The monkey B shown in the figure is holding onto the tail of the monkey A which is climbing up a rope. The masses of monkeys A and B are 5 kg and 2 kg respectively. If A can tolerate a tension of 30 N in its tail, what force should it apply on the rope in order to carry the monkey B with it ? (take $g = 10$ m/s^2)
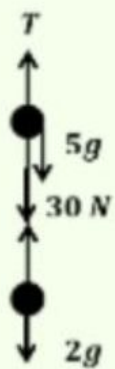

A $T \geq 70$ N and $T \leq 85$ N

B $T \geq 60$ N and $T \leq 85$ N

C $T \geq 60$ N and $T \leq 105$ N

D $T \geq 70$ N and $T \leq 105$ N

The correct option is **D** T ≥ 70 N and T ≤ 105 N

Suppose A moves upward with acceleration a such that maximum tension 30 N is produced in its tail.

T

↑

● ↓ 5g

↓ 30 N

↑

●

↓ 2g

$T - 5g - T_1 = 5a$

$\Rightarrow T - 5g - 30 = 5a \ldots (i)$

$T_1 - 2g = 2a$

$\Rightarrow 30 - 2g = 2a - -(ii)$

From equation (i) and (ii), we have

$a = 5 \ m/s^2$ and T = 105 N (max)

So, A can apply a maximum force of 105 N on the rope to carry the monkey B with it.

For minimum force there is no acceleration of monkey A and B.

$\Rightarrow a = 0$

From equation (i),

$T_1 - 2g = 0$

$\Rightarrow T_1 = 20 \ N$ (weight of monkey B)

From equation (ii),

$T - 5g - 20 = 0$ as $T_1 = 20$ N

$\Rightarrow T = 70$ N

∴ The monkey A should apply force between 70 N and 105 N to carry monkey B with it.