


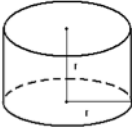








**Preparing for Technical Training:**  
Essential Skills for Water/Wastewater Operators

**Practice Tests**  
Answer Keys

## COURSE OUTLINE:

	Module #	Name	Practice Test included
	Module 1:	Basic Math Refresher	✗
	Module 2:	Fractions, Decimals and Percents	✗
	Module 3:	Measurement Conversions	✓
	Module 4:	Linear, Area and Volume Calculations	✓
	Module 5:	Solving Equations	✗
	Module 6:	Chemical Measurements	✓
	Module 7:	Hydraulics	✓
	Module 8:	Wastewater Electricity	✓



**Preparing for Technical Training:**  
**Essential Skills for Water/Wastewater Operators**

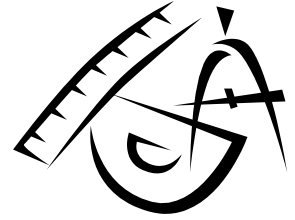
**MODULE 3**

**Measurement Conversions**

Practice Test  
**Answer Key**

## MODULE 3 – PRACTICE TEST

### MEASUREMENT CONVERSIONS



1) Convert 100 ml/sec to L/sec.

- a. 100,000 L/sec
- b. 10 L/sec
- c. 0.1 L/sec**
- d. 0.001 L/sec

$$\frac{100 \text{ ml}}{1 \text{ sec}} \times \frac{1 \text{ L}}{1000 \text{ ml}} = \frac{100 \text{ ml L}}{1000 \text{ sec ml}} = 0.1 \text{ L/sec}$$

Write numbers given as a fraction

Write the conversion as a fraction  
(found on the formula sheet)

2) Convert 75 ml/sec to L/sec

- a. 75,000 L/sec
- b. 0.075 L/sec**
- c. 0.0075 L/sec
- d. 750 L/sec

3) Convert 345 m/minute to m/s

- a. 5.75 m/s**
- b. 20,700 m/s
- c. 8 m/s
- d. 4.25 m/s

$$\frac{345 \text{ m}}{1 \text{ minute}} \times \frac{1 \text{ minute}}{60 \text{ s}}$$

$$= 5.75 \text{ m/s}$$

## MODULE 3 – PRACTICE TEST



4) Convert 1000 ml/s to lpm

- a. 0.017 lpm
- b. 16.7 lpm
- c. 1000 lpm
- d. 60 lpm**

$$\frac{1000 \text{ ml}}{1 \text{ s}} \times \frac{60 \text{ s}}{1 \text{ minute}} \times \frac{1 \text{ litre}}{1000 \text{ ml}} = \frac{60,000 \cancel{\text{ ml s}} \text{ litre}}{1000 \cancel{\text{ ml s}} \text{ min}} = \text{60 litre/min}$$

5) Convert 9.0032 ml/s to lpm

- a. 9003.2 lpm
- b. 540 lpm
- c. 0.540 lpm**
- d. 0.009 lpm

6) Convert 18 m<sup>3</sup>/s to lpm

- a. 18,000 lpm
- b. 18,000,000 lpm
- c. 1080 lpm
- d. 1,080,000 lpm**

$$\frac{18 \text{ m}^3}{1 \text{ s}} \times \frac{1000 \text{ L}}{1 \text{ m}^3} \times \frac{60 \text{ s}}{1 \text{ min}} = \text{1,080,000 lpm}$$

7) Convert 45.670 m<sup>3</sup>/s to lpm

- a. 45,670 lpm
- b. 45,670,000 lpm
- c. 2,740,000 lpm**
- d. 2,740 lpm

8) Convert 300 L in 15 seconds to L/min

- a. 1200 L/min**
- b. 18,000 L/min
- c. 270,000 L/min
- d. 2,700,000 L/min

## MODULE 3 – PRACTICE TEST



$$\frac{300 \text{ L}}{15 \text{ s}} \times \frac{60 \text{ s}}{1 \text{ min}} = \frac{18,000 \text{ L s}}{15 \text{ s min}} = \mathbf{1200 \text{ L/min}}$$

9) Convert 76,000,000 L/day to cubic metres per second.

- a. 0.76 cu. m/s
- b. 0.88 cu. m/s**
- c. 1267 cu. m/s
- d. 760 cu. m/s

$$\frac{76,000,000 \text{ L}}{1 \text{ day}} \times \frac{1 \text{ m}^3}{1000 \text{ L}} \times \frac{1 \text{ day}}{86,400 \text{ s}} = \mathbf{0.8796 \text{ cubic metres per second}}$$

10) How many kilograms of water are in a standpipe containing 5678 L?

- a. 567.8 kilograms
- b. 5,678 kilograms**
- c. 56,780 kilograms
- d. 56.78 kilograms

$$5678 \text{ L} = ? \text{ kg}$$

On the formula sheet we know that 1 L of water weighs 1 kg.

**So 5678 L of water would weigh 5678 kg!!**

11) A water meter in a residential home measures that 25 cubic metres of water are used every 30 days. What is the **daily** water use expressed in cubic metres, and litres?

- a. 25 m<sup>3</sup>, 250 L
- b. 25 m<sup>3</sup>, 0.00025 L
- c. 0.83<sup>3</sup> m, 830 L**
- d. 0.83<sup>3</sup> m, 0.00083 L

$$25 \text{ m}^3 = 30 \text{ days}$$

$$? \text{ m}^3 \quad 1 \text{ day}$$

$$= \mathbf{0.83333333 \text{ m}^3 / \text{day}}$$

$$\frac{0.83333333 \text{ m}^3}{1 \text{ m}^3} = \frac{? \text{ L}}{1000 \text{ L}}$$

$$= \mathbf{833.333333 \text{ L}}$$

## MODULE 3 – PRACTICE TEST



12) An empty atmospheric storage tank has a volume of 31.4 m<sup>3</sup>. How long will it take to fill 90% of the tank volume if a pump is discharging a constant 60 litres per minute into the tank?

**a. 7 hours 51 minutes**

b. 8 hours 21 minutes

c. 8 hours 23 minutes

d. 9 hours 17 minutes

$$\frac{31.4 \text{ m}^3}{1 \text{ m}^3} = \frac{? \text{ L}}{1000 \text{ L}}$$

= **31,400 L volume of the tank**

We're only wanting to fill 90% of it so  $31,400 \times 0.9 = \mathbf{28,260 \text{ L}}$

(90% converted to a decimal is 0.9)

$$\text{If the pump discharges } \frac{60 \text{ L}}{28,260 \text{ L}} = \frac{1 \text{ min}}{? \text{ min}}$$

= **471 minutes**

$$\frac{471 \text{ minutes}}{60 \text{ min}} = \frac{? \text{ hours}}{1 \text{ hour}}$$

= **7 hours and some minutes left over**

How many minutes in 7 full hours?     7 hours x 60 minutes = 420 minutes

So 471 minutes – 420 minutes = 51 minutes left over.

Answer: **7 hours and 51 minutes**

13) A chemical solution contains 2.5 lbs per Imperial gallon. What is this in g/L?

**a. 250 g/L**

b. 2.5 g/L

c. 300 g/L

d. 25 g/L

grams on the formula sheet is abbreviated “gr”

$$\frac{2.5 \text{ lbs}}{1 \text{ gal}} \times \frac{453.6 \text{ g}}{1 \text{ lb}} \times \frac{1 \text{ gal}}{4.54 \text{ L}} = \frac{1134 \text{ lbs g gal}}{4.54 \text{ gal lbs L}} = \mathbf{249.77973 \text{ g/L}}$$

## MODULE 3 – PRACTICE TEST



14) A small pump can discharge 17 litres of water every two days. Calculate that in litres per minute.

- a. 1.7 lpm
- b. 0.012 lpm
- c. 0.024 lpm
- d. 0.00035 lpm**

$$\frac{17 \text{ L}}{2 \text{ days}} \times \frac{1 \text{ day}}{1440 \text{ min}} = \mathbf{0.0059 \text{ litres per minute}}$$

15) 890,000 litres of water flows through a pipe every hour. How many litres will flow through that pipe every second?

- a. 10.3 L/s
- b. 247 L/s**
- c. 323 L/s
- d. 476 L/s

16) How many kilograms of a chemical applied at the rate of 3 mg/L are required to dose 200,000 litres?

- a. 0.2 kg
- b. 0.6 kg**
- c. 4 kg
- d. 8 kg

$$\frac{3 \text{ mg}}{?} = \frac{1 \text{ L}}{200,000 \text{ L}}$$

$$= 600,000 \text{ mg}$$

$$\text{Convert to kg: } \frac{600,000 \text{ mg}}{1,000,000 \text{ mg}} = \frac{? \text{ kg}}{1 \text{ kg}} = \mathbf{0.6 \text{ kg}}$$

## MODULE 3 – PRACTICE TEST



17) 25° Centigrade is equal to how many degrees Fahrenheit?

- a. 101°
- b. 91°
- c. 11°
- d. 77°**

$$\begin{aligned}\text{Fahrenheit} &= (25 \times 9/5) + 32 \\ &= (25 \times 1.8) + 32 \\ &= 45 + 32\end{aligned}$$

(Change the fraction into a decimal  $9 \div 5 = 1.8$ )

$$= 77 \text{ } ^\circ\text{F}$$

18) Convert 60.5 degrees Fahrenheit to degrees Celsius.

- a. 15.8 degrees Celsius**
- b. 20.6 degrees Celsius
- c. 72.0 degrees Celsius
- d. 101.2 degrees Celsius

$$\begin{aligned}\text{Celsius} &= (60.5 - 32) \times 5/9 \\ &= (28.5) \times 0.55555556\end{aligned}$$

(Change the fraction into a decimal  $5 \div 9 = 0.55555556$ )

$$= 15.8 \text{ } ^\circ\text{C}$$

19) Convert 88 degrees Celsius to Fahrenheit.

- a. 190 °F**
- b. 120 °F
- c. 31 °F
- d. 36 °F

20) Convert 0 °C to °F

- a. 0 °F
- b. 32 °F**
- c. 34 °F
- d. 58 °F

21) Convert 90 °F to °C

- a. 58 °C
- b. 32 °C**
- c. 104 °C
- d. 30 °C

# MODULE 3 – PRACTICE TEST

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**Preparing for Technical Training:**  
**Essential Skills for Water/Wastewater Operators**

**MODULE 4**

**Linear, Area and Volume**

Practice Test  
**Answer Key**

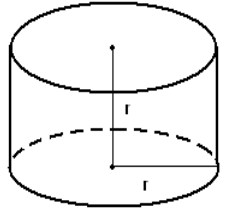
## MODULE 4 – PRACTICE TEST



### LINEAR, AREA AND VOLUME

1) If a clarifier has a diameter of 20.7 m, and a height of 26.2 m, what is the surface area of the water within the clarifier?

- a. 1707.18 m<sup>2</sup>
- b. 336.36 m<sup>2</sup>**
- c. 1349.60 m<sup>2</sup>
- d. 19.88 m<sup>2</sup>



$$\text{Area of circle} = \frac{\pi D^2}{4}$$

$$= \frac{3.14 (20.7)^2}{4}$$

$$= \frac{3.14 (428.49)}{4}$$

$$= \frac{1345.4586}{4}$$

$$\text{Area} = 336.36465 \text{ m}^2$$

2) What is the volume of water that is in a tank that is 38.1 m long and 21 m wide, and has a depth of 5.2 meters?

- a. 4,160,520 litres**
- b. 4,629,002 litres
- c. 1,741,445 litres
- d. 555,036 litres

$$\text{Volume} = L \times W \times H$$

$$= 38.1 \text{ m} \times 21 \text{ m} \times 5.2 \text{ m}$$

$$= 4160.52 \text{ m}^3$$

$$\text{From formula sheet } 1000 \text{ L} = 1 \text{ m}^3$$

$$\text{So } \frac{1000 \text{ L}}{?} = \frac{1 \text{ m}^3}{4160.52 \text{ m}^3}$$

Cross multiply, then divide by the third #

$$\text{Volume} = 4,160,520 \text{ L}$$

## MODULE 4 – PRACTICE TEST



3) If a storage tank is 23 m long, 11 m wide, and 4.25 m deep how many litres of water would it take to overflow the tank?

- a. **1,075,254 litres**
- b. 889,534 litres
- c. 1,160 litres
- d. 18,598 litres

$$\begin{aligned} \text{Volume} &= \text{L} \times \text{W} \times \text{H} \\ &= 23 \text{ m} \times 11 \text{ m} \times 4.25 \text{ m} \\ &= 1075.25 \text{ m}^3 \end{aligned}$$

**Convert to Litres**

$$\frac{1000 \text{ L}}{?} = \frac{1 \text{ m}^3}{1075.25 \text{ m}^3}$$

**Volume = 1,075,250 L**

**\*any more then this volume of water would overflow the storage tank.**

4) An empty atmospheric storage tank is 2 m in diameter and 10 m high. How long will it take to fill 90% of the tank volume if a pump is discharging a constant 60 litres per minute into the tank?

- a. **7 hours 51 minutes**
- b. 8 hours 21 minutes
- c. 8 hours 23 minutes
- d. 9 hours 17 minutes

$$\begin{aligned} \text{Volume} &= \frac{\pi D^2}{4} \times H \\ &= \frac{3.14 (2)^2}{4} \times 10 \text{ m} \\ &= 31.4 \text{ m}^3 \end{aligned}$$

**Convert 31.4 m<sup>3</sup> to litres**

$$\begin{aligned} \frac{1000 \text{ L}}{?} &= \frac{1 \text{ m}^3}{31.4 \text{ m}^3} \\ &= 31,400 \text{ L} \end{aligned}$$

**Calculate 90% of this volume**

$$31,400 \text{ L} \times 0.9 = 28,260 \text{ L}$$

**If the pump discharges 60 L in 1 min, then how long would it take to fill 28,260 L?**

$$\frac{60 \text{ L}}{28,260 \text{ L}} = \frac{1 \text{ min.}}{?}$$

$$471 \text{ min.}$$

**Convert 471 minutes to hours and minutes**

$$471 \text{ min} \div 60 \text{ minutes} = 7.85$$

This means 7 full hours and 0.85 of an hour

(It DOESN'T mean 85 minutes!!)

So, 7 full hours x 60 min = 420 minutes therefore there are 51 minutes left over

(471-420 = 51) **Answer = 7 hrs 51 min.**

## MODULE 4 – PRACTICE TEST



- 5) Factors of what number are used in the metric system?
- a. 5
  - b. 10**
  - c. 12
  - d. 64
- 6) A ditch that is 4.5 m wide, 6 m deep and 120 m long has to be dug for a water line. How many cubic meters of material must be removed?
- a. 3240 cubic meters**
  - b. 6250 cubic meters
  - c. 7200 cubic meters
  - d. 9,200 cubic meters
- 7) How many cubic meters of water will a rectangular tank that is 20 m long by 15 m wide and 10 m high hold?
- a. 2,000 cubic meters
  - b. 3,000 cubic meters**
  - c. 4,000 cubic meters
  - d. 5,000 cubic meters
- 8) Calculate the volume, in Megalitres, of a tank that is 75 m long, 20 m wide, and 10 m deep.
- a. 1.5 ML
  - b. 1500 ML
  - c. 150 ML
  - d. 15 ML**

$$\text{Volume} = \text{L} \times \text{W} \times \text{H}$$

$$= 75\text{m} \times 20\text{ m} \times 10\text{ m}$$

$$= 15,000\text{ m}^3$$

Convert to Litres

$$\frac{1\text{ m}^3}{15,000\text{ m}^3} = \frac{1000\text{L}}{?}$$

$$= 15,000,000\text{ L}$$

Convert Litres to Megalitres

$$\frac{1,000,000\text{ L}}{15,000,000\text{ L}} = \frac{1\text{ ML}}{?}$$

$$= 15\text{ ML}$$

## MODULE 4 – PRACTICE TEST



9) Calculate the volume in cubic meters of a circular clarifier 3 meters deep and 14 meters in diameter.

- a. 46.22 m<sup>3</sup>
- b. 462 m<sup>3</sup>**
- c. 1,600 L
- d. 1,300 L

10) If a clarifier has a diameter of 20.7 m, and a height of 26.2 m, what is the surface area of the water within the clarifier?

- a. 1707.18 m<sup>2</sup>
- b. 336.36 m<sup>2</sup>**
- c. 1349.60 m<sup>2</sup>
- d. 19.88 m<sup>2</sup>

11) How many litres of water are in a chemical tank that is 2134 mm in diameter and 6.1 m deep when the water level is only 4.9 m?

- a. 17517 litres**
- b. 19752 litres
- c. 1272 litres
- d. 2396 litres

**This # isn't needed!!**

We're trying to find the **volume of water** in the tank, not the volume of the tank.

$$\text{Volume} = \frac{\pi D^2}{4} \times H$$

**Change 2134 mm to m first**

$$\frac{2134 \text{ mm}}{1000} = \frac{2.134 \text{ m}}{1}$$

$$= 2.134 \text{ m}$$

**Now use the equation**

$$= \frac{3.14 (2.134)^2}{4} \times 4.9 \text{ m}$$

$$= \frac{3.14 (4.553956)}{4} \times 4.9 \text{ m}$$

$$= \frac{14.29942184}{4} \times 4.9 \text{ m}$$

$$= 3.57485546 \times 4.9 \text{ m}$$

$$= 17.51679175 \text{ m}^3$$

**Change m<sup>3</sup> to L**

$$\frac{1000 \text{ L}}{1} = \frac{1 \text{ m}^3}{17.51679175 \text{ m}^3}$$

$$= 17516.79175 \text{ L}$$

## MODULE 4 – PRACTICE TEST



- 12) If a clarifier has a diameter of 31.09 m, and a height of 3.66 m, what is the surface area of the water within the clarifier?
- 778 m<sup>2</sup>
  - 759 m<sup>2</sup>**
  - 421 m<sup>2</sup>
  - 2777 m<sup>2</sup>
- 13) How many litres of water are in a tank that has a 2.4 m width, a 5.8 m length and is 6.1 m deep?
- 130544 litres
  - 196910 litres
  - 84,912 litres**
  - 95972 litres
- 14) How many litres of water are in a tank that has a 2.4 m width, a 5.8 m length, and 4 m depth, but the water level is only 3.7 m deep?
- 51504 litres**
  - 45493 litres
  - 54835 litres
  - 58117 litres
- 15) Calculate the amount of water in a pipeline 150 mm in diameter and 10 km long.
- 4,100 L
  - 150,000 L
  - 177,000 L**
  - 207,000 L

$$\text{Volume} = \frac{\pi D^2}{4} \times H$$

**Change all units to metres first  
before using the equation**

$$\frac{1000 \text{ mm}}{150 \text{ mm}} = \frac{1 \text{ m}}{?}$$

$$\text{Diameter} = 0.15 \text{ m}$$

$$\frac{1000 \text{ m}}{?} = \frac{1 \text{ km}}{10 \text{ km}}$$

$$\text{Length} = 10,000 \text{ m}$$

**Now put the units into the equation:**

$$\begin{aligned} \text{Volume} &= \frac{3.14 (0.15\text{m})^2}{4} \times 10,000 \text{ m} \\ &= \frac{3.14 (0.0225\text{m}^2)}{4} \times 10,000 \text{ m} \\ &= 0.0176625 \text{ m}^2 \times 10,000 \text{ m} \\ &= 176.625 \text{ m}^3 \end{aligned}$$

$$\text{Convert to Litres: } \frac{1000 \text{ L}}{?} = \frac{1 \text{ m}^3}{176.625 \text{ m}^3}$$

**Answer = 176,625 L**

## MODULE 4 – PRACTICE TEST



- 16) Calculate the surface area of a circular clarifier having a diameter of 4.75 m
- a. 17.7 m<sup>2</sup>
  - b. 3.7 m<sup>2</sup>**
  - c. 7.46 m<sup>2</sup>
  - d. 70.8 m<sup>2</sup>
- 17) If the same clarifier from the above question was 2.5 m deep, and had a flat bottom, what would its volume be?
- a. 783,225 L
  - b. 4428 L
  - c. 44.28 L**
  - d. 783 L
- 18) A rectangular reservoir with vertical walls has its overflow 6 m above its floor. If the water level is 1.5 m below the overflow, what percentage of its maximum capacity does the reservoir contain?
- a. 75%**
  - b. 70%
  - c. 62.5%
  - d. 60%

**Set up a ratio:**

$$\frac{\text{If 6 m above the floor}}{\text{Then 4.5 m above the floor}} = \frac{100\% \text{ capacity}}{? \text{ capacity}}$$

(4.5 m because the water level is 1.5 m less than overflow which is 6m)

**Cross multiply and divide by the third number:**

$$4.5 \text{ m} \times 100\% \div 6 \text{ m} = 75\%$$

- 19) A square wet well measures 3.5 m wide by 3.5 m long. What is the surface area?
- a. 7 m<sup>2</sup>
  - b. 14 m<sup>2</sup>
  - c. 12.25 m<sup>2</sup>**
  - d. 25 m<sup>2</sup>

## MODULE 4 – PRACTICE TEST



20) A pipe is 25 centimetre in diameter and 3 metres long. What is the volume (capacity) of this pipe?

- a. **0.15 m<sup>3</sup>**
- b. 490.63 m<sup>3</sup>
- c. 1472 m<sup>3</sup>
- d. 0.05 m<sup>3</sup>

21) A water reservoir constructed beneath a water plant has the dimensions: 12.19 m wide by 18.29 m long by 3.66 m deep with an operating depth of 3.05 m for storage. Calculate the amount of water in the reservoir at the operating depth.

- a. 2,488,848 L
- b. 816,015 L
- c. 680 L
- d. **680,013 L**

**This number is not needed!**

$$V = L \times W \times H$$

$$12.19 \text{ m} \times 18.29 \text{ m} \times 3.05 \text{ m} = 680.013055 \text{ m}^3$$

$$\text{If } \frac{1000 \text{ L}}{?} = \frac{1 \text{ m}^3}{680.013155 \text{ m}^3}$$

$$? = 680,013 \text{ L}$$

22) A sedimentation tank is 10m wide and 40m long, with water to a depth of 4m. How many cubic meters of water are in the tank?

- a. 400 L
- b. 400 cu. m
- c. 1600 L
- d. **1600 cu. m**

23) A plastic rain barrel measures 1 m high with a diameter of 0.87m. Calculate the volume of the barrel in litres.

- a. **594 L**
- b. 0.594 L
- c. 683 L
- d. 0.683 L

## MODULE 4 – PRACTICE TEST



24) Find the volume of water displaced (in litres) if a ball having a diameter of 38 cm is submerged in a container of water.

- a. 151 L
- b. 230 L
- c. 229,730 L
- d. 29 L**

$$\text{Volume (of a sphere)} = \frac{4 \pi R^3}{3}$$

Diameter = 38 cm, so radius = 19 cm (half the diameter)

**Convert cm to m:**

$$\frac{19 \text{ cm}}{100 \text{ cm}} = \frac{? \text{ m}}{1 \text{ m}}$$

$$= 0.19 \text{ m}$$

**Plug the numbers into the formula:**

$$\text{Volume} = \frac{4 (3.14) (0.19)^3}{3}$$

$$= 0.0287162 \text{ m}^3$$

**Convert to Litres:**

$$\frac{0.0287162 \text{ m}^3}{1 \text{ m}^3} = \frac{? \text{ L}}{1000 \text{ L}}$$

$$= 28.7162 \text{ L}$$

## MODULE 4 – PRACTICE TEST



25) A water system has installed 1,450 feet of 12 inch diameter pipe. How many gallons of water will it take to fill the pipe?

- a. 4000 gallons
- b. 24,000 gallons
- c. 24 gallons
- d. 5300 gallons**

$$\text{Volume} = \frac{\pi D^2}{4} \times H$$

**Change 8 inches into metres:**

$$\frac{8 \text{ in}}{39.37 \text{ in}} = \frac{? \text{ m}}{1 \text{ m}}$$

$$= 0.2032 \text{ m}$$

**Change 2,450 feet to metres**

$$\frac{2,450 \text{ feet}}{1 \text{ foot}} = \frac{? \text{ m}}{0.305 \text{ m}}$$

$$= 747.25 \text{ m}$$

**Plug in the numbers:**

$$\text{Volume} = \frac{3.14 (0.2032 \text{ m})^2}{4} \times 747.25 \text{ m}$$

$$= 0.032412838 \text{ m}^2 \times 747.25 \text{ m}$$

$$= 24.220493 \text{ m}^3$$

**Convert m<sup>3</sup> to gallons (must convert m<sup>3</sup> to litres first and then litres to gallons)**

$$\frac{24.220493 \text{ m}^3}{1 \text{ m}^3} = \frac{? \text{ litres}}{1000 \text{ L}}$$

$$= 24220.493 \text{ L}$$

$$\frac{24220.493 \text{ L}}{1 \text{ L}} = \frac{? \text{ gallons}}{0.220 \text{ gallons}}$$

$$= \mathbf{5328.5084 \text{ gallons}}$$



# **Preparing for Technical Training:**

**Essential Skills for Water/Wastewater Operators**

## **MODULE 6**

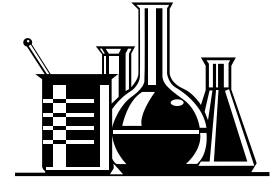
### **Chemical Measurements**

Practice Test  
**Answer Key**

## MODULE 6 – PRACTICE TEST



### CHEMICAL MEASUREMENTS



1) What is the chlorine dosage in milligrams per litre, if 117,000 m<sup>3</sup>/day is treated with 219 kg/day of chlorine?

- a. **1.87 mg/L of chlorine**
- b. 2.43 mg/L of chlorine
- c. 2.68 mg/L of chlorine
- d. 2.92 mg/L of chlorine

$$CD = \frac{C \times 1000}{Q}$$

$$CD = \frac{219 \times 1000}{117,000}$$

$$CD = \mathbf{1.87 \text{ mg/L}}$$

2) A chlorinator setting is 14 kg per day. If the flow being treated is 13.02 MLD, what is the chlorine dosage in mg/L?

- a. **1.1 mg/L**
- b. 0.6 mg/L
- c. 3.2 mg/L
- d. 2.4 mg/L

$$CD = \frac{C \times 1000}{Q}$$

Convert Q from 13.02 MLD to m<sup>3</sup>/day  
(first to litres and then to m<sup>3</sup>)

$$\frac{13.02 \text{ ML}}{1 \text{ ML}} = \frac{? \text{ L}}{1,000,000 \text{ L}}$$

$$= 13,020,000 \text{ L}$$

$$\frac{13,020,000 \text{ L}}{1000 \text{ L}} = \frac{? \text{ m}^3}{1 \text{ m}^3}$$

$$= \mathbf{13,020 \text{ m}^3/\text{day}}$$

Plug in the numbers:

$$CD = \frac{14 \text{ kg/day} \times 1000}{13,020 \text{ m}^3/\text{day}}$$

$$CD = \mathbf{1.0752 \text{ mg/L}}$$

## MODULE 6 – PRACTICE TEST

3) A treatment plant processes an average of 22,048 L/min. If the lime dosage is 100 grams/min, what is the dosage in milligrams per litre?

- a. 0.12 mg/L
- b. 4.5 mg/L**
- c. 40.2 mg/L
- d. 51.8 mg/L

$$CD = \frac{C \times 1000}{Q}$$

Convert C from 100 grams/min to kg/day:

$$\frac{100 \text{ grams}}{1 \text{ min}} \times \frac{1440 \text{ min}}{1 \text{ day}} \times \frac{1 \text{ kg}}{1000 \text{ g}} = 144 \text{ kg/day}$$

Convert Q from 22,048 L/min to m<sup>3</sup>/day:

$$\frac{22,048 \text{ L}}{1 \text{ min}} \times \frac{1 \text{ m}^3}{1000 \text{ L}} \times \frac{1440 \text{ min}}{1 \text{ day}} = 31,749.12 \text{ m}^3/\text{day}$$

Plug the numbers into the formula:

$$CD = \frac{144 \text{ kg/day} \times 1000}{31,749.12 \text{ m}^3/\text{day}}$$

$$CD = 4.5356 \text{ mg/L}$$

4) A chlorine dose of 50 kg/day is required to treat water. If calcium hypochlorite (65% available chlorine) is to be used, how many kg/day of hypochlorite will be required?

- a. 0.013 kg/day
- b. 77 kg/day**
- c. 50 kg/day
- d. 142 kg/day

$$\text{Chemical Required (kg)} = \frac{\text{Pure Chemical}}{\% \text{ Purity}}$$

$$= \frac{50 \text{ kg}}{0.65\%}$$

$$= 76.92 \text{ kg/day}$$

## MODULE 6 – PRACTICE TEST



5) How many kg of 70% available chlorine are necessary to provide 1.5 kg of chlorine?

- a. **2.14 kg**
- b. 1.05 kg
- c. 105 kg
- d. 3.33 kg

$$\text{Chemical Required (kg)} = \frac{\text{Pure Chemical (kg)}}{\% \text{ Purity}}$$

$$\text{Chemical Required} = \frac{1.5 \text{ kg}}{0.7}$$

$$= 2.14 \text{ kg}$$

6) How many kilograms of 61% calcium hypochlorite are required for a 50-mg/L dosage in a tank that is 33.5 m in diameter and has a water level of 5.8 m?

- a. 61.2 kg
- b. 509.8 kg
- c. 436.8 kg
- d. **418.8 kg**

$$\text{Chemical Required (kg)} = \frac{\text{Pure Chemical (kg)}}{\% \text{ purity (decimal)}}$$

You must calculate the amount of pure chemical you need to add for this size of tank:

**First: what is the volume of the tank in litres?**

$$\text{Volume} = \frac{3.14 (33.5\text{m})^2}{4} \times 5.8 \text{ m}$$

$$\text{Volume} = 5109.60425 \text{ m}^3$$

$$\frac{5109.60425 \text{ m}^3}{1 \text{ m}^3} = \frac{? \text{ L}}{1000 \text{ L}}$$

$$\text{Volume} = \mathbf{5,109,604.25 \text{ L}}$$

## MODULE 6 – PRACTICE TEST



So, if you put 50 mg of hypochlorite in 1 L, how much would you add to 5,109,604.25 L?

$$\frac{? \text{ mg}}{50 \text{ mg}} = \frac{5,109,604.25 \text{ L}}{1 \text{ L}}$$

= 255480212.5 mg of chemical to add to this tank

**Convert to kg before using the formula:**

$$\frac{255,480,212.5 \text{ mg}}{1,000,000 \text{ mg}} = \frac{? \text{ kg}}{1 \text{ kg}}$$

= **255.4802125 kg**

**Plug numbers into formula**

$$\text{Chemical Required (kg)} = \frac{255.4802125 \text{ kg}}{0.61\%}$$

Chemical Required = **418.8 kg**

## MODULE 6 – PRACTICE TEST



- 7) A small tank containing 3,795 L of water is to be disinfected using a hypochlorite (hypo) solution. If a dosage of 50 mg/L is desired and the available chlorine in the solution is 12%, how much hypochlorite solution should be added in grams?
- a. 1.58 grams
  - b. 15.80 grams
  - c. 1,580 grams**
  - d. 15,800 grams

$$\text{Chemical Required (kg)} = \frac{\text{Pure Chemical}}{\% \text{ purity}}$$

Calculate amount of pure chemical needed for that much water:

$$\frac{50 \text{ mg}}{? \text{ mg}} = \frac{1 \text{ L}}{3795 \text{ L}}$$
$$= 189,750 \text{ mg}$$

Convert to kg before using the formula:

$$\frac{189,750 \text{ mg}}{1,000,000 \text{ mg}} = \frac{? \text{ kg}}{1 \text{ kg}}$$
$$= \mathbf{0.18975 \text{ kg}}$$

Plug numbers into the formula:

$$\text{Chemical Required (kg)} = \frac{0.18975 \text{ kg}}{0.12 \%}$$

$$\text{Chemical required} = 1.58125 \text{ kg}$$

Convert final answer to grams:

$$\frac{1.58125 \text{ kg}}{1 \text{ kg}} = \frac{? \text{ g}}{1000 \text{ g}}$$
$$= \mathbf{1581.25 \text{ g}}$$

## MODULE 6 – PRACTICE TEST



8) How many kilograms of a chemical applied at the rate of 50 mg/L are required to dose 200,000 litres?

- a. 0.00005 kg
- b. 10 kg**
- c. 4 kg
- d. 8 kg

**Convert 50 mg/L to kg/L. (You have to first convert mg to g and then g to kg)**

$$\frac{50 \text{ mg}}{1000 \text{ mg}} = \frac{? \text{ g}}{1 \text{ g}}$$

$$= 0.05 \text{ g}$$

$$\frac{0.05 \text{ g}}{1000 \text{ g}} = \frac{? \text{ kg}}{1 \text{ kg}}$$

$$= 0.00005 \text{ kg}$$

**Set up a ratio:**

$$\frac{0.00005 \text{ kg}}{? \text{ kg}} = \frac{1 \text{ L}}{200,000 \text{ L}}$$

$$= 10 \text{ kg}$$

9) What is the chlorine demand if the chlorine residual is 2 mg/L and 8.7 mg/L of chlorine has been added?

- a. 5.3 mg/L
- b. 1.2 mg/L
- c. 4.7 mg/L
- d. 6.7 mg/L**

This means the same as “chlorine demand”

**Total Chlorine Dosage = Chlorine Demand + Chlorine Residual**

Rearrange the equation and get “Chlorine Demand” by itself:

$$\text{Dosage} = \text{Demand} + \text{Residual} - \text{Residual}$$

Do the same to both sides of the equation:

$$\text{Dosage} - \text{Residual} = \text{Demand} + \text{Residual} - \text{Residual}$$

$$\text{Dosage} - \text{Residual} = \text{Demand}$$

## MODULE 6 – PRACTICE TEST



**Plug the numbers into the formula:**

$$\text{Demand} = 8.7 \text{ mg/L} - 2 \text{ mg/L}$$

$$\text{Demand} = \mathbf{6.7 \text{ mg/L}}$$

10) If the chlorine dose is 11.05 mg/L and the chlorine residual is 2.20 mg/L, what is the chlorine demand?

a. 1.20 mg/L

**b. 8.85 mg/L**

c. 4.25 mg/L

d. 5.45 mg/L

Chlorine demand = Chlorine dosage – Chlorine residual

$$\text{Chlorine demand} = 11.05 \text{ mg/L} - 2.20 \text{ mg/L}$$

$$= \mathbf{8.85 \text{ mg/L}}$$

11) Calculate the chlorine demand using the following data.

Raw water flow is 0.75 MLD

Chlorinator feed rate is 6.0 mg/L

Chlorine residual is 1.8 mg/L

a. 0.8 mg/L

**b. 4.2 mg/L**

c. 4.0 mg/L

d. 5.8 mg/L

12) The chlorine dosage for a water system is 2.9 mg/L. If the chlorine residual after 30 minutes contact time is found to be 0.8 mg/L, what is the chlorine demand in mg/L?

a. 0.9 mg/L

b. 3.5 mg/L

**c. 2.1 mg/L**

d. 2.2 mg/L

$$\text{Chlorine demand} = 2.9 \text{ mg/L} - 0.8 \text{ mg/L}$$

$$= \mathbf{2.1 \text{ mg/L}}$$

## MODULE 6 – PRACTICE TEST

- 13) The difference between the amount of chlorine added to water and the amount of residual chlorine remaining at the end of a specified period is:
- a. The dosage
  - b. Free available chlorine
  - c. Chlorine residual
  - d. Chlorine demand**
- 14) Chlorine demand can be described as:
- a. Chlorine Dose, mg/L – Chlorine Residual, mg/L**
  - b. The chlorine dosage required by the GCDWQ
  - c. Chlorine Dose, mg/L + Chlorine Residual, mg/L
  - d. None of the above
- 15) The chlorine demand of water is 1.5 mg/L. If the desired chlorine residual is 0.7 mg/L, what is the desired chlorine dose, in mg/L?
- a. 0.9 mg/L
  - b. 0.7 mg/L
  - c. 2.8 mg/L
  - d. 2.2 mg/L**

# MODULE 6 – PRACTICE TEST

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# **Preparing for Technical Training:**

**Essential Skills for Water/Wastewater Operators**

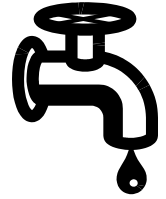
## **MODULE 7**

**Hydraulics**

**Practice Test  
Answer Key**

## MODULE 7 – PRACTICE TEST

### HYDRAULICS



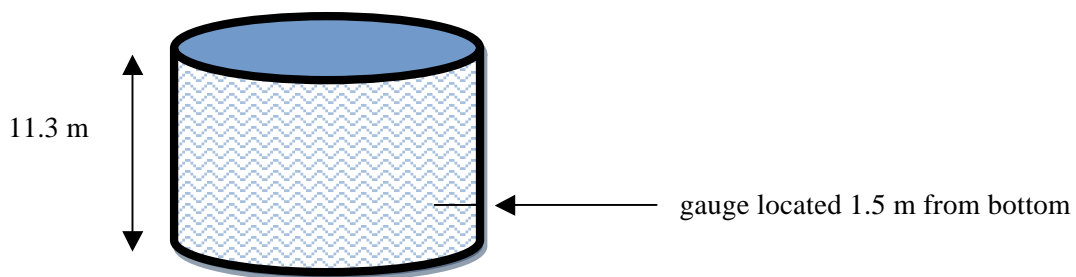
- 1) A pressure gauge reads 80.4 psi. What is the pressure in kPa?
- a. 4.5 kPa
  - b. 30.9 kPa
  - c. 209 kPa
  - d. 554 kPa**

$$\frac{80.4 \text{ psi}}{0.145 \text{ psi}} = \frac{? \text{ kPa}}{1 \text{ kPa}}$$

$$= 554.48 \text{ kPa}$$

- 2) If a storage tank, which is completely full, contains 11.3 m of water, what pressure would a pressure gauge read that is located 1.5 m above the bottom of the tank?
- a. 110.9 kPa
  - b. 9.61 kPa
  - c. 96.1 kPa**
  - d. 10.9 kPa

We know (from the formula sheet) that 1 metre of hydraulic head = 9.81 kPa



$$11.3 \text{ m} - 1.5 \text{ m} = 9.8 \text{ m}$$

$$\frac{9.8 \text{ m}}{1 \text{ m}} = \frac{? \text{ kPa}}{9.81 \text{ kPa}}$$

$$= 96.1 \text{ kPa}$$

## MODULE 7 – PRACTICE TEST



- 3) There are two standpipes in a distribution system and both of them are 20 m tall, with water up to the top. One of them holds 1.9 mega litres and the other holds 0.6 mega litres, how much pressure would be exerted in kilopascals?

- a. **196 kPa**
- b. 1034 kPa
- c. 571 kPa
- d. 669 kPa

The diameter of the standpipes doesn't matter, only the height of the water, which is 20 m:

$$\frac{20 \text{ m}}{1 \text{ m}} = \frac{? \text{ kPa}}{9.81 \text{ kPa}}$$

= 196.2 kPa of pressure in each standpipe.

- 4) Two columns of water are filled completely at sea level to a height of 31 meters. Column A is 0.5 meters in diameter. Column B is 5 meters in diameter. What will two pressure gauges, one attached to the bottom of each column, read?

<u>Column A</u>	<u>Column B</u>
a. 38 kPa	380 kPa
b. 88 kPa	80 kPa
c. 203 kPa	203 kPa
<b>d. 304 kPa</b>	<b>304 kPa</b>

**Pressure is not affected by diameter of the tank!**

- 5) If a pressure gauge on a pump reads 77 meters, how much pressure in kPa would be on the pump?
- a. 1069 kPa
  - b. **755 kPa**
  - c. 3406 kPa
  - d. 3902 kPa

## MODULE 7 – PRACTICE TEST



6) The pressure gauge at the bottom of a tank is 105 kPa. What is the depth of water in the tank?

- a. 10.1 m
- b. 17.1 m
- c. 27.1 m
- d. 10.7 m**

$$\frac{105 \text{ kPa}}{9.81 \text{ kPa}} = \frac{? \text{ m}}{1 \text{ m}} \quad = 10.7 \text{ m}$$

7) If a pressure gauge reads 1070 kPa, what would the pressure head be in meters?

- a. 109m**
- b. 77m
- c. 151m
- d. 173m

8) During a routine pressure test of a fire hydrant the gauge reads 455 kPa. What was the pressure head in meters?

- a. 8.84 m
- b. 46.38 m**
- c. 150.57 m
- d. 17.07 m

9) If a pressure gauge on a fire hydrant reads 120 m, what is the pressure head in kPa?

- a. 1177 kPa**
- b. 6274 kPa
- c. 2717 kPa
- d. 1069 kPa

10) What would the wire to water efficiency be on a pump that had water power of 16 kW and motor power of 21 kW?

- a. 89%
- b. 76%**
- c. 99%
- d. 69%

This question is looking for the “motor efficiency”. Use the formula:

$$\text{Motor Power} = \frac{\text{Water Power}}{\text{Motor Efficiency}}$$

Motor Efficiency

← Rearrange to solve for Motor Efficiency

## MODULE 7 – PRACTICE TEST



**Plug the numbers into the equation:**  $21 \text{ kW} = \frac{16 \text{ kW}}{\text{Motor Effic.}}$

**Get the unknown in the numerator:**  $21 \text{ kW (Motor Effic.)} = 16 \text{ kW}$

**Divide both sides by 21, to get the unknown by itself:**

$$\frac{\cancel{21} \text{ kW (Motor Effic.)}}{\cancel{21} \text{ kW}} = \frac{16 \text{ kW}}{21 \text{ kW}}$$

$$\text{Motor Efficiency} = \frac{16 \text{ kW}}{21 \text{ kW}}$$

$$\text{Motor Efficiency} = 0.76 \text{ kW}$$

**Change to a percent by multiplying by 100%:**  $0.76 \times 100\% = 76\%$

11) How is the velocity of water flow normally expressed?

- a. Meters per minute
- b. Litres per minute
- c. Litres per cm
- d. Meters per second**

12) Calculate the average weekly flow for a system with the following data.

Sunday - 3,000 litres	Monday - 4,000 litres	Tuesday - 3,500 litres
Wednesday - 2,000 litres	Thursday - 3,000 litres	Friday - 3,500 litres
Saturday - 2,000 litres		

- a. 2,000 Lpd
- b. 3,000 Lpd**
- c. 4,000 Lpd
- d. 5,000 Lpd

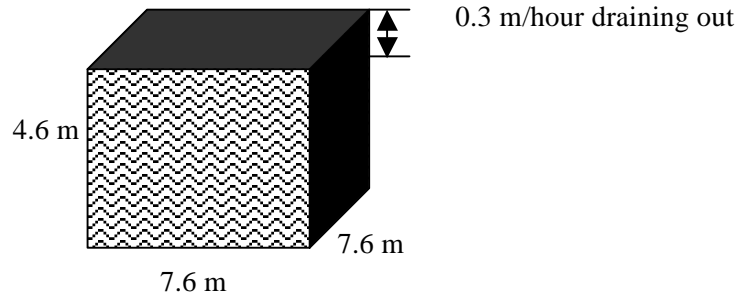
$$\frac{21,000 \text{ litres}}{? \text{ litres}} = \frac{7 \text{ days}}{\text{day}}$$

$$= 3000 \text{ L/day}$$

## MODULE 7 – PRACTICE TEST

13) Water is draining at a rate of 0.3 m/hr from a reservoir that is 4.6 m high, 7.6 m wide and 7.6 m long.  
How many litres of water are flowing out of the tank in that 1-hour?

- a. 2,650.7 L/hour
- b. 2,805 L/hour
- c. 17,328 L/hour**
- d. 265,696 L/hour



If 0.3 m/hour is draining out, how much **volume** (m<sup>3</sup>) is actually draining out?

Well, if the height that is draining out is 0.3 m then the length & width of the volume are each 7.6 m

$$\begin{aligned} \text{Volume} &= L \times W \times H \\ &= 7.6 \text{ m} \times 7.6 \text{ m} \times 0.3 \text{ m} \\ &= 17.328 \text{ m}^3 \end{aligned}$$

Convert from m<sup>3</sup>/hour to L /hour:

$$\frac{17.328 \text{ m}^3}{1 \text{ hour}} \times \frac{1000 \text{ L}}{1 \text{ m}^3} = \mathbf{17,328 \text{ L/hour}}$$

14) If a pipe has a 300 mm diameter, what is the velocity of the water if the pipe is carrying 0.090m<sup>3</sup>/sec?

- a. 1.27 m/sec**
- b. 1.60 m/sec
- c. 0.41 m/sec
- d. 4.02 m/sec

Use the formula  $\text{Velocity} = \frac{\text{Flow Rate}}{\text{Area}}$

Change 300 mm to m:

$$\begin{aligned} \frac{300 \text{ mm}}{1000 \text{ mm}} &= \frac{? \text{ m}}{1 \text{ m}} \\ &= 0.3 \text{ m} \end{aligned}$$

## MODULE 7 – PRACTICE TEST



**Calculate area:**

$$\begin{aligned} \text{Area} &= \frac{3.14 (0.3\text{m})^2}{4} \\ &= 0.07065 \text{ m}^2 \end{aligned}$$

**Put numbers into the velocity equation:**

$$\begin{aligned} \text{Velocity} &= \frac{0.090 \text{ m}^3/\text{sec}}{0.07065 \text{ m}^2} \\ &= \mathbf{1.27 \text{ m/sec}} \end{aligned}$$

- 15) A 150 mm diameter pipe is carrying 379 Lpm. What is the velocity of the flow in m/sec?
- a. 0.93m/sec
  - b. 0.24 m/sec
  - c. 0.36 m/sec**
  - d. 0.31 m/sec

Use the velocity formula:  $\text{Velocity} = \frac{\text{Flow Rate}}{\text{Area}}$

**You have to convert 379 lpm to m<sup>3</sup>/s before using the formula:**

$$\frac{379 \text{ L}}{1 \text{ min}} \times \frac{1 \text{ m}^3}{1000 \text{ L}} \times \frac{1 \text{ min}}{60 \text{ sec}} = 0.006316667 \text{ m}^3/\text{sec}$$

**Now calculate the area: (convert 150 mm to 0.15 m first)**

$$\begin{aligned} \text{Area} &= \frac{3.14 (0.15 \text{ m})^2}{4} \\ &= 0.0176625 \text{ m}^2 \end{aligned}$$

Now use the velocity formula:

$$\begin{aligned} \text{Velocity} &= \frac{0.006316667 \text{ m}^3/\text{sec}}{0.0176625 \text{ m}^2} \\ &= \mathbf{0.36 \text{ m/sec}} \end{aligned}$$

## MODULE 7 – PRACTICE TEST



16) A sedimentation tank has a capacity of 60,000 litres. In one hour, 20,800 litres of water flow to the clarifier. What is the detention time?

**a. 2.88 hours**

b. 1.56 hours

c. 5.16 hours

d. 0.88 hours

$$\text{Detention Time(s)} = \frac{\text{Volume (m}^3\text{)}}{\text{Flow Rate (m}^3\text{/s)}}$$

**Convert the volume of 60,000 L to m<sup>3</sup>:**

$$\frac{60,000 \text{ L}}{1000 \text{ L}} = \frac{? \text{ m}^3}{1 \text{ m}^3}$$

$$= 60 \text{ m}^3$$

**Convert Flow from 20,800 L/hour to m<sup>3</sup>/second:**

$$\frac{20,800 \text{ L}}{1 \text{ hour}} \times \frac{24 \text{ hours}}{86,400 \text{ seconds}} \times \frac{1 \text{ m}^3}{1000 \text{ L}}$$

$$= 0.0057777 \text{ m}^3\text{/second}$$

**Plug the numbers into the formula:**

$$\text{Detention Time} = \frac{60 \text{ m}^3}{0.0057777 \text{ m}^3\text{/s}}$$

$$= 10,384.755 \text{ seconds}$$

**Change seconds to hours:**

$$\frac{10,384.755 \text{ s}}{86,400 \text{ s}} = \frac{? \text{ hours}}{24 \text{ hours}}$$

**Answer = 2.88 hours**

## MODULE 7 – PRACTICE TEST



17) Find the detention time in minutes for a clarifier that has a diameter of 46.3 m and a water depth of 2.5 m, if the flow rate is 30.9 MLD.

- a. 32 minutes
- b. 197 minutes**
- c. 775 minutes
- d. 5,664 minutes

$$\text{Detention Time(s)} = \frac{\text{Volume (m}^3\text{)}}{\text{Flow Rate (m}^3\text{/s)}}$$

$$\text{Volume of a Cylinder} = \frac{\pi D^2}{4} \times H$$

$$\text{volume} = \frac{3.14 (46.3)^2}{4} \times 2.5 \text{ m}$$

$$\text{volume} = 4206.991625 \text{ m}^3$$

**Convert flow rate to m<sup>3</sup>/s:**

$$\frac{30.9 \text{ ML}}{1 \text{ day}} \times \frac{1,000,000 \text{ L}}{1 \text{ ML}} \times \frac{1 \text{ m}^3}{1000 \text{ L}} \times \frac{1 \text{ day}}{86,400 \text{ s}} = \frac{30,900,000}{86,400,000} = 0.357638889 \text{ m}^3/\text{s}$$

**Plug numbers into formula:**

$$\text{Detention Time} = \frac{4206.991625 \text{ m}^3}{0.357638889 \text{ m}^3/\text{s}} = 11804.49712 \text{ s}$$

**Convert seconds to minutes:**

$$\frac{11804.49712 \text{ s}}{60 \text{ s}} = \frac{? \text{ minutes}}{1 \text{ minute}}$$

**Answer = 196.74 minutes**

## MODULE 7 – PRACTICE TEST

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18) Brake horsepower is:

- a. **The power delivered by the motor to the pump.**
- b. The power delivered by the pump.
- c. Always greater than the motor horsepower.
- d. Always less than the motor horsepower.

19) What is the term for the combined efficiency of a pump and motor that is obtained by multiplying the pump efficiency by the motor efficiency?

- a. Total system efficiency
- b. Well efficiency
- c. **Wire-to-water efficiency**
- d. Motor-to-pipe efficiency



# **Preparing for Technical Training:**

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## **Essential Skills for Water/Wastewater Operators**



**FINAL ASSESSMENT**

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# FINAL ASSESSMENT



1) Convert 17.403 ml/s to lpm

- a. 9003.2 lpm
- b. 540 lpm
- c. 1.04 lpm**
- d. 1044 lpm

$$\frac{17.403 \text{ ml}}{1 \text{ s}} \times \frac{60 \text{ s}}{1 \text{ min}} \times \frac{1 \text{ L}}{1000 \text{ ml}}$$

**= 1.04 lpm**

2) If a pump discharges 10,350 L in 3 hours and 45 minutes, how many litres per minute is the pump discharging?

- a. 42 lpm
- b. 44 lpm
- c. 45 lpm
- d. 46 lpm**

↑  
**3.75 hours**

$$\frac{10,350 \text{ L}}{3.75 \text{ hr}} \times \frac{1 \text{ hr}}{60 \text{ min}}$$

**= 46 lpm**

3) An empty atmospheric storage tank has a volume of 31.4 m<sup>3</sup>. How long will it take to fill 60% of the tank volume if a pump is discharging a constant 60 litres per minute into the tank?

- a. 5 hours 19 minutes
- b. 8 hours 21 minutes
- c. 8 hours 23 minutes
- d. 5 hours 14 minutes**

**Convert the volume to Litres:**

$$\frac{31.4 \text{ m}^3}{1 \text{ m}^3} = \frac{? \text{ L}}{1000 \text{ L}}$$

= 31,400 L volume of the tank

**We're only wanting to fill 60% of it so 31,400 x 0.6 = 18,840 L**

(90% converted to a decimal is 0.9)

## FINAL ASSESSMENT



$$\begin{aligned} \text{If the pump discharges } \frac{60 \text{ L}}{18,840 \text{ L}} &= \frac{1 \text{ min}}{? \text{ min}} \\ &= \mathbf{314 \text{ minutes}} \end{aligned}$$

Convert minutes to hours:

$$\frac{314 \text{ minutes}}{60 \text{ min}} = \frac{? \text{ hours}}{1 \text{ hour}}$$

= 5 hours and some minutes left over

How many minutes in 5 full hours?     5 hours x 60 minutes = 300 minutes

So 314 minutes – 300 minutes = 14 minutes left over.

**Answer: 5 hours and 14 minutes**

4) Convert 88 degrees Celsius to Fahrenheit.

- a. **190 °F**
- b. 120 °F
- c. 31 °F
- d. 36 °F

$$\begin{aligned} \text{Fahrenheit} &= (88 \times 9/5) + 32 \\ &= \mathbf{190.4^\circ\text{F}} \end{aligned}$$

5) Convert 38 °F to °C.

- a. 0 °C
- b. **3.3 °C**
- c. 34 °C
- d. 3.4 °C

$$\begin{aligned} \text{Celsius} &= (38 - 32) \times 5/9 \\ &= \mathbf{3.3^\circ\text{C}} \end{aligned}$$

## FINAL ASSESSMENT

6) How many litres of liquor are in a treatment process tank that has a 4.4 m width, an 11 m length, and a 6.5 m depth, but the liquor level is only 1 m deep?

- a. 72,600 litres
- b. 143,000 litres
- c. 48,400 litres**
- d. 58,117 litres

This # isn't needed!

7) A water system has installed 2,450 feet of 8 inch diameter pipe. How many gallons of water will it take to fill the pipe?

- a. 11,000 gallons
- b. 24 gallons
- c. 5329 gallons
- d. 33,700 gallons**

$$\text{Volume} = \frac{\pi D^2}{4} \times H$$

Change 8 inches into metres:

$$\begin{aligned} \frac{8 \text{ in}}{39.37 \text{ in}} &= \frac{? \text{ m}}{1 \text{ m}} \\ &= 0.2032 \text{ m} \end{aligned}$$

Change 2,450 feet to metres:

$$\begin{aligned} \frac{2,450 \text{ feet}}{1 \text{ foot}} &= \frac{? \text{ m}}{0.305 \text{ m}} \\ &= 747.25 \text{ m} \end{aligned}$$

Plug the numbers into the formula:

$$\begin{aligned} \text{Volume} &= \frac{3.14 (0.2032 \text{ m})^2}{4} \times 747.25 \text{ m} \\ &= 0.032412838 \text{ m}^2 \times 747.25 \text{ m} \\ &= 24.220464 \text{ m}^3 \end{aligned}$$

Convert m<sup>3</sup> to gallons (must convert m<sup>3</sup> to litres first and then litres to gallons):

$$\begin{aligned} \frac{24.220464 \text{ m}^3}{1 \text{ m}^3} &= \frac{? \text{ litres}}{1000 \text{ L}} \\ &= 24220.464 \text{ L} \end{aligned}$$

$$\frac{24220.464 \text{ L}}{1 \text{ L}} = \frac{? \text{ gallons}}{0.220 \text{ gallons}}$$

$$= 5328.502 \text{ gallons}$$

## FINAL ASSESSMENT



8) Find the velocity of water in a channel if it takes 22 minutes for water to travel a distance of 504 metres in the pipe.

- a. 0.7 m/s
- b. 0.38m/s**
- c. 720 m/s
- d. 600 m/s

$$\text{Velocity} = \frac{\text{Distance}}{\text{Time}}$$

**Convert 22 minutes to seconds:**

$$\begin{aligned} 22 \text{ min} &= ? \text{ sec} \\ \frac{1 \text{ min}}{60 \text{ sec}} & \\ &= 1320 \text{ seconds} \end{aligned}$$

**Plug the numbers into the formula:**

$$\text{Velocity} = \frac{504}{1320}$$

$$\text{Velocity} = 0.3818 \text{ m/s}$$

9) A channel 2.1 m wide has water flowing through it at a depth of 0.9 m and a velocity of 1.3 m/s. Find the flow through the channel in cubic meters per second.

- a. 0.444 m<sup>3</sup>/s
- b. 0.609 m<sup>3</sup>/s
- c. 2.457 m<sup>3</sup>/s**
- d. 12.331 m<sup>3</sup>/s

**Flow Rate = Velocity x area**

**Calculate area:**

$$\begin{aligned} A &= l \times w \\ A &= 2.1 \text{ m} \times 0.9 \text{ m} \\ A &= 1.89 \text{ m}^2 \end{aligned}$$

**Plug numbers into the formula**

$$\begin{aligned} \text{Flow Rate} &= 1.3 \text{ m/s} \times 1.89 \text{ m}^2 \\ &= 2.457 \text{ m}^3/\text{s} \end{aligned}$$

## FINAL ASSESSMENT



10) The wastewater at a plant is dosed with 4.7 mg/L of chlorine. If the chlorine residual after 30 minutes contact time is found to be 0.8 mg/L, what is the chlorine demand in mg/L?

- a. 0.9 mg/L
- b. 3.5 mg/L
- c. 3.9 mg/L**
- d. 2.1 mg/L

$$\text{Chlorine demand} = 4.7 \text{ mg/L} - 0.8 \text{ mg/L}$$

$$= 3.9 \text{ mg/L}$$

11) How many kg of 90% available chlorine are necessary to provide 6.0 kg of chlorine?

- a. 2.14 kg
- b. 1.05 kg
- c. 6.7 kg**
- d. 6.0 kg

$$\text{Chemical Required (kg)} = \frac{\text{Pure Chemical (kg)}}{\% \text{ Purity}}$$

$$\text{Chemical Required} = \frac{6.0 \text{ kg}}{0.9}$$

$$\text{Answer} = 6.67 \text{ kg}$$

12) A treatment plant processes an average of 80,000 L/min. If the lime dosage is 75 grams/min, what is the dosage in milligrams per litre?

- a. 108 mg/L
- b. 11.8 mg/L
- c. 0.94 mg/L**
- d. 51.8 mg/L

$$\text{CD} = \frac{C \times 1000}{Q}$$

**Convert C from 114 grams/min to kg/day:**

$$\frac{75 \text{ grams}}{1 \text{ min}} \times \frac{1440 \text{ min}}{1 \text{ day}} \times \frac{1 \text{ kg}}{1000 \text{ g}} = 108 \text{ kg/day}$$

**Convert Q from 22,048 L/min to m<sup>3</sup>/day:**

## FINAL ASSESSMENT



$$\frac{80,000 \text{ L}}{1 \text{ min}} \times \frac{1 \text{ m}^3}{1000 \text{ L}} \times \frac{1440 \text{ min}}{1 \text{ day}} = 115,200 \text{ m}^3/\text{day}$$

**Plug the numbers into the formula:**

$$\text{CD} = \frac{108 \text{ kg/day} \times 1000}{115,200 \text{ m}^3/\text{day}}$$

$$\text{CD} = 0.9375 \text{ mg/L}$$

- 13) How many kilograms of 80% calcium hypochlorite are required for a 50-mg/L dosage in a tank that is 15.5 m in diameter and has a water level of 5.8 m?
- 418.8 kg
  - 547 kg
  - 546 kg
  - 684 kg**

$$\text{Chemical Required (kg)} = \frac{\text{Pure Chemical (kg)}}{\% \text{ purity (decimal)}}$$

You must calculate the amount of pure chemical you need to add for this size of tank:  
**First: what is the volume of the tank in litres?**

$$\text{Volume} = \frac{3.14 (15.5\text{m})^2}{4} \times 5.8 \text{ m}$$

$$\text{Volume} = 1093.85825 \text{ m}^3$$

$$\frac{1093.85825 \text{ m}^3}{1 \text{ m}^3} = \frac{? \text{ L}}{1000 \text{ L}}$$

$$\text{Volume} = 1,093,858.25 \text{ L}$$

**So, if you put 50 mg of hypochlorite in 1 L, how much would you add to 5,109,604.25 L?**

$$\frac{? \text{ mg}}{50 \text{ mg}} = \frac{1,093,858.25 \text{ L}}{1 \text{ L}}$$

$$= 54,692,912.5 \text{ mg of chemical to add to this tank}$$

**Convert to kg before using the formula:**

## FINAL ASSESSMENT



$$\frac{255,480,212.5 \text{ mg}}{1,000,000 \text{ mg}} = \frac{? \text{ kg}}{1 \text{ kg}}$$

$$= 546.929125 \text{ kg}$$

**Plug numbers into formula**

$$\text{Chemical Required (kg)} = \frac{546.929125 \text{ kg}}{0.80\%}$$

$$\text{Chemical Required} = 683.6614063 \text{ kg}$$

- 14) The pressure gauge at the bottom of a tank is 300 kPa. What is the depth of water in the tank?
- 31 m
  - 17 m
  - 27 m
  - 11 m**

$$\frac{300 \text{ kPa}}{9.81 \text{ kPa}} = \frac{? \text{ m}}{1 \text{ m}}$$

$$= 30.581 \text{ m}$$

- 15) Find the motor power for a pump station with the following parameters:

Motor Efficiency: 92%

Total Head: 52 m

Pump Efficiency: 79%

Flow: 7 MLD

- 61.3 kW
- 41.27 kW
- 56.78 kW**
- 0.7268 kW

$$\text{Motor Power} = \frac{\text{Water Power (Q x H)}}{E_p \times E_m}$$

$$\frac{6125}{E_p \times E_m}$$

Convert 7 MLD to L/min:

## FINAL ASSESSMENT



$$\frac{7 \text{ MLD}}{1 \text{ day}} \times \frac{1,000,000 \text{ L}}{1 \text{ MLD}} \times \frac{1 \text{ day}}{1440 \text{ min}}$$

$$= 4861.111 \text{ L/min}$$

**Plug the numbers into the formula:**

$$\frac{4861.111 \times 52 \text{ m}}{6125} = \frac{41.2698}{0.92 \times 0.79} = \frac{41.2698}{0.7268} = 56.78 \text{ kW}$$

16) A treatment pond operates with an average depth of 6 ft. The width of the pond is 400 ft., and the length is 650 ft. The flow to the pond is 0.0289 m<sup>3</sup>/day. What is the detention time in days?

- a. 44,000 days
- b. 17.7 days**
- c. 21.2 days
- d. 44 days

**Convert feet to metres:**

$$6 \text{ ft} = 1.829 \text{ m}$$

$$400 \text{ ft} = 121.951 \text{ m}$$

$$650 \text{ ft} = 198.170 \text{ m}$$

**Calculate the volume:**

$$\text{Volume} = 1.829 \text{ m} \times 121.951 \text{ m} \times 198.170 \text{ m}$$

$$= 44,201.495 \text{ m}^3$$

**Plug the numbers into the formula:**

$$\text{Detention Time (s)} = \frac{44,201.496 \text{ m}^3}{0.0289 \text{ m}^3/\text{s}}$$

$$= 1,529,463.5 \text{ s}$$

**Convert seconds to days:**

$$\frac{1,529,463.5 \text{ s}}{86,400 \text{ s}} = \frac{? \text{ days}}{1 \text{ day}}$$

$$= 17.7 \text{ days}$$

## FINAL ASSESSMENT



17) Estimate the velocity of wastewater flowing through a grit channel if a stick travels 16 m in 40 seconds.

- a. 640 m/s
- b. 2.5 m/s
- c. 0.4 m/s**
- d. 250 m/s

$$\text{Velocity} = D/T$$

$$= 16\text{m} / 40\text{s}$$

$$= \mathbf{0.4\ m/s}$$

18) The influent BOD of a waste pond is 175 mg/L and the effluent BOD is 23 mg/L. What is the BOD removal efficiency?

- a. 87%**
- b. 66 %
- c. 23 %
- d. 12%

$$\begin{aligned} \text{Removal Efficiency} &= \frac{175-23}{175} \times 100\% \\ &= \mathbf{87\%} \end{aligned}$$

19) i) A circular secondary clarifier handles a flow of 3,400 m<sup>3</sup>/day and a suspended solids concentration of 3,600 mg/L. The clarifier is 15 meters in diameter. Find the weir overflow rate.

- a. 227 m<sup>3</sup>/d x m
- b. 160,140 m<sup>3</sup>/d x m
- c. 54 m<sup>3</sup>/d x m
- d. 72 m<sup>3</sup>/d x m**

$$\begin{aligned} \text{Length of weir} &= 3.14 (15\ \text{m}) \longleftarrow \text{Circumference Formula!!} \\ &= 47.1\ \text{m} \end{aligned}$$

$$\text{Overflow} = \frac{3,400\ \text{m}^3/\text{day}}{47.1\ \text{m}}$$

$$= \mathbf{72\ \text{m}^3/\text{d}\ \text{x}\ \text{m}}$$

## FINAL ASSESSMENT



ii) Find the solids loading for the above question.

- a. **12,240 kg/day**
- b. 3.4 kg/day
- c. 3.6 kg/day
- d. 36,000 kg/day

$$\text{Solids Loading} = \frac{3,400 \text{ m}^3/\text{d} \times 3,600 \text{ mg/L}}{1000}$$

$$= 12,240 \text{ kg/day}$$

20) What is the term used for how hard the electricity is working?

- a. Amperage
- b. **Wattage**
- c. Voltage
- d. Ohms