

**21.** Water samples were collected and submitted to a commercial analytical laboratory for analysis. The laboratory provided the following results.

ion	concentration (mg/L)
$\text{SO}_4^{-2}$	17
$\text{Na}^+$	48
$\text{K}^+$	14
$\text{Cl}^-$	39
$\text{Ca}^{+2}$	56
$\text{Mg}^{+2}$	12
$\text{HCO}_3^-$	237

Is the ion analysis complete?

- (A) yes
- (B) no, it is deficient in anions
- (C) no, it is deficient in cations
- (D) cannot be determined

**22.** A water sample has a total dissolved solids (TDS) concentration of 425 mg/L and a specific conductivity of 32  $\mu\text{S}$ . What materials likely comprise the majority of the TDS of the sample?

- (A) nonionic solids
- (B) ionic solids
- (C) approximately equal amounts of both ionic and nonionic solids
- (D) cannot be determined

**23.** A small community plans to discharge 0.25 MGD of wastewater for treatment using a single-stage trickling filter. The wastewater has a  $\text{BOD}_5$  concentration of 186 mg/L after primary treatment. A  $\text{BOD}_5$  concentration of 30 mg/L is required at the filter discharge. For a recirculation factor of 2, what is most nearly the total volume of filter media required?

- (A) 2300  $\text{ft}^3$
- (B) 17,000  $\text{ft}^3$
- (C) 70,000  $\text{ft}^3$
- (D) 125,000  $\text{ft}^3$

**24.** A wastewater treatment plant treats 2.5 millions of gallons per day (MGD) of wastewater containing 42 mg/L nitrate nitrogen and 13 mg/L nitrite nitrogen.

To further reduce the nitrogen concentrations through denitrification, the plant will use methanol in a tertiary treatment process. The specific gravity of methanol is 0.7915. Most nearly, what is the daily volume of methanol required if the initial dissolved oxygen concentration is 1.9 mg/L?

- (A) 110 L/d
- (B) 180 L/d
- (C) 930 L/d
- (D) 1490 L/d

**25.** The normal chemical composition of a dry gas is given in the following table.

component	concentration (%)
nitrogen	53
oxygen	31
methane	12
carbon dioxide	4

The atmospheric pressure is 0.98 atm. What is most nearly the partial pressure exerted by the methane?

- (A) 0.0817 atm
- (B) 0.118 atm
- (C) 0.770 atm
- (D) 0.860 atm

**26.** What is the difference between primary and secondary standards, as used with the National Ambient Air Quality Standards (NAAQS), and primary and secondary air pollutants?

- (A) Primary and secondary standards define the permissible levels of primary and secondary pollutants, respectively, that can exist in ambient air.
- (B) Primary and secondary standards are regulatory levels to protect human health and prevent environmental damage, respectively. Primary and secondary pollutants relate to the emitted form of the pollutants.
- (C) Primary and secondary standards refer to the level of treatment required by air pollution control equipment. Primary and secondary pollutants define the type of emissions from primary and secondary treatment equipment.
- (D) There is no difference. They refer to the same

This problem corresponds to PEENPX Practice Exam 1, problem number 7.

## Morning Session 1

1. The average annual wastewater flow for a combined commercial/residential development is  $9 \times 10^6$  gal/yr. The typical daily flow during the maximum month is 125% of the average daily flow during the year. What is most nearly the daily average wastewater flow?

- (A) 31,000 gal/day
- (B) 35,000 gal/day
- (C) 45,000 gal/day
- (D) 68,000 gal/day

2. What is most nearly the required storage volume for a runoff volume of 1.2 cm and a storage-to-runoff-volume ratio of 0.25?

- (A) 0.25 cm
- (B) 0.30 cm
- (C) 1.2 cm
- (D) 3.3 cm

3. Four parallel sedimentation basins are required to treat  $12,000 \text{ m}^3/\text{d}$ . What is most nearly the overflow rate for a settling zone depth of 2.5 m and a settling time of 100 min?

- (A)  $0.38 \text{ m}^3/\text{m}^2\cdot\text{h}$
- (B)  $0.75 \text{ m}^3/\text{m}^2\cdot\text{h}$
- (C)  $0.96 \text{ m}^3/\text{m}^2\cdot\text{h}$
- (D)  $1.5 \text{ m}^3/\text{m}^2\cdot\text{h}$

4. Two sedimentation basins have a total flow rate of  $7500 \text{ m}^3/\text{d}$  and a weir overflow rate of  $14 \text{ m}^3/\text{m}\cdot\text{h}$ . What is most nearly the weir length required for each of the two sedimentation basins?

- (A) 4.5 m/tank
- (B) 11 m/tank
- (C) 23 m/tank
- (D) 140 m/tank

5. The influent to a wastewater treatment pond contains  $200 \text{ mg/L}$  biochemical oxygen demand (BOD),

$15 \text{ mg/L}$  total Kjeldahl nitrogen (TKN) and  $4 \text{ mg/L}$  total phosphorus (TP). Carbon is represented by BOD, and the typical C:N:P ratio for bacterial cells is 60:12:1. What measures are justified for the pond?

- (A) augmentation of nitrogen
- (B) augmentation of phosphorous
- (C) provisions for removal of nitrogen and phosphorous
- (D) no special measures for removal or augmentation are justified

6. A river receiving a wastewater discharge has the following characteristics.

temperature	48°F
dissolved oxygen (DO) upstream of discharge point	8.9 mg/L
deoxygenation constant	0.16/d
recoxygenation constant	0.23/d

What is most nearly the critical time for a mixed flow ultimate biochemical oxygen demand ( $\text{BOD}_u$ ) at the discharge point of  $10 \text{ mg/L}$ ?

- (A) 1.7 d
- (B) 2.6 d
- (C) 3.4 d
- (D) 6.4 d

7. A public water supply is disinfected with chlorine to inactivate giardia cysts. The chlorine feed occurs as the water enters the wet well where it experiences a hydraulic residence time of 30 min. The free chlorine concentration is  $2.0 \text{ mg/L}$ . The water is at  $15^\circ\text{C}$  and has a pH of 7.5. What is most nearly the minimum hydraulic residence time that is required to achieve a 3-log reduction in giardia cysts?

- (A) 19 min
- (B) 35 min
- (C) 38 min
- (D) 69 min

**,0000151614**

1. A municipal project has an initial cost of \$2.3M and a 10-year term, financed at an annual interest rate of 1.5%. The project assets will have \$143,000 of salvage value at the end of the project term. The annual maintenance costs are shown.

year	1	2	3	4	5	6	7	8	9	10
cost	18	13	14	15	16	17	18	19	20	21
	(\$1-0 <sup>3</sup> )									

Most nearly, how much money should be borrowed to finance the project over its full term?

- (A) ~~\$2,600,000~~
- (B) ~~\$2,630,000~~
- (C) ~~\$2,670,000~~
- (D) ~~\$2,700,000~~

1. See *NCEES Handbook Economics*.  $A$  is the recurring annual cost. The trend in the table shows cost increasing by \$1000 each year, or \$13,000 by the second year. Therefore,  $A$  is \$12,000, and  $G$ , the uniform increase in the annual cost each year, is \$1000.

The first-year cost in excess of  $G$  is  $\$18,000 - \$1000 = \$17,000$ .

$$\begin{aligned}
 P &= A(P/A, 1.5\%, 10) + G(P/G, 1.5\%, 10) \\
 &\quad + \$17,000 + P - F(P/F, 1.5\%, 10) \\
 &= \$12,000(P/A, 1.5\%, 10) + \$1000(P/G, 1.5\%, 10) \\
 &\quad + \$17,000 + \$2,300,000 - \$143,000(P/F, 1.5\%, 10)
 \end{aligned}$$

From interest tables,

$$\begin{aligned}
 (P/A, 1.5\%, 10) &= 9.2222 \\
 (P/G, 1.5\%, 10) &= 40.3675 \\
 (P/F, 1.5\%, 10) &= 0.8617
 \end{aligned}$$

Calculate the amount needed to finance the project.

$$\begin{aligned}
 P &= \$12,000(P/A, 1.5\%, 10) + \$1000(P/G, 1.5\%, 10) \\
 &\quad + \$17,000 + \$2,300,000 - \$143,000(P/F, 1.5\%, 10) \\
 &= (\$12,000)(9.2222) + (\$1000)(40.3675) \\
 &\quad + \$17,000 + \$2,300,000 - (\$143,000)(0.8617) \\
 &= \$2,344,810.80
 \end{aligned}$$

**The answer is (D).**

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This problem corresponds to PEENPX Practice Exam 1, problem number 79.

[Return to Questions \(/admin/questions/0?sfield=magento\\_id&stext=0000151614&sdka=&stype=&sdiff=\)](/admin/questions/0?sfield=magento_id&stext=0000151614&sdka=&stype=&sdiff=)

# Test Bank

## Question preview

### Question

A municipal project has an initial cost of \$2.3M and a 10-year term, financed at an annual interest rate of 1.5%. The project assets will have \$143,000 of salvage value at the end of the project term. The annual maintenance costs are shown.

year	1	2	3	4	5	6	7	8	9	10
cost (\$10 <sup>3</sup> )	18	13	14	15	16	17	18	19	20	21

Most nearly, how much money should be borrowed to finance the project over its full term?

### Answers

- (A) \$2,200,000
- (B) \$2,245,000
- (C) \$2,300,000
- (D) \$2,345,000

The answer is (D).

### Solution

See *NCEES Handbook Economics*.  $A$  is the recurring annual cost. The trend in the table shows cost increasing by \$1000 each year, or \$13,000 by the second year. Therefore,  $A$  is \$12,000, and  $G$ , the uniform increase in the annual cost each year, is \$1000.

The first-year cost in excess of  $G$  is  $\$18,000 - \$1000 = \$17,000$ .

$$\begin{aligned}
 P &= A (P/A, 1.5\%, 10) + G (P/G, 1.5\%, 10) \\
 &\quad + \$17,000 + P - F (P/F, 1.5\%, 10) \\
 &= \$12,000 (P/A, 1.5\%, 10) + \$1000 (P/G, 1.5\%, 10) \\
 &\quad + \$17,000 + \$2,300,000 - \$143,000 (P/F, 1.5\%, 10)
 \end{aligned}$$

From interest tables,

$$\begin{aligned}
 (P/A, 1.5\%, 10) &= 9.2222 \\
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 \end{aligned}$$

### QUESTION DATA

#### Vendor

0000151614

#### Solving Time

#### Difficulty

easy

#### Quantitative?

No

#### Status

Active

#### Created On

04/20/2020 11:58:41 PM

#### Published On

04/20/2020 11:58:41 PM

#### Modified On

04/21/2020 05:35:55 PM

#### OTHER VERSIONS

#### DISCIPLINES

#### KNOWLEDGE AREAS

#### PRODUCTS USED IN

Calculate the amount needed to finance the project.

$$\begin{aligned} P &= \$12,000 (P/A, 1.5\%, 10) + \$1000 (P/G, 1.5\%, 10) \\ &\quad + \cancel{\$17,000} + \$2,300,000 - \$143,000 (P/F, 1.5\%, 10) \\ &= (\$12,000) (9.2222) + (\$1000) (40.3675) \\ &\quad + \cancel{\$17,000} + \$2,300,000 - (\$143,000) (0.8617) \\ &= \cancel{\$2,344,810.80} \end{aligned}$$