

1 mL = 1 cm³. and 1 L = 1000 cm³.

1. We know that the tank contains the water it is currently holding, plus half of the bucket. The bucket can hold 28 L, so half of the bucket is 14 L. How much water is currently in the tank? $100\text{ cm} \times 60\text{ cm} \times 55\text{ cm} = 330,000\text{ cm}^3$. Can we add $330,000 + 14$? NO! We MUST have matching units! Since the 14 is in liters and the 330,000 is in cm³, we cannot add them until they are both liters or both cm³. So we convert $330,000\text{ cm}^3 = 330\text{ L}$ (just take away 3 zeros to convert to liters), and now we can add: $330\text{ L} + 14\text{ L} = \boxed{344\text{ L}}$

2. *total volume of the tank = volume of water currently in tank + volume of rock + extra 28 L.*

Find total volume of the tank: the dimensions are 1 m (l) by 40 cm (w) by 50 cm (h), or 100 cm by 40 cm by 50 cm, so the total volume is $100 \times 40 \times 50 = 200,000\text{ cm}^3$.

Find the volume of water currently in tank: the length and width are still 100 cm and 40 cm, but the height is 23 cm. So the volume of the water in the tank is $100 \times 40 \times 23 = 92,000\text{ cm}^3$.

Find 28 L in cm³: since $1000\text{ cm}^3 = 1\text{ L}$, $28\text{ L} = 28,000\text{ cm}^3$.

Now we can replace these numbers in our equation:

total volume of the tank = volume of water currently in tank + volume of rock + extra 28 L

$$200,000\text{ cm}^3 = 92,000\text{ cm}^3 + \text{volume of rock} + 28,000\text{ cm}^3$$

$$200,000\text{ cm}^3 = 120,000\text{ cm}^3 + \text{volume of rock}$$

So this means that the volume of the rock must be $\boxed{80,000\text{ cm}^3}$

3. The volume of the 6 cubes = the volume of the water that rises. If there are 4.5 L of water, which is $4.5 \times 1000 = 4500\text{ cm}^3$ of water, and the length and width are 30 and 15, then the height must be $4500 \div (30 \times 15) = 4500 \div 450 = 10\text{ cm}$. Then the water level rises to 12 cm. So this means the water level changes by $12 - 10 = 2\text{ cm}$.

Now we know that the volume of 6 cubes = *length* \times *width* \times *change in height* = $30 \times 15 \times 2 = 900\text{ cm}^3$. So each cube has volume $900 \div 6 = \boxed{150\text{ cm}^3}$

4. $\boxed{12\text{ cm}^3}$

5. *volume of whole tank = volume of cubes + volume of water.*

Find volume of cubes: the cubes have 10-cm sides, so *length* = *width* = *height* = 10. So the volume of one cube is $10 \times 10 \times 10 = 1000$. There are two cubes, so the total volume of the cubes is 2000 cm^3 .

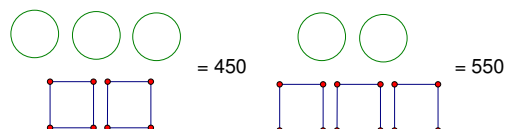
Find volume of water: The water flows in at 10 L/min, and it takes 4 minutes to fill in. That means there are $10 \times 4 = 40\text{ L}$ of water in the tank. We convert this to cm: $40 \times 1000 = 40,000\text{ cm}^3$.

Now we have *volume of whole tank = volume of cubes + volume of water* = $2000 + 40,000 = 42,000\text{ cm}^3$.

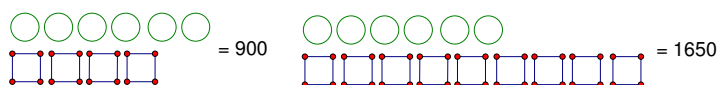
The tank has length and width 60 and 35. So we know that $60 \times 35 \times \text{height} = 42,000$, so *height* = $42,000 \div (60 \times 35) = 42,000 \div 2100 = \boxed{20\text{ cm}}$

6. We will use the equation $total\ volume = volume\ of\ beads\ and\ cubes + volume\ of\ water$.

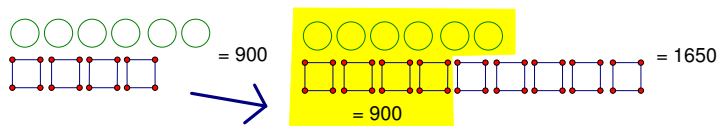
The first beaker has $3\ beads + 2\ cubes + 350\ mL\ water = 800\ mL$, and the second beaker has $2\ beads + 3\ cubes + 350\ mL\ water = 900\ mL$. So we can see from the first equation that $3\ beads + 2\ cubes = 450\ mL$, and from the second equation that $2\ beads + 3\ cubes = 550\ mL$.



Now let's pretend we doubled our amounts of beads and cubes in the first beaker. Then we would have double the volume, or we would have $6\ beads + 4\ cubes = 900\ mL$. Let's pretend that we triple the amount in the second beaker. Then we would have $6\ beads + 9\ cubes = 3 \times 550 = 1650\ mL$.



But notice: the second equation has 6 beads and 9 cubes, and we can take away 6 beads and 4 cubes because we know from the first equation that these have volume 900 mL.



So we know that $900 + 5\ cubes = 1650$, or $5\ cubes = 750$, or $cube = 750 \div 5 = 150\ mL = \boxed{150\ cm^3}$.

Now we go back to one of our original equations. For instance, $3\ beads + 2\ cubes = 450\ mL$. Since $cube = 150$, then $3\ beads + 2(150) = 450\ mL$, then $3\ beads + 300\ mL = 450\ mL$, so $3\ beads = 150\ mL$, so $bead = 150 \div 3 = 50\ mL = \boxed{50\ cm^3}$

7. The contents of the bucket that don't overflow from the tank are $4\ L - 350\ mL = 4\ L - .350\ L = 3.65\ L$. So in the 6 L tank, an additional 3.65 L fit. This means there was already $6\ L - 3.65\ L = \boxed{2.35\ L}$ in the tank.
8. $500 \div 50 = \boxed{10\ min}$
9. $342\ gal \div 1.5\ gal/sec = 228\ sec$. $228\ sec \div 60\ sec/min = \boxed{3.8\ min}$
10. What is the rate that the water is going into the tank? It flows in at 16 L/min and leaks out at .5 L/min. So after a minute, we have $16 - .5 = 15.5$ liters in the tank. So the rate at which the tank is filling is 15.5 L/min. So it takes $372\ L \div 15.5\ L/min = \boxed{24\ min}$