } M \cdot M)$$

$$= \log_2 (4 \, GB)$$

$$= \log_2 \left(2^2 \times 2^{30}\right)$$

$$= \log_2 \left(2^{32}\right)$$

$$\boxed{P \cdot A = 32 \text{ bit}}$$

Step 2:

$$\text{word offset} = \log_2 (\text{block size})$$

$$= \log_2 (4KB)$$

$$= \log_2 \left(2^2 \times 2^{10}\right)$$

$$= \log_2 \left(2^{12}\right)$$

$$\boxed{\text{Word offset} = 12 \text{ bit}}$$

Step 3:

$$tag \, bit = P.A \, bit - word \, \text{{}fut bit}$$
$$= 32 - 12$$

$$\boxed{tag = 20}$$

OR

$$No. \, of \, block \, in \, M.M = \frac{size \, of \, M.M}{size \, of \, block}$$

$$= \frac{4GB}{4KB}$$

$$= \frac{2^2 \times 2^{30}}{2^2 \times 2^{10}}$$

$$= \frac{2^{32}}{2^{12}}$$

$$= 2^{20}$$

$$Tag \, bit = log_2 \, (No. \, of \, Block \, in \, M.M).$$

$$= log_2 \left(2^{20} \right)$$

$$\boxed{tag = 20}$$

20	12

$$\longleftarrow \quad 32 \quad \longrightarrow$$

Step 4: Tag directory size = No. of lines in cache
$$\text{\Large *} \quad No. \, of \, bits. \, in \, tag$$

$$No. \, of. \, cache \, lines = \frac{size \, of \, C.M}{size \, of \, block}$$

$$= \frac{1MB}{4KB}$$

$$= \frac{2^{20}}{2^2 \times 2^{10}}$$

$$= \frac{2^{20}}{2^{12}}$$

$$\boxed{\begin{array}{l} \text{No. of} \\ \text{lines} \end{array} = 2^{8}}$$

Tag directory size $= 2^8 \times 20$

$$= 5120 \text{ bits}$$