

# CH402 Chemical Engineering Process Design

Class Notes L20

Bonds

## **A bond is essentially an IOU**

A bond is a long-term note issued by a corporation or government body for the purpose of financing major projects.

The borrower receives the money now and pays it back later.

In return, the borrower promises to pay back the money, with regular interest payments paid in between.

The conditions for repayment are specified at the time the bond is issued.

These conditions include the bond face value, bond interest rate (also called the “coupon”), and bond maturity date.

## Important terms

The bond face value (FV) refers to the denomination of the bond, normally \$1,000.

The face value is important for two reasons: (1) it represents the lump sum amount the holder will receive on the bond maturity date, and (2) it is used in conjunction with the bond interest rate and bond interest payment period to determine the interest per period the bond holder will receive prior to maturity.

This interest received per period by the bond holder is calculated according to the following equation:

$$I = \frac{FV \cdot b}{n}$$

FV = face value of the bond  
 b = bond interest rate (also known as coupon)  
 n = number of interest payments per year  
 I = amount of interest paid each period in dollars

The present worth of a bond can be determined by the following general equation:

$$PW_{\text{bond}} = I \cdot (P / A, i, n) + FV \cdot (P / F, i, n) \quad \text{where} \quad i = \frac{b}{n}$$

Definition: The interest is referred to as the “coupon.”

## Example

A municipal bond with a face value of \$10,000 will mature 15 years from now. The bond interest rate is 6% per year, payable quarterly. If the market interest rate is 16% per year compounded quarterly, the present worth of the bond is closest to:

- (a) \$4,173
- (b) \$4,345
- (c) \$5,277
- (d) \$6,135

**Solution:** The first step is to calculate the bond interest paid per quarter. Then, use this interest as an A value and the single amount face value to determine the present worth at the market interest rate. The quarterly market interest rate is  $16\%/4 = 4\%$  for  $15(4) = 60$  quarters.

$$I = \frac{FV \cdot b}{n} = \frac{10,000 \cdot 0.06}{4} = \$150$$

$$\begin{aligned} PW_{\text{bond}} &= I \cdot (P / A, i, n) + FV \cdot (P / F, i, n) \\ &= 150 \cdot (P / A, 4\%, 60) + 10,000 \cdot (P / F, 4\%, 60) \\ &= 150 \cdot 22.6235 + 10,000 \cdot 0.0951 \\ &= \$4,344.53 \quad \text{(b)//ANS} \end{aligned}$$

See review problems 11-18 for additional practice with bonds.

# Questions?