More Blood Pumped per Beat Slows the Heart Rate Down

If every single beer truck from the entire fleet of beer trucks drop off only 8 cases of beer to a store each visit that needs 336 cases per minute, then how many beer trucks are needed to deliver 336 caes of beer in one minute?

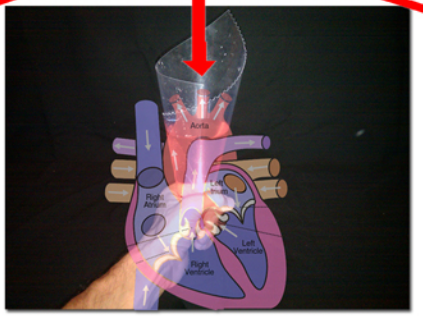
$$\frac{\text{1 truck}}{\text{8 cases}} = \frac{\text{? trucks}}{\text{336 cases}} \qquad \text{? = 42 trucks}$$

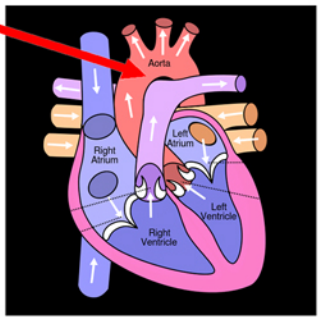
Obviously, if each beer truck dropped off more beer cases each visit, then the wharehouse would send less beer trucks to the store. For example, if each beer truck doubled its dropoff volume to 16 crates, then only 21 beer trucks - half the original amount - would be needed to drop off the same amount of beer.

The volume of blood ejected out of your left ventricle is analogous to the amount of beer cases unloaded during one visit to a store.

Stroke Volume = Volume of blood ejected from left ventricle

The red liquid in the 'hand held heart' represents the volume of blood pumped out of the left ventricle.





We already know an athlete or couch potato consumes 336 ml of O2 per minute.

At rest, each 100 ml packet of blood (each truck) drops off 8 ml of O2 per minute, therefore we ask:

How many deliveries are needed to drop off 336 ml O2 per minute?

$$\frac{\text{100 ml blood (1 truck)}}{\text{8 ml O2}} = \frac{\text{? blood}}{\text{336 ml O2}} =$$

42 trucks or 4,200 ml blood per min.
4,200 ml/min = 4.2 liters/min = Cardiac Output

It just so happens that a trained person's heart may actually adapt to eject 100 ml per beat and an untrained person may pump only 60 ml per beat. The above example demonstrates 100 ml blood pumped per beat delivers the same amount of blood per minute (4,200 ml/min) as an 'untrained' person's, (which pumps only 60 ml blood per beat). The trained person's heart rate at rest must slow down if O_2 uptake remains the same - which is the case. Recall, more blood pumped out each beat also includes more oxygen each beat. Therefore it takes less beats to deliver 4,200 ml of blood AND the required 336 ml O_2 to be consumed at rest.

CONSIDER THE TRAINED HUMAN..... COMPARED TO THE COUCH POTATO

Each beat ejects 100 ml (.1 liter) blood

4,200 ml (4.2 liters) blood per minute MUST be ejected to provide the total O2 consumed per minute (336 ml)

How many beats are needed to deliver 4.2 liters?

$$\frac{\text{1 beat}}{\text{100 ml}} = \frac{\text{? beats}}{\text{4,200 ml}} \qquad \text{= 42 bpm}$$

Each beat ejects 60 ml blood

4,200 ml (4.2 liters) blood per minute MUST be ejected to provide the total O2 consumed per minute (336 ml)

How many beats are needed to deliver 4.2 liters?

$$\frac{\text{1 beat}}{\text{60 ml}} = \frac{\text{? beats}}{\text{4,200 ml}} \qquad \text{? = 70 bpm}$$