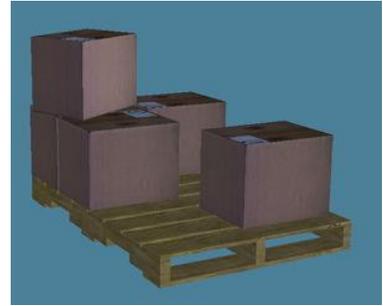# TDL Math:

Warehouse Packing & Loading Calculations

Industry: Transportation, Distribution, & Logistics (TDL)

Content Area: Mathematics

Core Topics: Using formulas, converting measurements, performing operations with decimals and percents, solving multi-step word problems

Objective: Students will be able to calculate area and volume, convert inches and feet, and compute percentages in order to accurately solve problems involving packing pallets and loading trucks.

Materials included:
Instructor's notes
Scenario: Warehouse Packing & Loading
Student worksheets
Quiz
Answer Keys

Industry Overview:
According to the U.S. Department of Labor, employment in the transportation and material movers industry is expected to grow approximately 8.6% between 2012 and 2022.[*] The transportation, distribution, and logistics (TDL) industry is comprised of a vast array of jobs, ranging from dock workers and delivery drivers to warehouse managers and logisticians. Mathematics and literacy skills are essential for students who plan to pursue a career in this field. TDL employees, including warehouse and distribution workers, must have the ability to use formulas and perform accurate mathematical calculations in their daily work.

[*] Source: http://www.bls.gov/emp/ep_table_101.htm Employment Projections program, U.S. Department of Labor, U.S. Bureau of Labor Statistics

Instructor's notes:

- The purpose of this module is to help students develop and apply math skills in a TDL workplace setting. The learning activities were designed to be incorporated throughout multiple instructional periods as math concepts are taught in a TDL context.

- After completing the module, students should be able to:
    - Use the area formula and weight information to calculate pallet load capacity
    - Use the volume formula to calculate the volume of loaded pallets and trucks
    - Solve multi-step pallet and truck loading problems

- **Setting the stage:** Provide students with background information about the typical responsibilities of warehouse and distribution center employees. You may want to have students use the occupational outlook handbook, O*NET and/or other relevant websites to research the job responsibilities, educational/training requirements, salary, etc. for TDL positions that interest them. In addition, you could have students view videos depicting typical warehouse and distribution center operations. (See links below)

    Bureau of Labor Statistics – Occupational Outlook Handbook:
    http://www.bls.gov/ooh/

    Occupational Information Network (O*NET)
    http://www.onetonline.org/link/summary/43-5071.00
    http://www.onetonline.org/link/summary/11-3071.02

    Virtual Warehouse tours:
    https://www.youtube.com/watch?v=QTrzEZJEX0c
    https://www.youtube.com/watch?v=b_893POZT44

- **For Activity 1:** Explain the formula to find the area of a rectangle. Work the scenario example problems with the class. Have students work the practice problems independently. Provide additional practice as needed. Have students complete **Worksheet 1**.

- **For Activity 2:** Explain the steps to solving multi-step weight problems. Work the scenario example problems with the class. Have students complete the practice problems independently. Provide additional practice as needed. Have students complete **Worksheet 2**.

- **For Activity 3:** Explain and review converting inches into feet and using the formula to find the volume of a rectangular prism. Work the scenario example problems with the class. Have students complete the practice problems independently. Provide additional practice as needed. Have students complete **Worksheet 3**.

- **Assessment: Quiz – Warehouse packing and loading calculations**

Workplace Scenario:

You are a supervisor at *BSP* Warehouse & Distribution, Inc. Your company provides storage and shipping services for several vendors throughout the Midwest. One of your primary responsibilities is to train and supervise warehouse employees. This week you are training Julie, a new employee, on the packing and loading procedures for outbound shipments. You tell Julie that when customer orders are received, warehouse pickers use forklifts, hand trucks, and wheeled bins to retrieve the products from warehouse racks. The products are then brought to the packing zone of the warehouse to be scanned and packed on pallets. Cases are stacked on pallets in a variety of patterns, depending on the size and weight of the cartons and other product requirements.

Activity 1: Packing Pallets – Calculating Area

Each time you receive a packing order, you use the weight and dimensions of the cartons and the other information listed on the ticket to help you determine the appropriate number of cases to safely stack on a pallet. Most of your orders are packed on standard 48" x 40" pallets. However, some orders may require smaller size pallets.

First, calculate the surface area of the cases and the surface area of the pallets in order to determine the number of cases that will fit on one layer of a pallet. Next, check the packing ticket to see how many cases high the product can be stacked. This information is important because stacking cases higher than the maximum allowed can result in damage to the products, or exceed the truck height limit.

The formula to calculate the area of a rectangle: **Area = Length x Width**

Example 1: Calculate the area for the following cases.

18" L x 10" W x 8" H　　→　　**A = L x W**　　→　　18 x 10 = <u>180 square inches or 180 in^2</u>

12" L x 8.5" W x 14" H　　→　　**A = L x W**　　→　　12 x 8.5 = <u>102 square inches or 102 in^2</u>

Note: Area is always written in square units

Practice 1: Calculate the area for the following cases.

14" L x 6" W x 15" H

20" L x 13.5" W x 12" H

15.5" L x 14" W x 10" H

Activity 1: Packing Pallets – Calculating Area Continued

Example 2: You receive a packing order for 120 cases of item #101. The dimensions of one case are 14" L x 13" W x 12" H. The maximum stacking height for this product is 4 cases.

   a. What is the total number of cases you can fit on one layer of a 48" x 40" pallet?
      Calculate the area of the pallet: 48 x 40 = 1920 square inches.

      Calculate the area of one case: 14 x 13 = 182 square inches.

      Divide the area of the pallet by the area of the case: 1920 ÷ 182 = 10.5; thus, <u>10 cases</u> will fit on one layer of the pallet. (**Note**: you will always <u>round down</u>, if necessary).

   b. If you put 10 cases on the first layer of the pallet, and you stack the cases 4 high, how many cases will you pack on one pallet?
      Multiply the number of cases in one layer by the number of layers: 10 x 4 = <u>40 cases</u>. .

   c. How many pallets will you need for this order?

      Divide the total number of cases ordered by the number of cases you can stack on one pallet.

      120 ÷ 40 = <u>3 pallets</u> will be needed for this order.

Practice 2: You receive a packing order for 280 cases of item #102. The case dimensions for this item are 13" L x 10.5" W x 15" H. The maximum pallet height for the truck delivering this order is 6.5 feet.

   a. What is the total number of cases you can fit on one layer of a 48" x 40" pallet?
      Calculate the area of the pallet:

      Calculate the area of one case:

      Divide the area of the pallet by the area of the case:

   b. How many cases high can you stack this order on a pallet?
      Convert the maximum pallet height of 6.5 feet into inches by multiplying by 12:

      Divide the result by 15 inches, the height of one case:

   c. How many total cases can you load on one pallet?
      Multiply the number of cases on one layer by the number of cases high you can stack the load.

   d. How many pallets will you need for this order?
      Divide the number of total cases by the number of cases you can load on one pallet.

Worksheet 1: Packing Pallets – Calculating Area   Name _____

You received the following packing orders. Make all the required calculations to pack the pallets for these orders.

1. You receive a packing order for 400 cases of item #103. The case dimensions for this item are 12" L x 15" W x 10" H. The maximum case stacking height for this product is 8 cases.

   a. What is the total number of cases you can fit on one layer of a 48" x 40" pallet?

   b. If you stack the cases 8 high, how many total cases can you load on one pallet?

   c. How many pallets will you need for this order?

2. You receive a packing order for 240 cases of item #104. The case dimensions for this item are 24" L x 20" W x 20" H. The maximum pallet height for the truck delivering this order is 7 feet.

   a. What is the total number of cases you can fit on one layer of a 48" x 40" pallet?

   b. How many cases high can you stack this order on a pallet?

   c. How many total cases will you stack on one pallet?

   d. How many pallets will you need for this order?

3. You receive a packing order for 480 cases of item #105. The case dimensions for this item are 15" L x 10.5" W x 8" H. The maximum pallet height for the truck delivering this order is 7 feet.

   a. What is the total number of cases you can fit on one layer of a 36" x 36" pallet?

   b. How many cases high can you stack this order on a pallet?

   c. How many total cases will you stack on one pallet?

   d. How many pallets will you need for this order?

4. You receive a packing order for 360 cases of item #106. The case dimensions for this item are 18.5" L x 12.5" W x 15" H. The maximum case stacking height for this product is 5 cases.

   a. What is the total number of cases you can fit on one layer of a 48" x 40" pallet?

   b. How many total cases will you stack on one pallet?

   c. How many pallets will you need for this order?

Activity 2: Packing Pallets – Calculating Weight

Weight is another important factor which must be considered when loading pallets. Both pallets and delivery trucks have maximum weight limits which must be followed.

When you receive a packing order, you will check the case weight of the product, the pallet weight, and the maximum loaded pallet weight allowed for the order. You will use this information to calculate the total weight for each loaded pallet and verify that the weight of the load is safe.

Example 1: You receive a packing order for 120 cases of item #201. You pack 40 cases each on 3 pallets. Each case weighs 35.2 lbs. and each empty pallet weighs 45 lbs. The maximum loaded pallet weight for this order is 1500 lbs.

    a. What is the weight of one loaded pallet?

        Multiply the weight of one case by the total number of cases loaded on one pallet. Add the result to the weight of the empty pallet.

        35.2 x 40 + 45 = <u>1453 lbs.</u>

    b. Is the weight of the load safe?

        Compare the loaded pallet weight you calculated to the maximum weight allowed.

        <u>Yes</u>, 1453 lbs. is less than the 1500 lb. maximum allowed.

    c. What is the total load weight for the entire order?

        Multiply the weight of one loaded pallet by the total number of pallets.

        1453 x 3 = <u>4359 lbs</u>.

Practice 1: You receive a packing order for 280 cases of item #202. You pack 70 cases each on 4 pallets. Each case weighs 26.5 lbs. and each pallet weighs 45 lbs. The maximum loaded pallet weight for this order is 2000 lbs.

    a. What is the weight of one loaded pallet?

    b. Is the weight of the load safe?

    c. What is the total load weight for the entire order?

Worksheet 2: Packing Pallets – Calculating Weight   Name _____

Perform the weight calculations for each of the following packing orders.

1. You receive a packing order for 400 cases of item #203. You pack 80 cases each on 5 pallets. Each case weighs 24 lbs. and each pallet weighs 45 lbs. The maximum loaded pallet weight for this order is 2000 lbs.

    a. What is the weight of one loaded pallet?

    b. Is the weight of the load safe?

    c. What is the total load weight for the entire order?

2. You receive a packing order for 240 cases of item #204. You pack 16 cases each on 15 pallets. Each case weighs 43.5 lbs. and each pallet weighs 45 lbs. The maximum loaded pallet weight for this order is 1500 lbs.

    a. What is the weight of one loaded pallet?

    b. Is the weight of the load safe?

    c. What is the total load weight for the entire order?

3. You receive a packing order for 480 cases of item #205. You pack 80 cases each on 6 pallets. Each case weighs 25 lbs. and each pallet weighs 45 lbs. The maximum loaded pallet weight for this order is 2000 lbs.

    a. What is the weight of one loaded pallet?

    b. Is the weight of the load safe?

    c. What is the total load weight for the entire order?

4. You receive a packing order for 360 cases of item #206. You pack 40 cases each on 9 pallets. Each case weighs 36.3 lbs. and each pallet weighs 45 lbs. The maximum loaded pallet weight for this order is 1500 lbs.

    a. What is the weight of one loaded pallet?

    b. Is the weight of the load safe?

    c. What is the total load weight for the entire order?

Activity 3: Loading Trucks – Volume and Weight

You explain to Julie that she will need to calculate the volume and weight of each loaded pallet to ensure that outgoing shipments will fit in the designated delivery truck. Your company uses different size delivery trucks, depending on the volume and weight of the orders.

The formula to find the volume of a rectangular prism: **Volume = Length x Width x Height**

Note: Volume is always written in cubic units.

You will need to convert inches into feet before calculating the volume of a loaded pallet. To convert inches into feet, divide by 12. Round your answers to the nearest tenths place, if necessary.

Example: Your order has 6 loaded pallets, each measuring 48" L x 40" W x 60" H. Find the volume of one loaded pallet and the entire order.

Step1: Convert the inches into feet. $48 \div 12 = 4'$ L $\quad 40 \div 12 = 3.3'$ W $\quad 60 \div 12 = 5'$ H

Step 2: Calculate the volume in cubic feet of one pallet. **V = L x W x H** $\rightarrow 4 \times 3.3 \times 5 = \underline{66 \text{ ft}^3}$

Step 3: Multiply by the number of pallets to find the volume for the entire order. $66 \times 6 = \underline{396 \text{ ft}^3}$

Practice 1a: Your order has 12 full pallets and each pallet contains 50 cases. Each case weighs 38.2 lbs. and each empty pallet weighs 45 lbs. The dimensions for each loaded pallet are 48" L x 40" W x 84" H. Find the volume and weight of one loaded pallet and the entire order.

Step 1: Convert the inches into feet.

Step 2: Calculate the volume of one pallet.

Step 3: Multiply by the number of pallets to find the volume of the entire order.

Step 4: Calculate the weight of one loaded pallet.

Step 5: Multiply by the number of pallets to find the weight of the entire order.

Practice 1b: A 36 foot delivery truck has the following interior load dimensions, 35' L x 7.5' W x 7' H. The truck holds a maximum of 16 standard 48" x 40" pallets and has a maximum weight capacity of 30,000 lbs. Calculate the volume of the truck.

You use this truck for the order in 1a above. What percent of the truck's weight capacity would the order require? To find the percent, divide the weight of the order by the weight capacity of the truck.

What percent of the truck's volume capacity would the order require? To find the percent, divide the total volume of the order by the total weight capacity of the truck.

Worksheet 3: Loading Trucks – Volume and Weight   Name _____

1. **Your company has the following trucks available for outgoing shipments. Calculate the total volume for each truck.**

a. Truck A: 28 foot truck will hold a maximum of 12 standard pallets. It has a weight limit of 20,000 lbs. The interior load dimensions for this truck are 27' L x 7' W x 6.5 H.

b. Truck B: 42 foot truck will hold a maximum of 20 standard pallets. It has a weight limit of 38,000 lbs. The interior load dimensions for this truck are 41' L x 7' W x 7.5' H.

c. Truck C: 53 foot tractor trailer will hold a maximum of 26 standard pallets It has a weight limit of 45,000 lbs. The load dimensions for this truck are 52' L x 7.5' W x 8' H.

2. **Find the volume and weight of one loaded pallet and the entire order for each of the following.**

a. An order has 12 full pallets and each pallet contains 40 cases. Each case weighs 35.5 lbs. and each empty pallet weighs 45 lbs. The dimensions for each loaded pallet are 48" L x 40" W x 66" H

b. An order has 20 full pallets and each pallet contains 36 cases. Each case weighs 47.3 lbs. and each empty pallet weighs 45 lbs. The dimensions for each loaded pallet are 48" L x 40" W x 78" H.

c. An order has 24 full pallets and each pallet contains 100 cases. Each case weighs 18.2 lbs. and each empty pallet weighs 45 lbs. The dimensions for each loaded pallet are 48" L x 40" W x 84" H

3. **Find the percent of capacity for each of the following.**

a. You load truck A with the order in #2a above. What percent of the truck's weight capacity would the order require? What percent of the truck's volume capacity would the order require?

b. You load truck B with the order in #2b above. What percent of the truck's weight capacity would the order require? What percent of the truck's volume capacity would the order require?

c. You load truck C with the order in #2c above. What percent of the truck's weight capacity would the order require? What percent of the truck's volume capacity would the order require?

Quiz: Packing and Loading Calculations   Name: _____

1. You receive a packing order for 600 cases of item #401. The case dimensions for this item are 20" L x 15" W x 8" H. The maximum pallet height for the truck delivering this order is 7 feet.

   a. What is the total number of cases you can fit on one layer of a 48" x 40" pallet?

   b. How many cases high can you stack this order on a pallet?

   c. How many total cases will you stack on one pallet?

   d. How many pallets will you need for this order?

2. You receive a packing order for 500 cases of item #402. You pack 100 cases each on 5 pallets. Each case weighs 16.5 lbs. and each pallet weighs 45 lbs. The maximum loaded pallet weight for this order is 2000 lbs.

   a. What is the weight of one loaded pallet?

   b. Is the weight of the load safe?

   c. What is the total load weight for the entire order?

3. A 45 foot truck will hold a maximum of 22 standard pallets. It has a weight limit of 40,000 lbs. The interior load dimensions for this truck are 44' L x 7' W x 7.5' H.

   a. What is the volume of this truck?

4. Your order has 20 full pallets and each pallet contains 60 cases. Each case weighs 31.5 lbs. and each empty pallet weighs 45 lbs. The dimensions for each loaded pallet are 48" L x 40" W x 85" H.

   a. What is the weight and volume of one loaded pallet?

   b. What is the weight and volume of the entire order?

5. You load the truck from #3 with the order from #4 above.

   a. What percent of the truck's weight capacity would the order require?

   b. What percent of the truck's volume capacity would the order require?

Activity 1

Practice 1: $14 \times 6 = \underline{84 \text{ in}^2}$

$20 \times 13.5 = \underline{270 \text{ in}^2}$

$15.5 \times 14 = \underline{217 \text{ in}^2}$

Practice 2a: $48 \times 40 = 1920 \text{ in}^2$

$13 \times 10.5 = 136.5 \text{ in}^2$

$1920 \div 136.5 = 14.1$, round down → $\underline{14 \text{ cases per layer}}$

Practice 2b: $6.5 \times 12 = 78$ inches

$78 \div 15 = 5.2$, round down → $\underline{5 \text{ cases high}}$

Practice 2c: $14 \times 5 = \underline{70 \text{ cases per pallet}}$

Practice 2d: $280 \div 70 = \underline{4 \text{ pallets needed for the order}}$

Activity 2

Practice 1a: $70 \times 26.5 + 45 = \underline{1900 \text{ lbs. per pallet}}$

Practice 1b: $\underline{\text{Yes}}$; 1900 is less than the 2000 lb. maximum

Practice 1c: $1900 \times 4 = \underline{7600 \text{ lbs. for the total order}}$

Activity 3

Practice 1a: Convert inches to feet: $48 \div 12 = 4'$ $40 \div 12 = 3.3'$ $84 \div 12 = 7'$

Volume of one pallet: $4 \times 3.3 \times 7 = \underline{92.4 \text{ ft}^3}$

Volume of entire order: $92.4 \times 12 = \underline{1108 \text{ ft}^3}$

Weight of one pallet: $50 \times 38.2 + 45 = \underline{1955 \text{ lbs.}}$

Weight of the entire order: $1955 \times 12 = \underline{23,460 \text{ lbs.}}$

Practice 1b: Volume of the truck: $35 \times 7.5 \times 7 = \underline{1837.5 \text{ ft}^3}$

$23,460 \div 30,000 = .782 \rightarrow \underline{78.2\%}$

$1108 \div 1837.5 = .603 \rightarrow \underline{60.3\%}$

1. You receive a packing order for 400 cases of item #103. The case dimensions for this item are 12" L x 15" W x 10" H. The maximum case stacking height for this product is 8 cases.

    a. What is the total number of cases you can fit on one layer of a 48" x 40" pallet?

      48 x 40 = 1920 sq. in.; 12 x 15 = 180 sq. in.; 1920 ÷ 180 = 10.6 → <u>10 cases per layer</u>

    b. If you stack the cases 8 high, how many total cases can you load on one pallet?

      10 x 8 = <u>80 cases per pallet</u>

    c. How many pallets will you need for this order? 400 ÷ 80 = <u>5 pallets</u>

2. You receive a packing order for 240 cases of item #104. The case dimensions for this item are 24" L x 20" W x 20" H. The maximum pallet height for the truck delivering this order is 7 feet.

    a. What is the total number of cases you can fit on one layer of a 48" x 40" pallet?

      48 x 40 = 1920;   24 x 20 = 480;   1920 ÷ 480 = <u>4 cases per layer</u>

    b. How many cases high can you stack this order on a pallet?   Max. truck height: 7 feet;

      7 x 12 = 84 in.; case height: 20 in.; 84 ÷ 20 = 4.2 → <u>4 cases high</u>

      7   How many total cases will you stack on one pallet? 4 x 4 = <u>16 cases per pallet</u>

      8   How many pallets will you need for this order? 240 ÷ 16 = <u>15 pallets</u>

3. You receive a packing order for 480 cases of item #105. The case dimensions for this item are 15" L x 10.5" W x 8" H. The maximum pallet height for the truck delivering this order is 7 feet.

    a. What is the total number of cases you can fit on one layer of a 36" x 36" pallet?

      36 x 36 = 1296 sq. in.; 15 x 10.5 = 157.5 sq. in.; 1296 ÷ 157.5 = 8.2 → <u>8 cases per layer</u>

    b. How many cases high can you stack this order on a pallet? Max. truck height: 7 feet;

      7 x 12 = 84 in.; case height: 8 in.; 84 ÷ 8 = 10.5 → <u>10 cases high</u>

    c. How many total cases will you stack on one pallet? <u>8 x 10 = 80 cases per pallet</u>

    d. How many pallets will you need for this order?   480 ÷ 80 = <u>6 pallets</u>

4. You receive a packing order for 360 cases of item #106. The case dimensions for this item are 18.5" L x 12.5" W x 15" H. The maximum case stacking height for this product is 5 cases.

    a. What is the total number of cases you can fit on one layer of a 48" x 40" pallet?

      48 x 40 = 1920 sq. in.; 18.5 x 12.5 = 231.25 sq. in.; 1920 ÷ 231.25 = 8.3 → 8 <u>cases per layer</u>

    b. How many total cases will you stack on one pallet? 8 x 5 = <u>40 cases per pallet</u>

    c. How many pallets will you need for this order? 360 ÷ 40 = <u>9 pallets</u>

1. You receive a packing order for 400 cases of item #203. You pack 80 cases each on 5 pallets. Each case weighs 24 lbs. and each pallet weighs 45 lbs. The maximum loaded pallet weight for this order is 2000 lbs.

   a. What is the weight of one loaded pallet? 80 x 24 = 1920;   1920 + 45 = 1965 lbs.

   b. Is the weight of the load safe? Yes, 1965 is less than the 2000 lb. maximum allowed.

   c. What is the total load weight for the entire order? 1965 x 5 = 9825 lbs.

2. You receive a packing order for 240 cases of item #204. You pack 16 cases each on 15 pallets. Each case weighs 43.5 lbs. and each pallet weighs 45 lbs. The maximum loaded pallet weight for this order is 1500 lbs.

   a. What is the weight of one loaded pallet? 16 x 43.5 = 696;   696 + 45 = 741 lbs.

   b. Is the weight of the load safe? Yes, 741 is less than the 1500 lb. maximum allowed.

   c. What is the total load weight for the entire order? 741 x 15 = 11,115 lbs.

3. You receive a packing order for 480 cases of item #205. You pack 80 cases each on 6 pallets. Each case weighs 25 lbs. and each pallet weighs 45 lbs. The maximum loaded pallet weight for this order is 2000 lbs.

   a. What is the weight of one loaded pallet? 80 x 25 = 2000;   2000 + 45 = 2045 lbs.

   b. Is the weight of the load safe? No, 2045 is more than the 2000 lb. maximum allowed.

   c. What is the total load weight for the entire order? 2045 x 6 = 12,270 lbs.

4. You receive a packing order for 360 cases of item #206. You pack 40 cases each on 9 pallets. Each case weighs 36.3 lbs. and each pallet weighs 45 lbs. The maximum loaded pallet weight for this order is 1500 lbs.

   a. What is the weight of one loaded pallet? 40 x 36.3 = 1452;   1452 + 45 = 1497 lbs.

   b. Is the weight of the load safe? Yes, 1497 is less than the 1500 maximum allowed.

   c. What is the total load weight for the entire order? 1497 x 9 = 13,473 lbs.

1. **Your company has the following trucks available for outgoing shipments. Calculate the total volume for each truck.**

  a. Truck A: 28 foot truck will hold a maximum of 12 standard pallets. It has a weight limit of 20,000 lbs. The interior load dimensions for this truck are 27' L x 7' W x 6.5 H.
  27 x 7 x 6.5 = <u>1228.5 cubic feet</u>

  b. Truck B: 42 foot truck will hold a maximum of 20 standard pallets. It has a weight limit of 38,000 lbs. The interior load dimensions for this truck are 41' L x 7' W x 7.5' H.
   41 x 7 x 7.5 = <u>2152.5 cubic feet</u>

  c. Truck C: 53 foot tractor trailer will hold a maximum of 26 standard pallets It has a weight limit of 45,000 lbs. The load dimensions for this truck are 52' L x 7.5' W x 8' H.
   52 x 7.5 x 8 = <u>3120 cubic feet</u>

2. **Find the volume and weight of one loaded pallet and the entire order for each of the following.**

  a. An order has 12 full pallets and each pallet contains 40 cases. Each case weighs 35.5 lbs. and each empty pallet weighs 45 lbs. The dimensions for each loaded pallet are 48" L x 40" W x 66" H. 4 x 3.3 x 5.5 = <u>72.6 cu. ft. per pallet</u>   72.6 x 12 = <u>871.2 cu. ft. per order</u>
  35.5 x 40 = 1420 + 45 = <u>1465 lbs. per pallet</u>   1465 x 12 = <u>17580 lbs. per order</u>

  b. An order has 20 full pallets and each pallet contains 36 cases. Each case weighs 47.3 lbs. and each empty pallet weighs 45 lbs. The dimensions for each loaded pallet are 48" L x 40" W x 78" H. 4 x 3.3 x 6.5 = <u>85.8 cu. ft. per pallet</u>   85.8 x 20 = <u>1716 cu. ft. per order</u>
  47.3 x 36 = 1702.8 + 45 = <u>1747.8 lbs. per pallet</u>   1747.8 x 20 = <u>34,956 lbs. per order</u>

  c. An order has 24 full pallets and each pallet contains 100 cases. Each case weighs 18.2 lbs. and each empty pallet weighs 45 lbs. The dimensions for each loaded pallet are 48" L x 40" W x 84" H. 4 x 3.3 x 7 = <u>92.4 cu. ft. per pallet</u>   92.4 x 24 = <u>2217.6 cu. ft. per order</u>
  18.2 x 100 = 1820 + 45 = <u>1865 lbs. per pallet</u>   1865 x 24 = <u>44,760 lbs. per order</u>

3. **Find the percent of capacity for each of the following.**

  a. You load truck A with the order in #2a above. What percent of the truck's weight capacity would the order require? What percent of the truck's volume capacity would the order require?
  17,580/20,000 = .879 = <u>87.9% of weight</u>   871.2/1228.5 = .709 = <u>70.9% of volume</u>

  b. You load truck B with the order in #2b above. What percent of the truck's weight capacity would the order require? What percent of the truck's volume capacity would the order require?
  34,956/38,000 = .9198 = <u>92% of weight</u>   1716/2152.5 = .797 = <u>79.7% of volume</u>

  c. You load truck C with the order in #2c above. What percent of the truck's weight capacity would the order require? What percent of the truck's volume capacity would the order require?
  44760/45000 = .9946 = <u>99.5% of weight</u>   2217.6/3120 = .7107 = <u>71.1% of volume</u>

Quiz: Packing and Loading Calculations   **Answer Key**

1. You receive a packing order for 600 cases of item #401. The case dimensions for this item are 20" L x 15" W x 8" H. The maximum pallet height for the truck delivering this order is 7 feet.

    a. What is the total number of cases you can fit on one layer of a 48" x 40" pallet?
        48 x 40 = 1920; 20 x 15 = 300; 1920 ÷ 300 = 6.4   →   <u>6 cases per layer</u>

    b. How many cases high can you stack this order on a pallet?
        7ft. x 12 = 84 in.;   84 ÷ 8 = 10.5   →   <u>10 cases high</u>

    c. How many total cases will you stack on one pallet? 6 x 10 = <u>60 cases per pallet</u>

    d. How many pallets will you need for this order? 600 ÷ 60 = <u>10 pallets</u>

2. You receive a packing order for 500 cases of item #402. You pack 100 cases each on 5 pallets. Each case weighs 16.5 lbs. and each pallet weighs 45 lbs. The maximum loaded pallet weight for this order is 2000 lbs.

    a. What is the weight of one loaded pallet? 100 x 16.5 = 1650 + 45 = <u>1695 lbs. per pallet</u>

    b. Is the weight of the load safe? <u>Yes, 1695 is less than 2000 lbs.</u>

    c. What is the total load weight for the entire order? 1695 x 5 = <u>8475 lbs.</u>

3. A 45 foot truck will hold a maximum of 22 standard pallets. It has a weight limit of 40,000 lbs. The interior load dimensions for this truck are 44' L x 7' W x 7.5' H.

    a. What is the volume of this truck? 44 x 7 x 7.5 = <u>2310 cubic feet</u>

4. Your order has 20 full pallets and each pallet contains 60 cases. Each case weighs 31.5 lbs. and each empty pallet weighs 45 lbs. The dimensions for each loaded pallet are 48" L x 40" W x 85" H.
    a. What is the weight and volume of one loaded pallet? 48/12 = 4; 40/12 = 3.3; 85/12 = 7.1; 4 x 3.3 x 7.1 = <u>93.72 cu. ft. per pallet</u>   93.72 x 20 = <u>1874.4 cu. ft. per order</u>

    b. What is the weight and volume of the entire order?
        31.5 x 60 = 1890 + 45 = <u>1935 lbs. per pallet</u>   1935 x 20 = <u>38,700 lbs. per order</u>

5. You load the truck from #3 with the order from #4 above.

    a. What percent of the truck's weight capacity would the order require?
        38,700 ÷ 40,000 = .9675   →   <u>96.8%</u>

    b. What percent of the truck's volume capacity would the order require?
        1874.4 ÷ 2310 = .811   →   <u>81.1%</u>