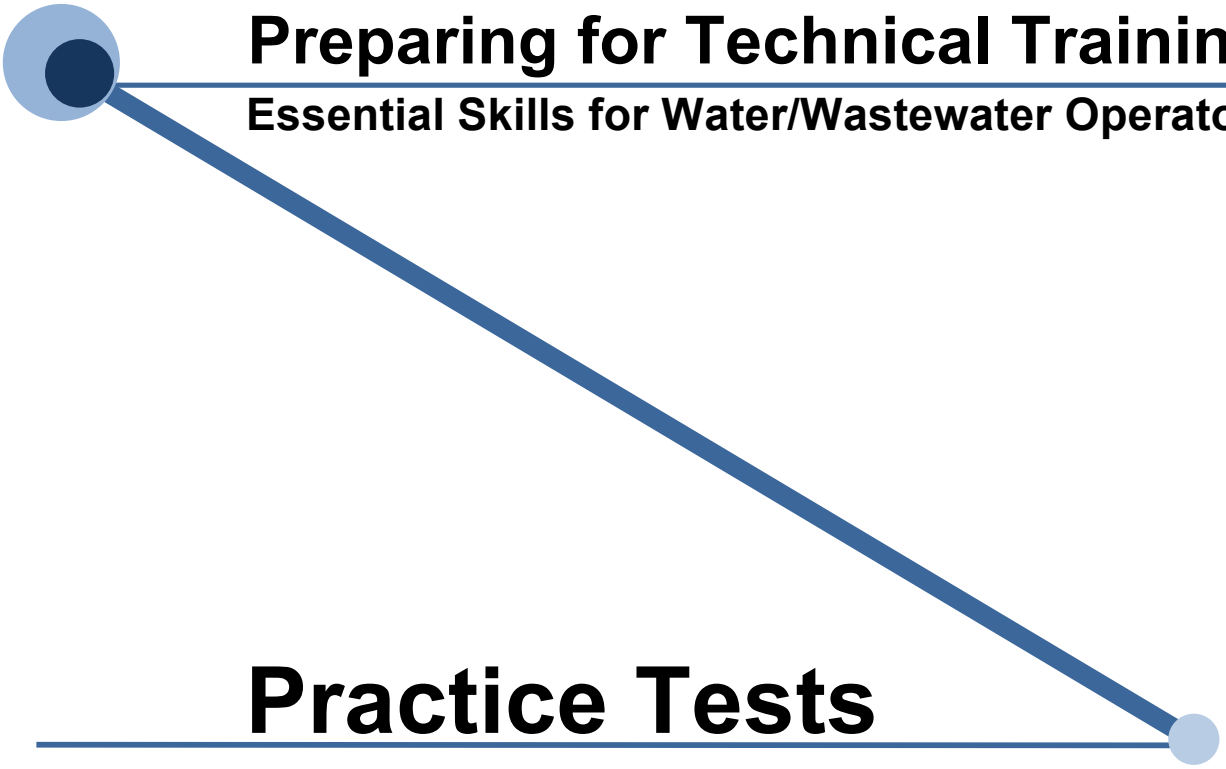
Preparing for Technical Training:

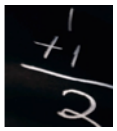
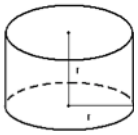
Essential Skills for Water/Wastewater Operators



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

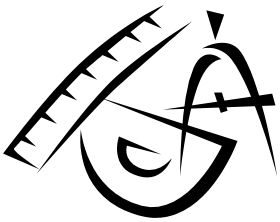
Measurement Conversions

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

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

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

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

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

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

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

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^3/s to lpm

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

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

7) Convert 45.670 m^3/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

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

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

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

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 L = ? 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 m³, 250 L

b. 25 m³, 0.00025 L

c. 0.83³ m, 830 L

d. 0.83³ m, 0.00083 L

25 m³ = 30 days
? m³ 1 day
= **0.83333333 m³ /day**

$$\frac{0.833333333\text{ m}^3}{1\text{ m}^3} = \frac{?\text{ L}}{1000\text{ L}}$$

= **833.333333 L**

MODULE 3 – PRACTICE TEST

12) An empty atmospheric storage tank has a volume of 31.4 m³. 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

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

(90% converted to a decimal is 0.9)

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

We're only wanting to fill 90% of it so 31,400 x 0.9 = **28,260 L**

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

= **471 minutes**

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

= 7 hours and <u>some minutes left over</u>

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"

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

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

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

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 mg

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

MODULE 3 – PRACTICE TEST

17) 25^{o} Centigrade is equal to how many degrees Fahrenheit?

a. 101^{o}
b. 91^{o}
c. 11^{o}
d. 77^{o}

Fahrenheit = (25 x 9/5) + 32 **(Change the fraction into a decimal 9 ÷ 5 = 1.8)**
= (25 x 1.8) + 32
= 45 + 32
= 77 °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

Celsius = (60.5 – 32) x 5/9 **(Change the fraction into a decimal 5 ÷ 9 = 0.55555556)**
= (28.5) x 0.55555556
= 15.8 °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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MODULE 4

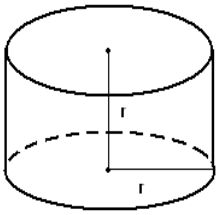
Linear, Area and Volume

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^2
b. 336.36 m^2
c. 1349.60 m^2
d. 19.88 m^2

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

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

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

$= \frac{1345.4586}{4}$

Area = 336.36465 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

Volume = L x W x H

= 38.1 m x 21 m x 5.2 m

= 4160.52 m^3

From formula sheet 1000 L = 1 m^3

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

Cross multiply, then divide by the third #

Volume = 4,160,520 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

Volume = L x W x H

= 23 m x 11 m x 4.25 m

= 1075.25 m³

Convert to Litres

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

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

Volume $= \frac{\pi D^2}{4}$ **x H**

$= \frac{3.14\ (2)^2}{4}$ x 10 m

= 31.4 m³

Convert 31.4 m³ to litres

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

= 31,400 L

Calculate 90% of this volume

31,400 L x 0.9 = 28,260 L

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

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

471 min.

Convert 471 minutes to hours and minutes

471 min ÷ 60 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

Volume = L x W x H

= 75m x 20 m x 10 m

= 15,000 m^3

Convert to Litres

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

= 15,000,000 L

Convert Litres to Megalitres

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

= 15 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^3
b. 462 m^3
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^2
b. **336.36 m^2**
c. 1349.60 m^2
d. 19.88 m^2

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.

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

Change 2134 mm to m first

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

$= 2.134$ 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^3 to L

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

$= 17516.79175$ 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?

a. 778 m^2
b. 759 m^2
c. 421 m^2
d. 2777 m^2

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?

a. 130544 litres
b. 196910 litres
c. 84,912 litres
d. 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?

a. 51504 litres
b. 45493 litres
c. 54835 litres
d. 58117 litres

15) Calculate the amount of water in a pipeline 150 mm in diameter and 10 km long.

a. 4,100 L
b. 150,000 L
c. 177,000 L
d. 207,000 L

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

Change all units to metres first before using the equation

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

Diameter = 0.15 m

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

Length = 10,000 m

Now put the units into the equation:

Volume = $\frac{3.14\ (0.15\text{m})^2}{4}$ x 10,000 m

= $\frac{3.14\ (0.0225\text{m}^2)}{4}$ x 10,000 m

= 0.0176625 m^2 x 10,000 m

= 176.625 m^3

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 m²
b. 3.7 m²
c. 7.46 m²
d. 70.8 m²

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:

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

(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 m x 100% ÷ 6 m = **75%**

19) A square wet well measures 3.5 m wide by 3.5 m long. What is the surface area?

a. 7 m²
b. 14 m²
c. 12.25 m²
d. 25 m²

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 m³
b. 490.63 m³
c. 1472 m³
d. 0.05 m³

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 x W x H
12.19 m x 18.29 m x 3.05 m = 680.013055 m³

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

? = 680,013 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

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 m

Plug the numbers into the formula:

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

= 0.0287162 m^3

Convert to Litres:

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

= 28.7162 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

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

Change 8 inches into metres:

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

= 0.2032 m

Change 2,450 feet to metres

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

= 747.25 m

Plug in the numbers:

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

= 0.032412838 m^2 x 747.25 m

= 24.220493 m^3

Convert m^3 to gallons (must convert m^3 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 L

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

= 5328.5084 gallons

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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 m³/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

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

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

CD = **1.87 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

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

Convert Q from 13.02 MLD to m³/day (first to litres and then to m³)

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

= 13,020,000 L

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

= **13,020 m³/day**

Plug in the numbers:

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

CD = **1.0752 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.l2 mg/L
b. 4.5 mg/L
c. 40.2 mg/L
d. 51.8 mg/L

$$\textbf{CD} = \frac{\textbf{C x 1000}}{\textbf{Q}}$$

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

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

Convert Q from 22,048 L/min to m³/day:

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

Plug the numbers into the formula:

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

CD = **4.5356 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

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

$$= \frac{50 \text{ kg}}{0.65\%} \qquad \textbf{= 76.92 kg/day}$$

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

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

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

= 2.14 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

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

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?

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

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

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

Volume = **5,109,604.25 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?

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

= 255480212.5 mg of chemical to add to this tank

Convert to kg before using the formula:

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

= 255.4802125 kg

Plug numbers into formula

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

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

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 mg

Convert to kg before using the formula:

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

= **0.18975 kg**

Plug numbers into the formula:

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

Chemical required = 1.58125 kg

Convert final answer to grams:

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

= **1581.25 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 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:

Dosage = Demand + Residual **– Residual**

Do the same to both sides of the equation:

Dosage **– Residual** = Demand + Residual **– Residual**
Dosage – Residual = Demand

MODULE 6 – PRACTICE TEST

Plug the numbers into the formula:

Demand = 8.7 mg/L – 2 mg/L

Demand = **6.7 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
Chlorine demand = 11.05 mg/L – 2.20 mg/L

= 8.85 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

Chlorine demand = 2.7 mg/L – 0.8 mg/L

= 2.1 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

Preparing for Technical Training:

Essential Skills for Water/Wastewater Operators

MODULE 7

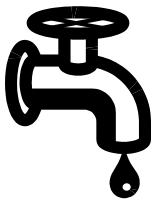
Hydraulics

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

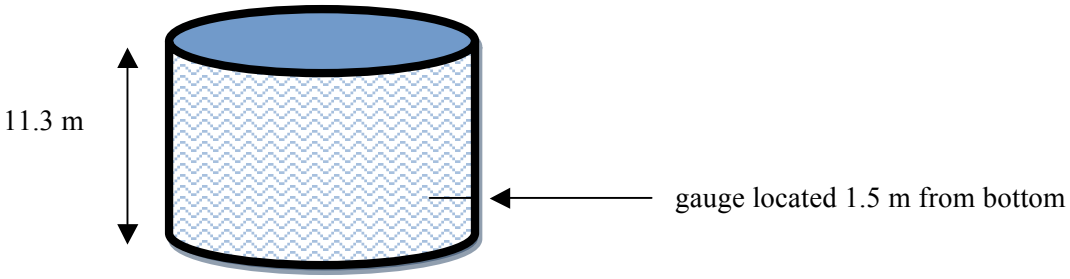
$$\frac{80.4 \text{ psi}}{0.145 \text{ psi}} = \frac{? \text{ kPa}}{1 \text{ kPa}}$$

= 554.48 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 m – 1.5 m = 9.8 m

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

= 96.1 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?

Column A	Column B
a. 38 kPa	380 kPa
b. 88 kPa	80 kPa
c. 203 kPa	203 kPa
d. 304 kPa	**304 kPa**

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

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

Motor Power = Water Power / Motor Efficiency ← **Rearrange to solve for Motor Efficiency**

MODULE 7 – PRACTICE TEST

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

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

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

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

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

Motor Efficiency = 0.76 kW

Change to a percent by multiplying by 100%: 0.76 x 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

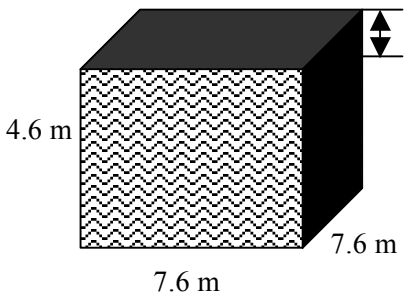
$$\frac{21{,}000\ \text{litres}}{?\ \text{litres}} = \frac{7\ \text{days}}{\text{day}}$$

= 3000 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 (m³) 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

Volume = L x W x H
= 7.6 m x 7.6 m x 0.3 m
= 17.328 m³

Convert from m³/hour to L /hour: $\frac{17.328\ m^3}{1\ hour} \times \frac{1000\ L}{1\ m^3} =$ **17,328 L/hour**

14) If a pipe has a 300 mm diameter, what is the velocity of the water if the pipe is carrying 0.090m³/sec?

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

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

Change 300 mm to m:

$\frac{300\ mm}{1000\ mm} = \frac{?\ m}{1m}$
= 0.3 m

MODULE 7 – PRACTICE TEST

Calculate area:

$$\text{Area} = \frac{3.14\ (0.3\text{m})^2}{4}$$

$$= 0.07065\ \text{m}^2$$

Put numbers into the velocity equation:

$$\text{Velocity} = \frac{0.090\ \text{m}^3/\text{sec}}{0.07065\ \text{m}^2}$$

= 1.27 m/sec

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 m³/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)

$$\text{Area} = \frac{3.14\ (0.15\ \text{m})^2}{4}$$

$$= 0.0176625\ \text{m}^2$$

Now use the velocity formula:

$$\text{Velocity} = \frac{0.006316667\ \text{m}^3/\text{sec}}{0.0176625\ \text{m}^2}$$

= 0.36 m/sec

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 m³:

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

$= 60\text{ m}^3$

Convert Flow from 20,800 L/hour to m³/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

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

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 m³/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

18) Brake horsepower is:

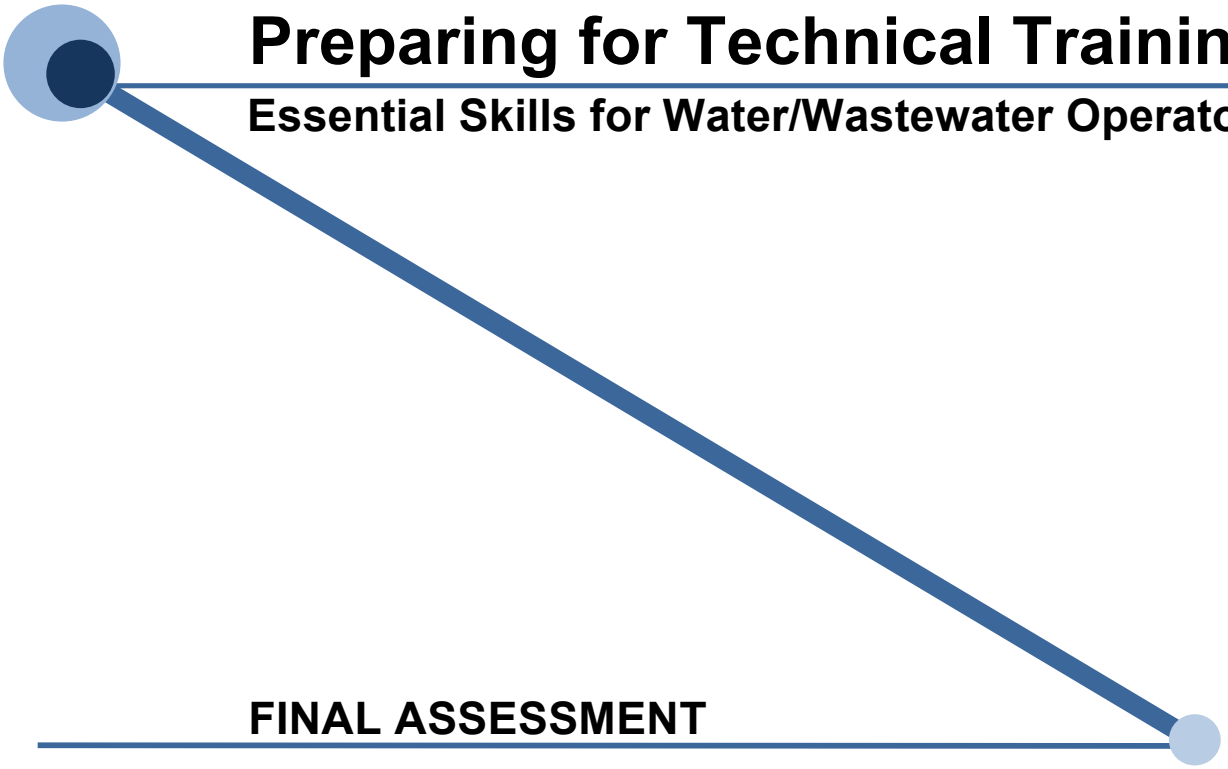
a. The power delivered by the motor to the pump.
b. The power delivered by the pump.
c. Always greater than the motor horsepower.
d. Always less than the motor horsepower.

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:

Essential Skills for Water/Wastewater Operators



FINAL ASSESSMENT

Answer Key

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?

3.75 hours

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

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

= 46 lpm

3) An empty atmospheric storage tank has a volume of 31.4 m³. 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:

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

(90% converted to a decimal is 0.9)

= 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

FINAL ASSESSMENT

If the pump discharges $\frac{60\text{ L}}{18{,}840\text{ L}} = \frac{1\text{ min}}{?\text{ min}}$

= 314 minutes

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

Fahrenheit = (88 x 9/5) + 32
= 190.4°F

5) Convert 38 °F to °C.

a. 0 °C

b. 3.3 °C

c. 34 °C

d. 3.4 °C

Celsius = (38 – 32) x 5/9
= 3.3 °C

FINAL ASSESSMENT

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

This # isn't needed!

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

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

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

Change 8 inches into metres:

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

= 0.2032 m

Change 2,450 feet to metres:

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

= 747.25 m

Plug the numbers into the formula:

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

= 0.032412838 m² x 747.25 m
= 24.220464 m³

Convert m³ to gallons (must convert m³ to litres first and then litres to gallons):

$$\frac{24.220464 \text{ m}^3}{1 \text{ m}^3} = \frac{? \text{ litres}}{1000 \text{ L}}$$

= 24220.464 L

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

= 5328.502 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:

$$\frac{22 \text{ min}}{1 \text{ min}} = \frac{? \text{ sec}}{60 \text{ sec}}$$

= 1320 seconds

Plug the numbers into the formula:

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

Velocity = 0.3818 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^3/s

b. 0.609 m^3/s

c. 2.457 m^3/s

d. 12.331 m^3/s

Flow Rate = Velocity x area

Calculate area:

A = l x w

A = 2.1 m x 0.9 m

A = 1.89 m^2

Plug numbers into the formula

Flow Rate = 1.3 m/s x 1.89 m^2

= 2.457 m^3/s

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

Chlorine demand = 4.7 mg/L – 0.8 mg/L
= 3.9 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

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

$$\text{Chemical Required} = \frac{6.0 \text{ kg}}{0.7}$$

Answer = 6.67 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

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

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 m³/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:

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

CD = 0.9375 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?

a. 418.8 kg
b. 547 kg
c. 546 kg
d. 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?

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

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

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

Volume = 1,093,858.25 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 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 kg

Plug numbers into formula

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

Chemical Required = 683.6614063 kg

14) The pressure gauge at the bottom of a tank is 300 kPa. What is the depth of water in the tank?

a. 31 m
b. 17 m
c. 27 m
d. 11 m

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

= 30.581 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

a. 61.3 kW
b. 41.27 kW
c. 56.78 kW
d. 0.7268 kW

$$\text{Motor Power} = \frac{\text{Water Power } \frac{(Q \times H)}{6125}}{Ep \times Em}$$

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 L/min

Plug the numbers into the formula:

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

= 56.78 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 m³/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 ft = 1.829 m
400 ft = 121.951 m
650 ft = 198.170 m

Calculate the volume:
Volume = 1.829 m x 121.951 m x 198.170 m
= 44,201.495 m³

Plug the numbers into the formula:
Detention Time (s) = $\dfrac{44{,}201.496\text{ m}^3}{0.0289\text{ m}^3/\text{s}}$
= 1,529,463.5 s

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

= 17.7 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

Velocity = D/T

= 16m / 40s

= 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%

$$\text{Removal Efficiency} = \frac{175-23}{175} \times 100\%$$

= 87%

19) i) A circular secondary clarifier handles a flow of 3,400 m^3/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 $m^3/d \times m$
b. 160,140 $m^3/d \times m$
c. 54 $m^3/d \times m$
d. 72 $m^3/d \times m$

Length of weir = 3.14 (15 m) ← Circumference Formula!!
= 47.1 m

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

= 72 $m^3/d \times m$

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

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

= 12,240 kg/day

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

a. Amperage

b. Wattage

c. Voltage

d. Ohms