Cubes – Advance

1. A cube has a surface area of 600 cm^2. What is its volume?

    a) 800 cm^3
    b) 1000 cm^3
    c) 1200 cm^3
    d) 1600 cm^3

    Ans) b

    Explanation:

    For a cube with surface area 600 cm^2, $6s^2 = 600$ so $s^2 = 100$ and $s = 10$ cm. Its volume is $s^3 = 10^3 = 1000$ cm^3.

2. A cube has a space diagonal of $10\sqrt{3}$ cm. What is its surface area?

    a) 450 cm^2
    b) 500 cm^2
    c) 600 cm^2
    d) 750 cm^2

    Ans) c

    Explanation:

    The space diagonal d of a cube is given by $d = s\sqrt{3}$. If $d = 10\sqrt{3}$, then $s = 10$ cm. The surface area is $6s^2 = 6 \times 100 = 600$ cm^2.

3. If the side of a cube is increased by 20%, by what approximate percent does its volume increase?

    a) Approximately 73% increase
    b) Approximately 44% increase
    c) Approximately 20% increase

d) Approximately 100% increase

Ans) a

Explanation:

Increasing each edge by 20% multiplies the edge by 1.2, so the volume increases by $1.2^3 = 1.728$. This represents a 72.8% increase in volume (approximately).

4. What is the surface area of a cuboid with dimensions 4 cm, 5 cm, and 6 cm?

   a) 140 cm^2
   b) 154 cm^2
   c) 150 cm^2
   d) 148 cm^2

   Ans) d

   Explanation:

   A cuboid with dimensions 4 cm, 5 cm, and 6 cm has surface area $2(4\times5 + 5\times6 + 4\times6) = 2(20+30+24) = 2\times74 = 148$ cm^2.

5. If a cuboid with dimensions 10 cm, 20 cm, and 30 cm is painted at a rate of \$0.05 per cm^2, what is the total cost to paint it?

   a) \$100
   b) \$105
   c) \$115
   d) \$110

   Ans) d

   Explanation:

   A cuboid with dimensions 10 cm, 20 cm, and 30 cm has surface area $2(10\times20 + 20\times30 + 10\times30) = 2(200 + 600 + 300) = 2200$ cm^2. At \$0.05 per cm^2, the cost is $2200\times0.05 = \$110$.

6. If each dimension of a cuboid is increased by 10%, by approximately what percent does its volume increase?

    a) 10%
    b) 33%
    c) 30%
    d) 40%

    Ans) b

    Explanation:

    Increasing each dimension of a cuboid by 10% scales its volume by $1.1^3 \approx 1.331$, so the volume increases by approximately 33.1%.

7. A cube is inscribed in a cuboid with dimensions 10 cm, 12 cm, and 14 cm. What is the maximum possible edge length of the cube?

    a) 8 cm
    b) 12 cm
    c) 10 cm
    d) 14 cm

    Ans) c

    Explanation:

    A cube is inscribed in a cuboid only if the cube's edge is limited by the smallest cuboid dimension. Here, the cuboid dimensions are 10 cm, 12 cm, and 14 cm, so the maximum cube edge is 10 cm.

8. A cube is inscribed in a cuboid only if the cube's edge is limited by the smallest cuboid dimension. Here, the cuboid dimensions are 10 cm, 12 cm, and 14 cm, so the maximum cube edge is 10 cm.

    a) $2\sqrt[3]{10}$
    b) $3\sqrt[3]{10}$
    c) $8\sqrt[3]{10}$
    d) $4\sqrt[3]{10}$

Ans) d

Explanation:

Let the cuboid dimensions be in the ratio 2:3:4, so they are 2k, 3k, and 4k. Given volume = $24k^3 = 240$, we have $k^3 = 10$, so $k = \sqrt[3]{10}$. The height is $4k = 4\sqrt[3]{10}$.

9. A cuboid has a fixed volume of 216 cm^3. For which dimensions is its surface area minimized?

    a) 6, 6, 6 cm
    b) 5, 6, 7 cm
    c) 4, 8, 9 cm
    d) 6, 7, 6 cm

Ans) a

Explanation:

For a fixed volume, the surface area is minimized when the shape is a cube. For a volume of 216 cm^3, the cube has an edge length of 6 cm and a surface area of $6 \times 6^2 = 216$ cm^2 (correction: $6 \times 36 = 216$).

10. A cuboid's dimensions are in the ratio 2:3:6 and its volume is 216 cm^3. What is the length of its space diagonal?

    a) $6\sqrt[3]{6}$
    b) $7\sqrt[3]{6}$
    c) $7\sqrt[3]{4}$
    d) $8\sqrt[3]{6}$

Ans) b

Explanation:

A cuboid has dimensions in the ratio 2:3:6 and volume 216 cm^3. Let dimensions be 2k, 3k, and 6k; then $36k^3 = 216$, so $k^3 = 6$ and $k = \sqrt[3]{6}$. The space diagonal is $7k = 7\sqrt[3]{6}$.

11. A cube is inscribed in a sphere of radius $5\sqrt{3}$ cm. What is the surface area of the cube?

    a) 600 cm^2
    b) 500 cm^2
    c) 700 cm^2
    d) 800 cm^2

    Ans) a

    Explanation:

    A cube is inscribed in a sphere. The space diagonal of the cube equals the diameter of the sphere. If the sphere's radius is $5\sqrt{3}$ cm, the diameter is $10\sqrt{3}$ cm, so $s = (10\sqrt{3})/\sqrt{3} = 10$ cm, and the cube's surface area is $6 \times 10^2 = 600$ cm^2.

12. A cuboid has dimensions 4 cm, 5 cm, and 6 cm. If each dimension is increased by 20%, by what percent does its volume increase?

    a) 72.8%
    b) 50%
    c) 100%
    d) 120%

    Ans) a

    Explanation:

    A cuboid with dimensions 4, 5, and 6 cm has its volume increased by a factor of $1.2^3 = 1.728$ when each dimension is increased by 20%, meaning the volume increases by 72.8%. However, the question asks for the percent increase; 72.8% is the correct answer.

13. If the edge of a cube is decreased by 10%, by what percent does its volume decrease approximately?

    a) 27.1%
    b) 30%
    c) 25%
    d) 20%

Ans) a

Explanation:

If a cube's edge is decreased by 10%, the new volume is $(0.9s)^3 = 0.729\ s^3$, so the volume decreases by approximately 27.1%.