Level II Study Handbook Sample

The UpperMark *Study Handbooks* for Level II comprise 2 volumes, each covering about 6 Topics from the CAIA curriculum. This is a sample of one of the Topic chapters. You will notice the material is very comprehensive, yet focused. It is clearly presented.

> Keywords and learning objective statements are in ***bold italics*** so they stand out.

> Formulas are explained and examples given for any calculation problem.

> Keystrokes for both financial calculators approved for use during the CAIA exam are also provided whenever used.

> Each Topic chapter ends with a set of sample test questions, with detailed answers. In Level II, these include short answer questions to prepare you for essays given on the exam.

> Each volume includes practice essays and the sample essays given by the CAIA Association.

After studying the material in the *Study Handbooks*, we recommend candidates practice further using our *TestBank* software, which currently has about 1,000 exam questions. We add new questions during the exam season.

> *TestBank* enables clients to generate their own customized exams and the software application also creates Mock Exams that simulate the CAIA exams.

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> Please take a moment to check out the demo of *TestBank* on our website at www.uppermark.com/samplesAndDemos.php.

Headers reference the Topic number and name for easy navigation through chapters.

Each Topic in the curriculum is presented as a separate chapter.

Topic 3

Selected Hedge Fund Strategy – Convertible Arbitrage

The main points from the CAIA Study Guide are presented for each Topic.

Main Points

Basics of convertible arbitrage, types of convertible securities, valuation models, the key components of a successful convertible arbitrage strategy, credit analysis and asset value credit evaluation, and building a trading strategy using hedging techniques and risk management.

Convertible arbitrage is one of the most common hedge fund strategies. These strategies attempt to exploit anomalies in the prices of corporate instruments that are convertible into common stock, such as convertible bonds. Convertible arbitrageurs typically purchase convertible securities and then short the underlying stock to hedge the associated equity risk. In general, the performance of the position is equity-like if the corporate issuer performs well and is distressed debt-like if the issuer's performance is poor. Convertible arbitrage is considered one of the most profitable hedge fund strategies, yielding high risk-adjusted long-term returns.

L.O. 1. Discuss the evolution of the convertible arbitrage strategy.

Learning Objective statements are clearly set off from text in easy-to-locate grey boxes.

The ***convertible arbitrage strategy*** has been in existence for more than a century, with the first convertible security appearing in the 1800s. The typical convertible arbitrage strategy involves the purchase of convertible securities and the simultaneous short sale of the common stock of the company that issued the securities. The strategy attempts to profit from relative mispricings between the convertible security and the stock.

Convertible securities include convertible bonds that promise to pay interest income, repay the principal at maturity, and have the additional ….

L.O. 4. List and explain the basic characteristics of convertible securities and the risks of the convertible arbitrage strategy.

Convertible securities are bonds with embedded call options on the underlying stock. Therefore, convertible securities exhibit features of both bonds and options, and have an asymmetrical risk and return profile.

- The embedded option is represented by the conversion feature that gives the holder the right to exchange the bond for a specified number of shares of the issuer's stock, called the *conversion ratio*. Thus, the convertible bond may be viewed as a straight bond combined with a warrant. The conversion ratio is equal to the par value of the bond divided by the conversion price.

$$\text{Conversion Ratio} = \frac{\text{Par Value of Bond}}{\text{Conversion Price}}$$

Suppose *XYZ* Corp. issues a convertible bond with a conversion price of $26. The conversion ratio is then $\frac{\text{Par Value}}{\text{Conversion Price}} = \frac{\$1000}{\$26} = 38.46$ shares. So, each bond is convertible into 38.46 shares of stock.

- The *conversion price* is the effective price at which the shares are acquired and is equal to the par value of the bond divided by the conversion ratio.

$$\text{Conversion Price} = \frac{\text{Par Value of Bond}}{\text{Conversion Ratio}}$[1]$$

- The investment value of the convertible security represents the fair value of a straight bond with similar features but without the conversion option. Convertible bonds typically pay coupon interest biannually and repay principal at maturity. Therefore, the investment value of the convertible is equal to the present value of all bond cash flows including interest and principal:

$$\text{Investment Value of Convertible} = \sum_{t=1}^{n} \frac{\text{Coupon}}{(1+k)^t} + \frac{\text{Par}}{(1+k)^n},$$

is the credit-adjusted discount rate and n is the number of coupon payments until . The investment value of the convertible, like other fixed-income securities, fluctuates with interest rates and the credit quality of the issue. As maturity approaches, the investment value converges to par value.

- The conversion value of the convertible security is the total value of the shares into which it can be converted. It is given by the product of the current stock price and the conversion ratio. This value is also referred to as the ***parity*** value and varies with the price of the underlying stock.

$$\text{Conversion Value (Parity)} = \text{Stock Price} \times \text{Conversion Ratio}$$

Suppose *XYZ* Corp.'s stock is currently selling for $22 per share. Then the conversion/parity value is $22 × 38.46 shares = $846.12.

Formulas are clearly explained and the variables defined.

Footnotes offer further clarification.

[1] **Note**: This is in effect the same relationship/formula as the one above it for conversion ratio. Notice that you can "cross-multiply" the formula for the conversion ratio to get the formula for the conversion price.

- Graphically, the conversion value is a 45 degree straight line, starting from the origin of a coordinate system, where the stock price is on the horizontal axis and conversion price is on [illegible] investment value is a straight horizontal line on this graph. Together, the [illegible] the conversion value represent lower boundaries for the convertible [illegible] convertibles generally trade at a premium over their investment and [illegible] These are depicted in Figure 1. A convertible value below this lower [illegible] theory, generate arbitrage opportunities.

Clearly presented figures help illustrate complex concepts.

The figures are discussed in the text for complete comprehension.

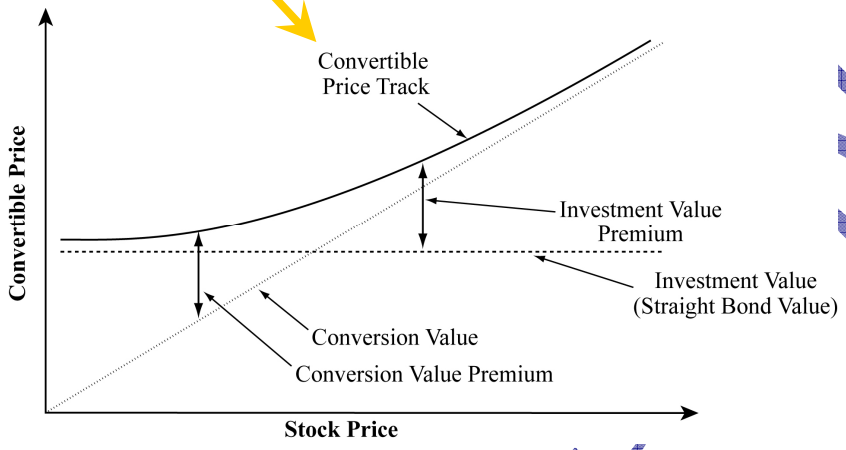


Figure 1

- The convertible price is typically above the lower boundary. The investment value premium is the percentage amount by which the convertible price exceeds the investment value, that is, the value of its fixed-income component.

$$\text{Investment Value Premium} = \frac{\text{Convertible Price} - \text{Investment Value}}{\text{Investment Value}}$$

The higher the investment value premium, the more sensitive the convertible is to the equity price. For investment premiums closer to zero, the convertible performs more like its fixed income component.

- The conversion value premium is the percentage amount by which the convertible price exceeds the conversion value (parity), that is, the value of its equity component.

Conversion Value Pren[illegible]ersion Value
[illegible]ue

Examples are provided for all Learning Objectives that involve a calculation.

The higher the conversion premium, the lower the equity sensitivity. As stock prices increase and the conversion premium gets closer to zero, the convertible performs more like its underlying stock.

Example

Suppose the convertible bond issued by *XYZ* Corp. has a maturity of 6 years, an annual coupon rate of 5%, and a yield to maturity of 7.4%. If the current market price of the convertible issue is $1,060, what is the issue's investment value premium and conversion value premium?

The conversion value was found on the previous page to be $846.12. So the conversion value premium is:

$$\frac{\text{Convertible Price} - \text{Conversion Value}}{\text{Conversion Value}} = \frac{\$1{,}060 - \$846.12}{\$846.12} = 25.28\%.$$

$$\text{Investment Value Premium} = \frac{\text{Convertible Price} - \text{Investment Value}}{\text{Investment Value}} = \frac{\$1{,}060 - \text{Investment Value}}{\text{Investment Value}}.$$

Each example provides detailed solutions.

d the bond's investment value, we can use the formula for the present value of the cash flows. However, it is easier to use a financial calculator. The keystrokes are provided below; **PV** denotes the *present value* of the bond.

TI BAII Plus:	**6**	**N**	**7.4**	**I/Y**	**50**	**PMT**	**1,000**	**FV**	**CPT**	**PV** => **PV = -887.00**
HP-12C:	**6**	**n**	**7.4**	**i**	**50**	**PMT**	**1,000**	**FV**	**PV**	=> **PV = -887.00**

So, the investment value of the bond is $887, and the investment value premium is:

$$\frac{\text{Convertible Price} - \text{Investment Value}}{\text{Investment Value}} = \frac{\$1{,}060 - \$887}{\$887} = 19.5\%.$$

Calculator keystrokes are provided for calculation problems.

Keystrokes are specific to the two calculators permitted by the CAIA Association: the TI BAII Plus and the HP-12C.

These are provided so you do not have to take time to work through your calculator manual!

rtible bonds is generally larger than the dividend paid on the underlying ld take for the income differential, that is, the added return on the bonds, ion premium paid when the bond was purchased is referred to as the payback period.

ge strategy, while a low-volatility strategy, has exposure to a multitude derstanding and management of these risk exposures are crucial to the the strategy. The main types of ***risks pertaining to the convertible*** marized below.

to exposure to the volatility of the general equity market. Convertible arbitrage managers are exposed to this risk as a result of the short hedge position taken in the common stock of the convertible issuer. When the convertible hedge is properly established, the overall equity market risk exposure can be very small or zero, resulting in a market neutral position.

2. Interest rate risk

- This refers to the effects of changes in interest rates on the value of a convertible arbitrage position. As with all fixed income instruments, the price of the convertible security is inversely related to the level of interest rates. However, the degree of sensitivity of the convertible security depends on how closely it trades to its investment value, that is, to the fixed income value of the security.
  - > When the value of the embedded option is low and the convertible price is close to its straight bond price, the convertible price is more sensitive to interest rates.

When the option is a larger fraction of the total convertible value, interest rate risk is lower because the option's value moves in the same direction as interest rates, reducing the overall effect on the convertible position. In addition, the short stock position may ….

where *Nu* and *Nd* are the conversion probabilities from the previous up node and down node, respectively, and *p* is the ***up transition probability*** defined as:

$$p = \frac{e^{r\Delta t} - d}{u - d},$$

where u and d were defined in L.O. 10 as $u = e^{\sigma\sqrt{\Delta t}}$ and $d = 1/u$. The up transition probability represents the probability that the stock price increases. The *down transition probability* is given by:

$$1 - p.$$

Starting at maturity and moving backwards through the tree, the conversion probability values are calculated for each time period until the current time period is reached. These values are then [illegible]ate the discount rate for each node (as discussed in L.O.12).

Keywords and significant terms are indicated in *bold italics*.

L.O. 12. Describe the basic steps for constructing the parity tree and convertible pricing tree using the credit discount rate.

Parity Tree

As discussed in L.O. 4, the ***parity*** value of a convertible security is another term for its conversion value, that is, the total value of shares into which the security can be converted. So parity is the product of the convertible's conversion ratio and its current underlying stock price.

- The convertible's parity value at maturity is used to calculate its price using binomial pricing.
- The ***parity tree*** (also referred to as the ***convertible parity lattice tree***) is constructed by taking the binomial stock price tree and multiplying each price in the tree by the convertible's conversion ratio. This parity tree is used to calculate the delta and gamma of the convertible security. The process is described in L.O.13.

Convertible Pricing Tree

To construct the ***convertible pricing tree***, the appropriate discount rate needs to be found. This discount rate, referred to as the ***credit discount rate***, is calculated using the conversion probability values (discussed in L.O.11). The result is a binomial tree of credit discount rates, each of which depends on the likelihood of convergence to equity, which in turn depends on the stock price.

- When stock prices are high, the convertible is deep in-the-money, and the conversion probability is equal to 1, the discount rate should be the risk-free rate. The reason for this is that the investor will convert to equity without any risk of default.
- When stock prices are low, the convertible is deep out-of-the-money and convergence to debt value is likely, the discount rate should incorporate the appropriate credit spread above the risk-free rate.
- The credit discount rate, denoted by r_{credit}, is computed as:

$$r_{credit} = \left[q \times (1+r) + (1-q) \times (1+k)\right] - 1, \ldots.$$

L.O. 5. Calculate the risk-reward ratio.

The risk-reward ratio of investing in a convertible security can be determined using scenario analysis. First, the value of a convertible security and its total return are determined given an up move in the underlying stock price. Then, the same is done for a downward move in the stock price. When the change in the underlying stock price is the same in each direction, the ***risk-reward***

"Note" sections provide valuable insight and guidance.

$$\text{Risk-reward ratio} = \frac{\text{Total \%age Increase in Convertible}}{\left|\text{Total \%age Decrease in Convertible}\right|}$$

$$= \frac{\text{\%age Increase in Convertible + Coupon Rate}}{\left|\text{\%age Decrease in Convertible + Coupon Rate}\right|}.$$

Notice that the total percentage change in the convertible's value includes the coupon rate.

Note: If the sizes of the increase and decrease in stock price are not the same, the risk-reward ratio can be determined as:

$$\text{Risk-reward ratio} = \frac{\dfrac{\text{Total \%age Increase in Convertible}}{\text{\%age Increase in Stock}}}{\dfrac{\text{Total \%age Decrease in Convertible}}{\text{\%age Decrease in Stock}}}.$$

The convexity of the convertible with respect to moves in the stock price makes it a very attractive hedging vehicle. This convexity is the *gamma* of the convertible and reflects the fact that the convertible bond increases in value as the underlying stocks increase in value and does not decrease as much when stock prices decrease because of the convertible bond's investment value.[2] For instance, a convertible may increase 60% as much as the stock price when stock prices increase but only decrease 10% as much as the stock price when stock prices decrease. The risk-reward ratio in this case would be 6 to 1.

Example

A convertible may rise in price 15% for a 25% increase in stock price and fall 10% for a 25% decrease in stock price. With a 5% coupon income, what is the risk-reward ratio?

$$\text{Risk-reward ratio} = \frac{\text{Total \%age Increase in Convertible}}{\left|\text{Total \%age Decrease in Convertible}\right|}$$

$$= \frac{\text{\%age Increase in Convertible + Coupon Rate}}{\left|\text{\%age Decrease in Convertible + Coupon Rate}\right|} = \frac{15\% + 5\%}{\left|-10\% + 5\%\right|} = \frac{20\%}{5\%} = \frac{4}{1}.$$

So, with a 5% coupon income, the total payoffs are 20% and ratio of 4 to 1….

Information in the text is connected to facilitate learning.

[2] Gamma is discussed further in L.O. 15.

Keywords & Learning Objectives

Keywords

144A {p. 273}
Arbitrage {p. 2}
Asset swap {p. 172}
Beta {p. 7}
Binomial option model {p. 35}
Black-Scholes Option Pricing Model (BSOPM) {p. 18}
Bleed {p. 274}
Break-even time {p. 274}
Busted convert {p. 23}
Chi {p. 64}
Convertible asset swap {p. 173}
Credit default swap {p. 179}
Credit discount rate {p. 40}
Debt exchangeable for common stock (DECS) {p. 28}
Delta {p. 43}
Downside gamma {p. 52}
Gamma {p. 44}
Haircut {p. 131}
Liquid Yield Option Note (LYON) {p. 209}
Mandatory convertibles {p. 28}
Monthly income preferred securities (MIPS) {p. 27}
Omicron {p. 65}
Parity {p. 43}
Preferred Equity Red {p. 28}
Phi {p. 69}
Preferred Redeemable Increased Dividend Equity Security (PRIDES) {p. 28}
Rho {p. 59}
TECONS {p. 27}
Theta {p. 57}
Transition multiplier {p. 37}
Transition probability {p. 37}
Upside gamma {p. 52}
Upsilon {p. 67}
Vega {p. 55}
Zero coupon convertibles {p. 27}

Each chapter ends with the keywords and Learning Objectives from the CAIA Study Guide.

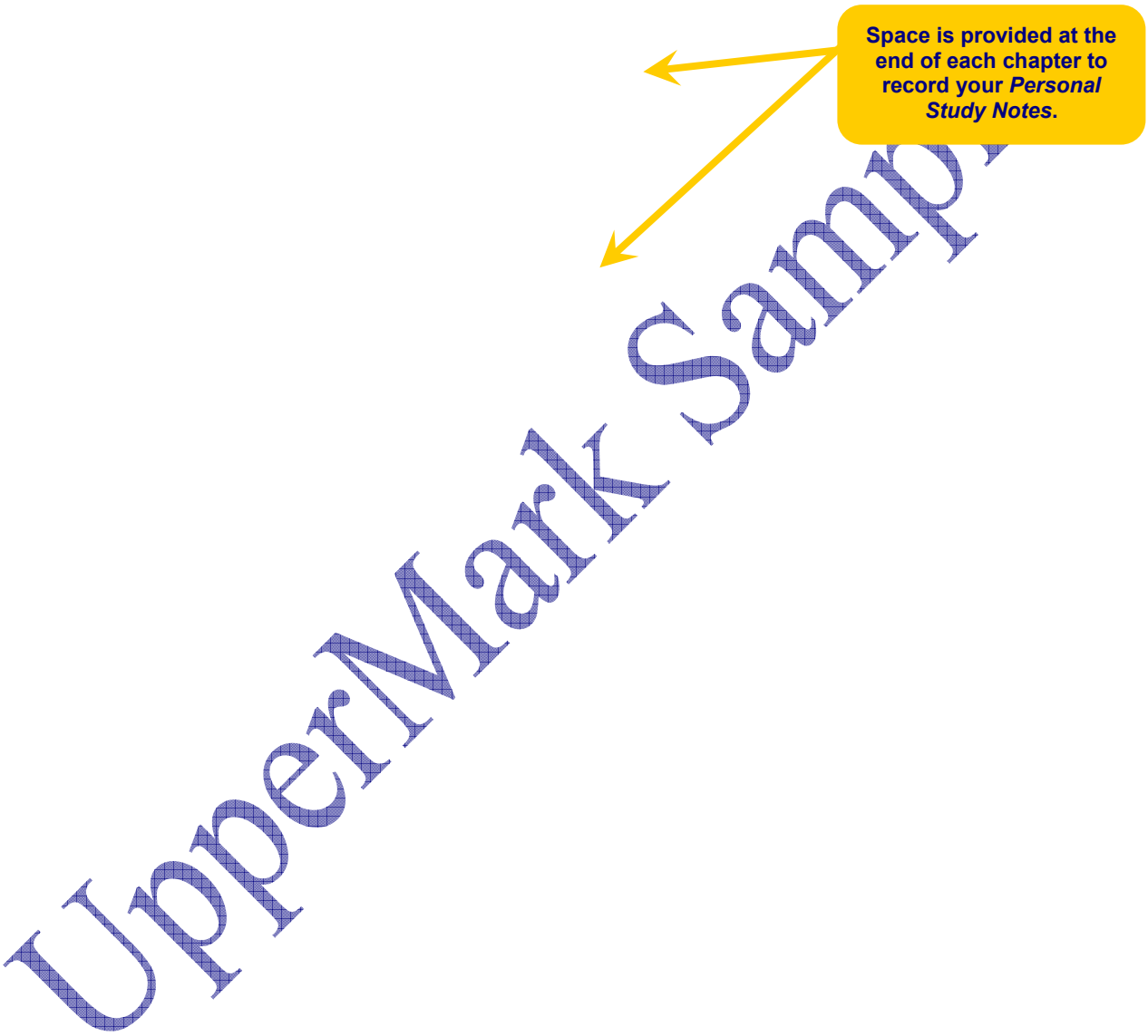
Learning Objectives

The candidate should be able to:

1. Discuss the evolution of the convertible arbitrage strategy. *{p. 1-6}*
2. Explain the rationale behind hedging with convertibles. *{p. 6-7}*
3. Discuss the historical performance of the convertible arbitrage strategy. *{p. 7-12}*
4. List and explain the basic characteristics of convertible securities and the risks of the convertible arbitrage strategy. *{p. 12-8}*
5. Calculate the risk-reward ratio. *{p. 18}*
6. Discuss methods of valuation for convertible securities, calculate the value of a convertible using the stock-plus method, and understand the components of the convertible profile graph. *{p. 18-23}*
7. List and explain the various convertible characteristics sought by arbitrageurs. *{p. 23-25}*
8. List and explain the various convertible structures. *{p. 26-33}*
9. Explain why convertible valuation models are important. *{p. 34}*
10. Construct a two-period binomial stock price tree given a stock's current price, volatility, and the risk-free interest rate. *{p. 34-8}*
11. Describe the basic steps for constructing a conversion probability tree using the conv formula. *{p. 38-9}*
12. Describe the basic steps for constructing the parity tree and convertible pricing tree us discount rate. *{p. 40-3}*
13. Explain how convertible deltas and gammas can be determined using a conversion parity lattice tree. *{p. 43-4}*
14. List and explain non-quantitative factors impacting convertible valuation. *{p. 45-7}*
15. Understand the significance of the basic Greeks (delta, modified delta, gamma, vega, theta, and rho) for convertible arbitrage strategies. *{p. 48-60}*
16. Explain the significance of chi, omicron, upsilon, and phi. *{p. 64-70}*

Page numbers to the original text are provided for easy reference.

Topic 3 – Personal Study Notes



Topic 3 – Practice Test Questions

9. A busted convertible can be hedged with a synthetic bond created by:

   A. writing a call and buying an out-of-the-money call.
   B. writing a call and buying an out-of-the-money put.
   C. writing a put and buying an out-of-the-money call.
   D. writing a put and an out-of-the-money call.

Practice test questions are provided at the end of each chapter.

10. The main purpose of a convertible asset swap is to:

   A. eliminate exposure to the underlying stock.
   B. extract an underlying option component.
   C. increase position liquidity.
   D. transfer credit risk.

11. If an arbitrageur identifies a distressed firm that he expects to go into bankruptcy, a hedge opportunity will most likely exist if the firm's busted convertibles trade at delta values:

   A. that are positive.
   B. near or above zero.
   C. between zero and one.
   D. near or above one.

The *Study Handbooks* have over 320 practice test questions.

Also, use our *TestBank* software's exclusive feature to include all of these questions in your *TestBank* database.

Short Answer Questions

12. Lindsey Raven has been assigned the task of valuing a convertible bond using a two-period binomial tree.

   a. Describe how the conversion probability tree associated with the convertible bond should be constructed.

   b. Explain where the conversion probabilities are used.

Short answer questions help you prepare for the essays given on the exam.

The answer key provides both the correct answer and the Learning Objective addressed.

This is important so that you can know what material to review if you need further practice.

Topic 3 – Answers & Explan

Question Number	Answer	Learning Objective	Explanation
9.	A	28c	A busted convertible can be hedged with a synthetic bond by writing a call and buying an out-of-the-money call for protection. The purpose of the strategy is to add income to the busted convertible.
10.	B	29	Convertible asset swaps are a vehicle for synthetically extracting the option component of a convertible issue while transferring the fixed-income component to another party.
		36	When a distressed firm is expected to default, if delta values are near or above one, there exists a hedge opportunity in the firm's distressed convertibles that trade in the distressed zone of the convertible profile graph where gamma is negative. Other favorable traits include indications of high probability of bankruptcy; plenty of stock to short and available listed options; and a positive bankruptcy recovery rate for the bondholder.

Detailed explanations are provided for each practice test question.

Where appropriate, calculator keystrokes are also provided.

Short Answer Questions

Question Number	Learning Objective	Answer
12a.	11	The conversion probability tree gives the various probabilities that the convertible bond will be converted to stock at different time periods. The tree is constructed by starting with the nodes at maturity and then working backwards toward the current time period. At each node at maturity - • the conversion probability = 1, if conversion to equity is optimal (that is, conversion value is > par value plus coupon); and • the conversion probability = 0, if conversion to equity is not optimal (that is, conversion value ≤ par value plus coupon). Once the conversion probabilities at maturity are found, those at the nodes prior to maturity are found using the formula: Conv. Prob. $= p \times Nu + (1-p) \times Nd$, where $p = \frac{\left(e^{r\Delta t} - d\right)}{\left(u - d\right)}$ is the transition probability and *Nu* & *Nd* are conversion probabilities from the previous up & down nodes, respectively (that is, the nodes at later time periods – since remember we start at maturity and work backwards through the tree).
12b.	12	The conversion probabilities are used to find the discount rates (referred to as the credit discount rates) used to calculate the value of the convertible bond. Each node of the binomial tree has a credit discount rate associated with it and it is calculated using the formula below. $r_{credit} = \left[q \times (1+r) + (1-q) \times (1+k)\right] - 1$ In this formula, *q* is the conversion probability, *r* is the risk-free rate, *k* is the credit spread adjusted discount rate.

Sample Essays are given at the end of both Level II *Study Handbooks*.

Sample Essay Questions

Essay 1

Abbas Naser is a convertible bond arbitrage trader, who has been asked by a colleague to address a seminar of junior analysts on the topic of convertible bonds. After the seminar, members of the audience ask Mr. Naser questions, a sample of which is listed below.

Provide answers that would be most appropriate for the questions.

A. Would you explain why convertible arbitrage managers can be exposed to equity market risk, and what they could do to establish a risk-neutral position?

(2 points)

B. Suppose there is an 8.2% convertible bond priced at $1,180 and a 7.7% convertible bond priced at $989. Would you explain which of these securities has a value closest to parity?

(2 points)

C. To use the binomial pricing model to value a convertible security, you need to construct a binomial stock price tree. What would be the two stock prices at the first period of a two-period tree for a stock that is priced at $87.50 and has an annual volatility is 14%, assuming intervals of three months?

(2 points)

Guideline Answer for Sample Essay Question 1
Selected Hedge Fund Strategy – Convertible Arbitrage (Topic 3)

Calamos, Nick. Convertible Arbitrage: Insights and Techniques for Successful Hedging.

Purpose: To test candidates' understanding of the basic characteristics of a convertible security, how to hedge its underlying equity risk, and how to set up a two-period stock price tree to use for valuation.

Keywords: Delta, parity, and transition multiplier.

Learning Objectives:

4. List and explain the basic characteristics of convertible securities and the risks of the convertible arbitrage strategy. *{p. 12-8}*
6. Discuss methods of valuation for convertible securities, calculate the value of a convertible using the stock-plus method, and understand the components of the graph. *{p. 18-23}*
10. Construct a two-period binomial stock price tree given a stock's curr and the risk-free interest rate. *{p. 34-8}*

Guideline Answers are detailed, listing the Topic(s) covered and specific keywords and L.O.s referenced.

Abbas Naser is a convertible bond arbitrage trader, who has been asked by a colleague to address a seminar of junior analysts on the topic of convertible bonds. After the seminar, members of the audience ask Mr. Naser questions, a sample of which is listed below.

Provide answers that would be most appropriate for the questions.

A. Would you explain why convertible arbitrageurs are exposed to equity market risk, and what they could do to establish an equity risk-neutral position? **(2 points)**

A convertible bond is a straight bond with an embedded equity call option. The holder of the bond owns fixed income securities that can be converted into a number of the bond issuer's shares. It is the shares underlying the convertible that expose the position to equity market (or beta) risk.

To hedge this risk, arbitrageurs short the underlying stock against the long convertible position. To establish a neutral position, the arbitrageur would need to sell 'delta' shares of stock. Delta provides a measure of the convertible's sensitivity to small changes in stock price.

B. Suppose there is an 8.2% convertible bond priced at $1,180 and a 7.7% convertible bond priced at $989. Would you explain which of these securities has a value closest to parity? **(2 points)**

Parity represents the value investors receive when they convert the bond into shares. It is also referred to as the conversion value and represents a lower boundary for the price of the convertible. As share price increases, so too does the value of the convertible. For a very high stock price, the convertible is considered in-the-money and trades with a very high degree of equity sensitivity and little or no fixed-income sensitivity. Out-the-money convertibles ….

Each *Study Handbook* has a comprehensive index of key terms.

Index

The index can be used as an extra study tool to test your knowledge of key terms.