Case Study 3

A logistics company is managing a shipment of medical supplies that need to be stored in a large warehouse. The warehouse storage room is a cuboid with dimensions 20 meters in length, 15 meters in breadth, and 10 meters in height. The company uses standard cubical wooden crates to pack the medicine bottles. Each wooden crate has an edge length of 2 meters.

The manager needs to ensure that the room is not overfilled and that there is enough space for a ventilation path. According to safety regulations, 20% of the total volume of the room must be left empty for air circulation. Furthermore, the company is considering a smaller "Express Delivery" container, which is a cuboid measuring 5 meters by 4 meters by 3 meters. The floor of the warehouse room needs to be painted with a special anti-static coating, excluding the area where the heavy generator is fixed. The generator occupies a square base area of 4 meters by 4 meters.

1. What is the total volume of the warehouse storage room?

   (a) 3000 cubic meters
   (b) 1500 cubic meters
   (c) 2000 cubic meters
   (d) 3500 cubic meters

   Answer: (a) 3000 cubic meters
   Solution: Volume of a cuboid = length × breadth × height. Volume = $20 \times 15 \times 10 = 3000$ cubic meters.

2. How many cubical wooden crates can fit into the warehouse if the entire volume was used?

   (a) 375 crates
   (b) 750 crates
   (c) 500 crates
   (d) 425 crates

   Answer: (a) 375 crates
   Solution: Volume of one cubical crate = side^3 = $2 \times 2 \times 2 = 8$ cubic meters. Number of crates = $\frac{\text{Total Volume}}{\text{Volume of one crate}} = \frac{3000}{8} = 375$ crates.

3. If 20% of the warehouse volume must be left empty for ventilation, what is the maximum volume available for storage?

   (a) 2400 cubic meters
   (b) 600 cubic meters
   (c) 2500 cubic meters
   (d) 2800 cubic meters

   Answer: (a) 2400 cubic meters
   Solution: Volume to be left empty = 20% of 3000 = $\frac{20}{100} \times 3000 = 600$ cubic meters. Available volume = $3000 - 600 = 2400$ cubic meters.

4. What is the total floor area of the warehouse that needs to be painted (excluding the generator base)?

   (a) 300 square meters
   (b) 284 square meters

(c) 250 square meters

(d) 316 square meters

Answer: (b) 284 square meters

Solution: Total floor area = length $\times$ breadth = $20 \times 15 = 300$ square meters. Area of generator base = $4 \times 4 = 16$ square meters. Area to be painted = $300 - 16 = 284$ square meters.

5. How many "Express Delivery" cuboid containers ($5m \times 4m \times 3m$) would have a combined volume equal to the total volume of the warehouse?

(a) 50 containers

(b) 40 containers

(c) 60 containers

(d) 100 containers

Answer: (a) 50 containers

Solution: Volume of one express container = $5 \times 4 \times 3 = 60$ cubic meters. Number of containers = $\frac{3000}{60} = 50$ containers.