Flow Rate - Worksheet

Skill

Group A - Calculating flow rate

Use the information to calculate the flow rate:

1) A tap releases 5 litres of water in 4 minutes. Calculate the flow rate in litres per minute.

2) A hose pipe can release 8 litres of water in 160 seconds. Calculate the flow rate in litres per second.

3) Juice is leaking from the bottom of a carton. The carton is $330\ ml$ when full and is empty after 11 minutes. Calculate the flow rate in ml per minute.

4) A tap fills a cuboid container $5\ cm$ by $8\ cm$ by $20\ cm$. The container is full after 16 seconds. Calculate the flow rate in cm^3 per second.

5) A hose pipe fills a cube with side length $80\ cm$. The cube is full after 40 minutes. Calculate the flow rate in cm^3 per minute.

6) A full paddling pool in the shape of a cuboid is being drained through a valve. The paddling pool is 2 metres by 1 metre by $50\ cm$ and is empty after 5 minutes. Calculate the flow rate in m^3 per minute.

7) A tap is filling a $500\ ml$ jug with water. The jug is half full after 8 seconds. Calculate the flow rate in ml per second.

8) A tap fills a cube of side length $24\ cm$. The cube is one third full after 35 seconds. Calculate the flow rate in cm^3 per second.

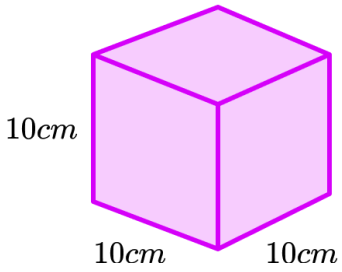
9) A cuboid container measuring $40\ cm$ by $30\ cm$ by $25\ cm$ is being filled with water from a tap. The container is 60% full after 5 minutes. Calculate the flow rate in cm^3 per minute.

Flow Rate - Worksheet

Group B - Finding the time to fill a container

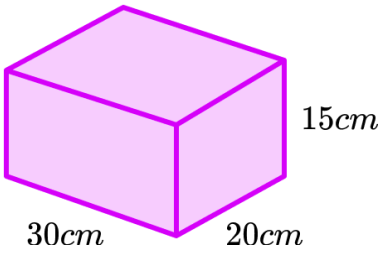
Find the volume of the shape and use the flow rate to find the time to fill the container:

1)



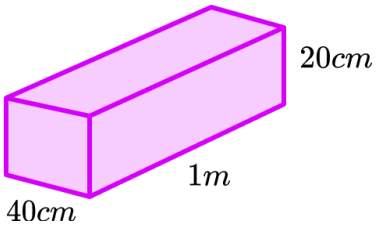
Flow rate = 20 cm^3/s

2)



Flow rate = 45 cm^3/s

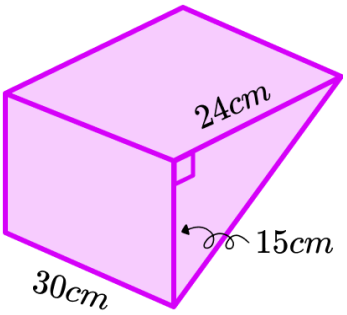
3)



Flow rate = 50 cm^3/s

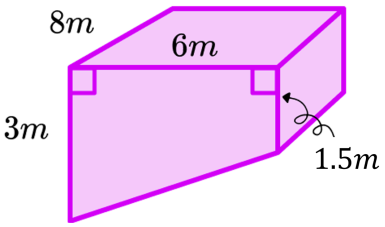
Give your answer in minutes and seconds.

4)



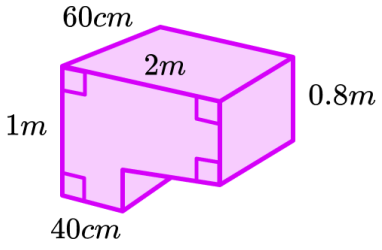
Flow rate = 20 cm^3/s

5)



Flow rate = 12 m^3/h

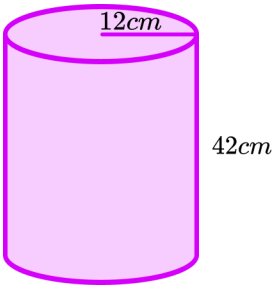
6)



Flow rate = 45 cm^3/s

Give your answer in minutes and seconds.

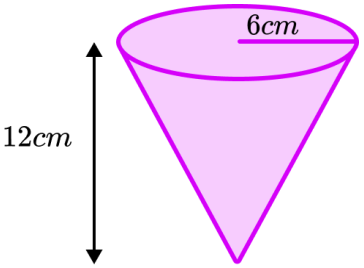
7)



Flow rate = $4l/min$

$(1\ cm^3 = 1\ ml)$

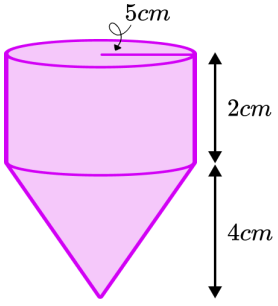
8)



Flow rate = 30 cm^3/s

$Volume\ of\ a\ cone = \frac{1}{3}\pi r^2 h$

9)



Flow rate = $4.5ml/min$

$Volume\ of\ a\ cone = \frac{1}{3}\pi r^2 h$

Flow Rate - Worksheet

Group C - Using flow rate to calculate missing volumes, depths or times.

Use the flow rate provided to find the missing value:

1) A tap produces a flow rate of 4 litres per minute. Find the time taken for the tap to fill a 6 litre bucket.

2) A hose pipe produces a flow rate of 6 litres per minute. A gardener spends 10 minutes watering his plants. How much water did the gardener use?

3) A coffee machine dispenses coffee with a flow rate of 800ml per minute. How long does it take to produce a $200\ ml$ coffee?

4) A tap produces a flow rate of 3.5 litres per minute. How much water is released from the tap after 90 seconds?

5) A waterfall has a flow rate of $400\ m^3$ per second. How much water flows over the waterfall in 10 minutes?

6) A dripping tap produces a flow rate of $0.625\ ml$ per second. How long does it take for the dripping tap to fill a 1 litre jug? Give your answer in minutes and seconds.

7) An air pump produces a flow rate of $30\ cm^3$ per second. Find the volume of air produced in 1 hour, giving your answer in m^3.

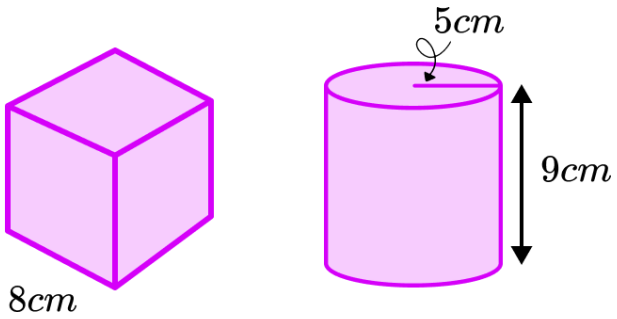
8) An empty cuboid container with a square base of area $24\ cm^2$ is being filled from a tap producing a flow rate of $50\ cm^3$ per second. Find the height of the water after 6 seconds.

9) A swimming pool holds $45\ m^3$ of water. The swimming pool must be drained by a pump. The pump removes the water with a flow rate of 7200 litres per hour. Given that $1\ m^3 = 1000$ litres. How long will it take to drain the swimming pool, in hours and minutes?

Flow Rate - Worksheet

Applied

1) The image shows two containers, a cube with side length $8\ cm$ and a cylinder with radius $5\ cm$ and height $9\ cm$.

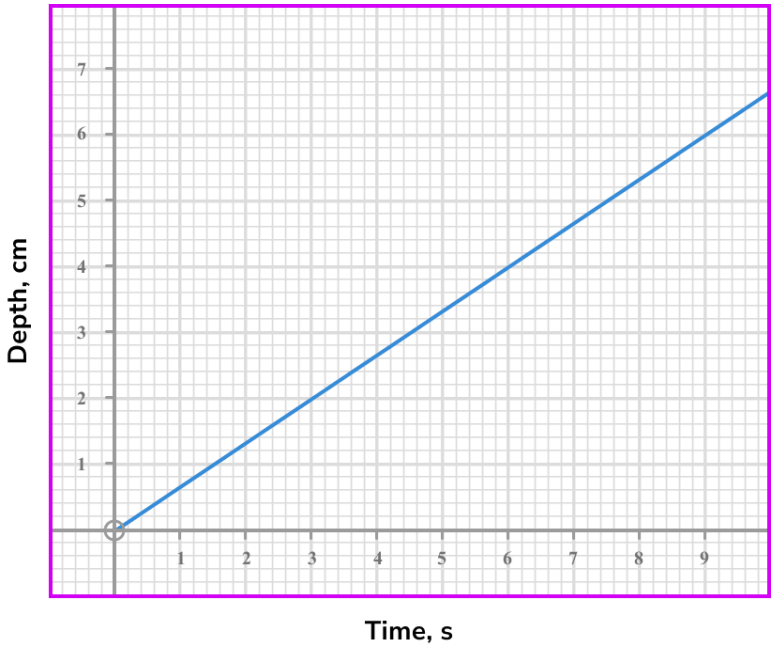


A tap fills the cube container in 32 seconds.

(a) Find the flow rate of the tap in cm^3 per second.

(b) How long will the same tap take to fill the cylinder?

2) A tap is filling a container with water. The graph shows the depth, cm, of water in the container at times measured in seconds.



(a) Use the information from the graph to find the flow rate of the tap in cm per second.

(b) If the container had a rectangular base measuring $4\ cm$ by $6\ cm$. What is the flow rate of the tap in cm^3 per second?

Flow Rate - Worksheet

3) A cuboid measuring 2 metres by $60\ cm$ by $80\ cm$ is being filled from a pipe releasing water at a rate of 12 litres per minute.

(a) Find the time taken to fill the container in hours and minutes.
$[1m^3 = 1000\ litres]$

(b) Once the container is full, a plug at the bottom is removed which lets water drain at a rate of $16\ cm^3$ per second. Find the total time taken for the container to be filled and then emptied.

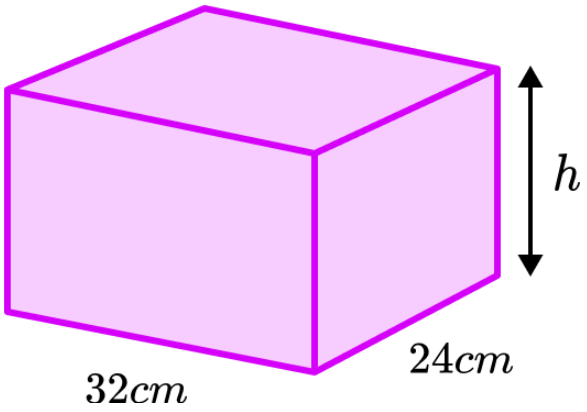
4) A hot air balloon can hold 2500 cubic metres of air.

(a) The hot air balloon is assumed to be the shape of a sphere. If the formula for the volume of a sphere is $V = \frac{4}{3}\pi r^3$. Find the radius of the balloon in metres.

(b) A fan used to inflate the hot air balloon has a flow rate of 300000 litres per minute. How long will it take to inflate the hot air balloon?
$[1m^3 = 1000\ litres]$

Flow Rate - Exam Questions

1) The diagram shows a container in the shape of the cuboid. The base of the container is a rectangle measuring 32 cm by 24 cm.



A tap produces a flow rate of 4 litres per minute.

The tap can fill the container in 4 minutes and 48 seconds.

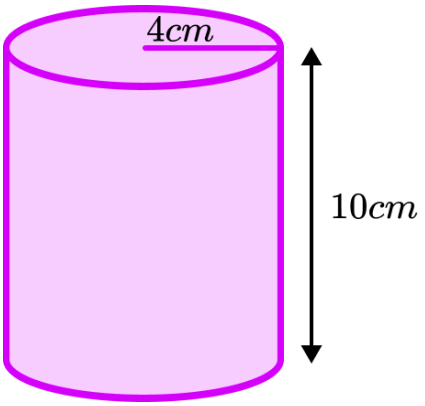
Using the fact that 1 $ml = 1\ cm^3$, find the height of the container in centimetres.

.....cm

(4 marks)

Flow Rate - Exam Questions

2) The organiser of a fun run needs to provide 120 cups of water for competitors to drink from during a race. Each cup is a cylinder of radius 4 cm and height 10 cm as shown in the diagram.



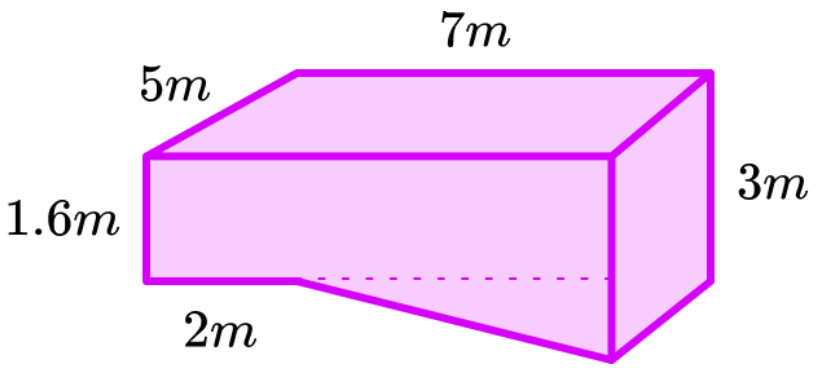
The organiser needs to fill all 120 cups with water from a tap which has a flow rate of 3.5 litres per minute. There is only 16 minutes available to get all of the cups filled. Will the organiser get all of the cups filled in the available time?
Show your working.
[1 ml = 1 cm^3]

.....

(4 marks)

Flow Rate - Exam Questions

3) The image shows a full swimming pool that needs cleaning, so will be emptied by a pump.



After 30 minutes the water level has decreased by 40 cm.

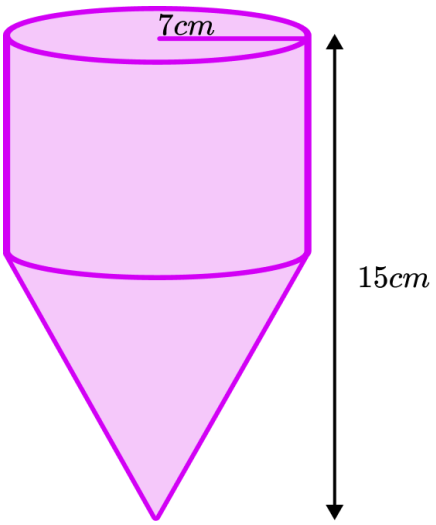
How much **extra** time will be required for the swimming pool to be completely empty? Give your answer in minutes.

.....mins

(5 marks)

Flow Rate - Exam Questions

4) Water is flowing in the the container shown at a rate of π millilitres per minute.



The container consists of a cylinder and a cone. The heights of the cylinder and cone and in the ratio 2: 3.

Find the time taken to completely fill the container. Give your answer in minutes.

[$Volume\ of\ a\ cone\ = \frac{1}{3}\pi r^2 h$]

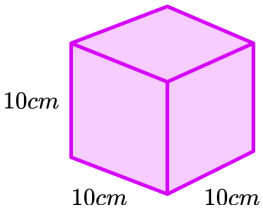
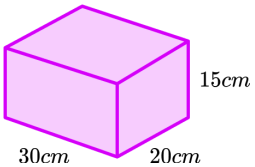
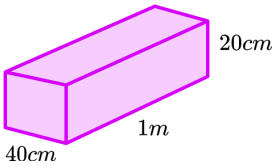
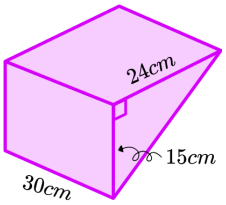
……mins

(5 marks)

Flow Rate - Answers

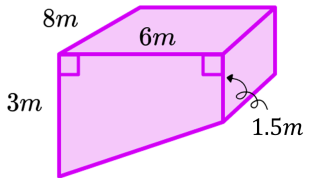
	Question	Answer
	Skill Questions	
Group A	Use the information to calculate the flow rate:	
	1) A tap releases 5 litres of water in 4 minutes. Calculate the flow rate in litres per minute.	**1)** 1.25 litres per minute
	2) A hose pipe can release 8 litres of water in 160 seconds. Calculate the flow rate in litres per second.	**2)** 0.05 litres per second
	3) Juice is leaking from the bottom of a carton. The carton is $330\ ml$ when full and is empty after 11 minutes. Calculate the flow rate in ml per minute.	**3)** $30\ ml$ per minute
	4) A tap fills a cuboid container $5\ cm$ by $8\ cm$ by $20\ cm$. The container is full after 16 seconds. Calculate the flow rate in cm^3 per second.	**4)** $50\ cm^3$ per second
	5) A hose pipe fills a cube with side length $80\ cm$. The cube is full after 40 minutes. Calculate the flow rate in cm^3 per minute.	**5)** $12800\ cm^3$ per minute
	6) A full paddling pool in the shape of a cuboid is being drained through a valve. The paddling pool is 2 metres by 1 metre by $50\ cm$ and is empty after 5 minutes. Calculate the flow rate in m^3 per minute.	**6)** $0.2\ m^3$ per minute
	7) A tap is filling a $500\ ml$ jug with water. The jug is half full after 8 seconds. Calculate the flow rate in ml per second.	**7)** $31.25\ ml$ per second

Flow Rate - Answers

Group A contd	**8)** A tap fills a cube of side length $24\ cm$. The cube is one third full after 35 seconds. Calculate the flow rate in cm^3 per second. **9)** A cuboid container measuring $40\ cm$ by $30\ cm$ by $25\ cm$ is being filled with water from a tap. The container is 60% full after 5 minutes. Calculate the flow rate in cm^3 per minute.	**8)** $131.66\ cm^3$ per second (2 d.p.) **9)** $3600\ cm^3$ per minute
Group B	Find the volume of the shape and use the flow rate to find the time to fill the container: **1)**  Flow rate = 20 cm^3/s **2)**  Flow rate = 45 cm^3/s **3)**  Flow rate = 50 cm^3/s. Give your answer in minutes and seconds. **4)**  Flow rate = 20 cm^3/s	**1)** $1000\ cm^3$, 50 seconds **2)** $9000\ cm^3$, 200 seconds **3)** $80000\ cm^3$, 26 minutes 40 seconds **4)** $5400\ cm^3$, 270 seconds

Flow Rate - Answers

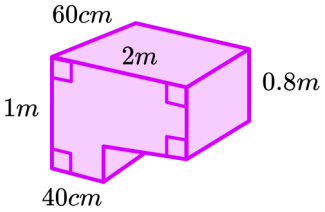
5)



Flow rate = 12 m^3/h

5) 108 m^3, 9 hours

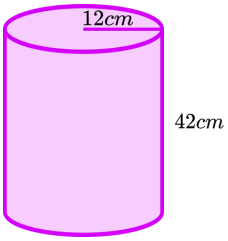
6)



Flow rate = 45 cm^3/s. Give your answer in minutes and seconds.

6) 1008000 cm^3, 373 minutes 20 seconds

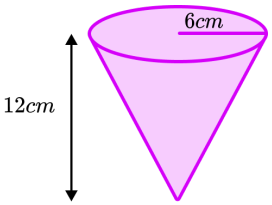
7)



Flow rate = $4l/m$ (1 cm^3 = 1 ml)

7) 19000.35... cm^3, 4.75minutes (to 3 s.f.)

8)

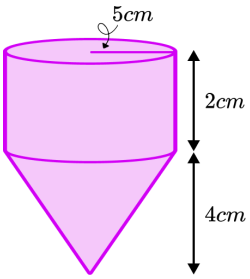


Flow rate = 30 cm^3/s

$Volume\ of\ a\ cone = \frac{1}{3}\pi r^2 h$

8) 452.389... cm^3, 15.1 seconds (to 3 s.f.)

9)



Flow rate = 4.5ml/min

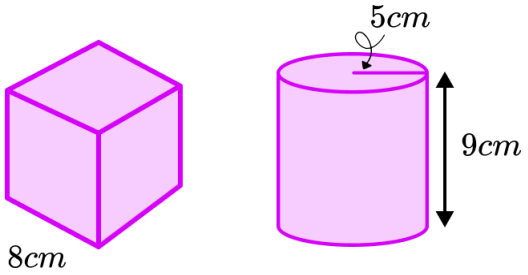
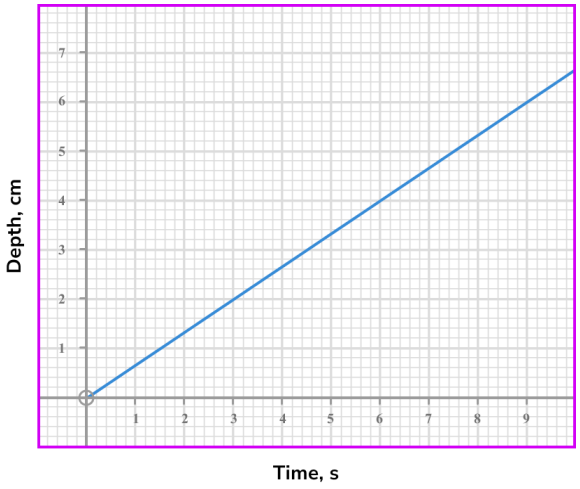
$Volume\ of\ a\ cone = \frac{1}{3}\pi r^2 h$

9) 261.79... cm^3, 58.2 minutes (3 s.f.)

Flow Rate - Answers

Group C	Use the flow rate provided to find the missing value: **1)** A tap produces a flow rate of 4 litres per minute. Find the time taken for the tap to fill a 6 litre bucket.	**1)** 1.5 minutes
	2) A hose pipe produces a flow rate of 6 litres per minute. A gardener spends 10 minutes watering his plants. How much water did the gardener use?	**2)** 60 litres
	3) A coffee machine dispenses coffee with a flow rate of 800ml per minute. How long does it take to produce a $200\ ml$ coffee?	**3)** 0.25 minutes or 15 seconds
	4) A tap produces a flow rate of 3.5 litres per minute. How much water is released from the tap after 90 seconds?	**4)** 5.25 litres
	5) A waterfall has a flow rate of $400\ m^3$ per second. How much water flows over the waterfall in 10 minutes?	**5)** $240000\ m^3$
	6) A dripping tap produces a flow rate of $0.625\ ml$ per second. How long does it take for the dripping tap to fill a 1 litre jug? Give your answer in minutes and seconds.	**6)** 26 minutes 40 seconds
	7) An air pump produces a flow rate of $30\ cm^3$ per second. Find the volume of air produced in 1 hour, giving your answer in m^3.	**7)** $0.108\ m^3$
	8) An empty cuboid container with a square base of area $24\ cm^2$ is being filled from a tap producing a flow rate of $50\ cm^3$ per second. Find the height of the water after 6 seconds.	**8)** $12.5\ cm$
	9) A swimming pool holds $45\ m^3$ of water. The swimming pool must be drained by a pump. The pump removes the water with a flow rate of 7200 litres per hour. Given that $1\ m^3 = 1000$ litres. How long will it take to drain the swimming pool, in hours and minutes?	**9)** 6 hours 15 minutes

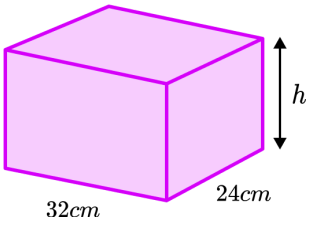
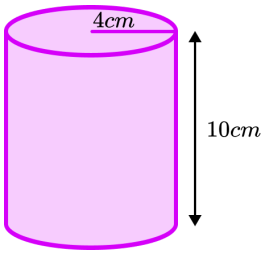
Flow Rate - Answers

	Question	Answer
	Applied Questions	
1)	The image shows two containers, a cube with side length $8\ cm$ and a cylinder with radius $5\ cm$ and height $9\ cm$.  A tap fills the cube container in 32 seconds. **a)** Find the flow rate of the tap in cm^3 per second. **b)** How long will the same tap take to fill the cylinder?	**a)** $16\ cm^3$ per second. **b)** 44.2 seconds (3 s.f.)
2)	A tap is filling a container with water. The graph shows the depth, cm, of water in the container at times measured in seconds.  **a)** Use the information from the graph to find the flow rate of the tap in cm per second. **b)** If the container had a rectangular base measuring $4\ cm$ by $6\ cm$. What is the flow rate of the tap in cm^3 per second?	**a)** $0.66...\ cm$ per second **b)** $16\ cm^3$ per second

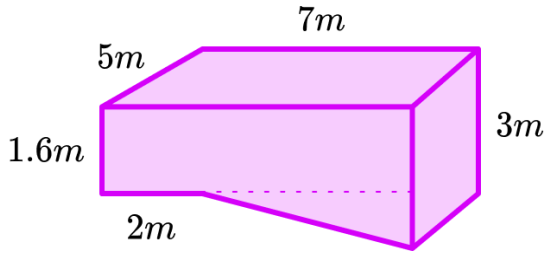
Flow Rate - Answers

3)	A cuboid measuring 2 metres by 60 cm by 80 cm is being filled from a pipe releasing water at a rate of 12 litres per minute.	
	a) Find the time taken to fill the container in hours and minutes. $[1m^3 = 1000\ litres]$	**a)** 1 hour 20 minutes
	b) Once the container is full, a plug at the bottom is removed which lets water drain at a rate of 16 cm^3 per second. Find the total time taken for the container to be filled and then emptied.	**b)** Draining time = 16 hours 40 minutes Total time = 18 hours.
4)	A hot air balloon can hold 2500 cubic metres of air. 	
	a) The hot air balloon is assumed to be the shape of a sphere. If the formula for the volume of a sphere is $V = \frac{4}{3}\pi r^3$. Find the radius of the balloon in metres.	**a)** 8.42 metres (2 d.p.)
	b) A fan used to inflate the hot air balloon has a flow rate of 300000 litres per minute. How long will it take to inflate the hot air balloon? $[1m^3 = 1000\ litres]$	**b)** 8 minutes 20 seconds

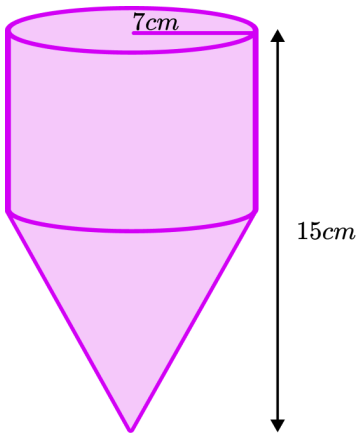
Flow Rate - Mark Scheme

	Question	Answer	
	Exam Questions		
1)	 The diagram shows a container in the shape of the cuboid. The base of the container is a rectangle measuring $32\ cm$ by $24\ cm$. A tap produces a flow rate of 4 litres per minute. The tap can fill the container in 4 minutes and 48 seconds. Using the fact that $1\ ml\ =\ 1\ cm^3$, find the height of the container in centimetres.	4 min 48 sec = 4. 8 mins 4 litres per min = 4000 cm^3 per min $4000\ \times\ 4.8\ =\ 19200\ cm^3$ $19200\ \div\ (32\ \times\ 24)\ =\ 25\ cm$	**(1)** **(1)** **(1)** **(1)**
2)	 The organiser of a fun run needs to provide 120 cups of water for competitors to drink from during a race. Each cup is a cylinder of radius 4 cm and height 10 cm as shown in the diagram. The organiser needs to fill all 120 cups with water from a tap which has a flow rate of 3. 5 litres per minute. There is only 16 minutes available to get all of the cups filled. Will the organiser get all of the cups filled in the available time? Show your working. [$1\ ml\ =\ 1\ cm^3$]	Volume of 1 cup = $\pi\ \times\ 4^2\ \times\ 10\ =\ 502.65...\ cm^3$ Total volume = $60318.5...\ cm^3$ Finding time by dividing by 3500 or equivalent = 17. 23.. minutes No	**(1)** **(1)** **(1)** **(1)**

Flow Rate - Mark Scheme

3)	 The image shows a full swimming pool that needs cleaning, so will be emptied by a pump. After 30 minutes the water level has decreased by 40 cm. How much **extra** time will be required for the swimming pool to be completely empty? Give your answer in minutes.	Volume of decrease = $14\,000\,000\ cm^3$ Flow rate = $466\,666.6...\ cm^3$ per min or equivalent Remaining volume = $120 \times 500 \times 700 + \frac{500 \times 140}{2} \times 500$ $= 59\,500\,000\ cm^3$ Remaining time = $59\,500\,000 \div 466\,666.6..$ 127.5 minutes	**(1)** **(1)** **(1)** **(1)** **(1)** **(1)**

Flow Rate - Mark Scheme

4)	 Water is flowing in the the container shown at a rate of π millilitres per minute. The container consists of a cylinder and a cone. The heights of the cylinder and cone and in the ratio 2: 3. Find the time taken to completely fill the container. Give your answer in minutes. $[Volume\ of\ a\ cone\ = \frac{1}{3}\pi r^2 h]$	Heights of cylinder and cone found as 6 cm and 9 cm Volume of cylinder = $294\pi\ cm^3$ Volume of cone = $147\pi\ cm^3$ Total volume = $441\pi\ cm^3$ Time = 441 minutes	**(1)** **(1)** **(1)** **(1)** **(1)**