MATHEMATICS

Stage 5

Measurement and Space

Area and Surface Area

Volume

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Exam Equivalent Time: 136.5 minutes *(based on allocation ~1.25 min/mark)*

norWEST CHRISTIAN COLLEGE
STRENGTH OF PURPOSE

Worked Solutions

1. C Volume (002142)

Convert all measurements to centimetres:

$$V = l \times b \times h$$
$$= 30 \times 5 \times 400$$
$$= 60\ 000\ \text{cm}^3$$
$$\Rightarrow C$$

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2. C Volume (029073)

$$V = \frac{1}{3}Ah$$
$$A = 35 \times 35$$
$$= 1225\ \text{m}^2$$
$$\therefore V = \frac{1}{3} \times 1225 \times 22$$
$$= 8983.33\ldots\ \text{m}^3$$
$$\Rightarrow C$$

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3. B+ Volume (060327)

$1\ \text{mL} = 1\ \text{cm}^3 \quad \Rightarrow \quad 1\ \text{L} = 1000\ \text{cm}^3$

Mean mark 35%.

$$\text{Volume} = Ah$$
$$12\ 000 = 240 \times h$$
$$h = \frac{12\ 000}{240}$$
$$= 50\ \text{cm}$$
$$\Rightarrow D$$

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4. B+ Area and Surface Area (010181)

Total Area = Area of cylinder + ½ sphere

Area of cylinder $= 2\pi rh$

$= 2\pi \times 24 \times 30$

$= 4523.9$

Area of ½ sphere $= \frac{1}{2} \times 4\pi r^2$

$= \frac{1}{2} \times 4\pi \times 24^2$

$= 3619.1$

$\therefore$ Total area $= 4523.9 + 3619.1$

$= 8143 \text{ m}^2$

$\Rightarrow A$

Mean mark 40%

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5. E Area and Surface Area (245991)

S.A. $= 2 \times (6 \times 14) + 2 \times (6 \times 5) + 2 \times (5 \times 14)$

$= 2(84 + 30 + 70)$

$= 368 \text{ m}^2$

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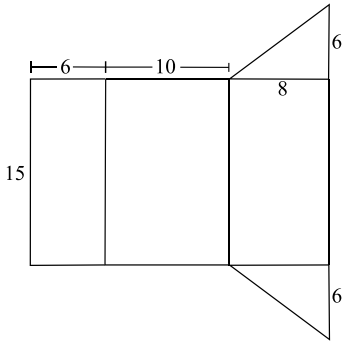
6. D Area and Surface Area (245997)

i.



ii. S.A. $= (15 \times 6) + (15 \times 10) + (15 \times 8) + 2 \times (\frac{1}{2} \times 8 \times 6)$

$= 90 + 150 + 120 + 2(24)$

$= 408 \text{ cm}^2$

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7. D Area and Surface Area (246012)

Area (front side) $= (4 \times 2) + (2 \times 2) = 12 \text{ m}^2$

S.A. $= 2 \times 12 + 2 \times (5 \times 4) + 4 \times (5 \times 2)$

$= 24 + 2(20) + 4(10)$

$= 104 \text{ m}^2$

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8. D Volume (247440)

Volume $= \pi r^2 h$

$= \pi \times 9^2 \times 45$

$= 11\,451.10\ldots$

$= 11\,451 \text{ cm}^3$ (nearest cm^3)

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9. D Volume (247252)

Volume $= l \times b \times h$

$= 9.5 \times 4.2 \times 6.8$

$= 271.32$

$= 271 \text{ cm}^3$ (nearest cm^3)

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10. C Area and Surface Area (060377)

$SA = 4\pi r^2$

$= 4 \times \pi \times 5^2$

$= 314.15\ldots$

$= 314 \text{ cm}^2$ (nearest cm^2)

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11. C Volume (247456)

Volume $= \frac{1}{3} \times A \times h$

$= \frac{1}{3} \times 120 \times 120 \times 65$

$= 312\,000 \text{ m}^3$

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12. C Volume (247473)

$$\begin{aligned}\text{Volume} &= \frac{1}{3} \times A \times h \\ &= \frac{1}{3} \times \pi \times 9.5^2 \times 19.5 \\ &= 1842.936\ldots \\ &= 1842.94 \text{ cm}^3\end{aligned}$$

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13. C Volume (247256)

$$\begin{aligned}\text{Area (trapezium)} &= \frac{1}{2}h(a+b) \\ &= \frac{1}{2} \times 4(10+14) \\ &= 48 \text{ m}^2\end{aligned}$$

$$\begin{aligned}\text{Volume} &= A \times h \\ &= 48 \times 9 \\ &= 432 \text{ m}^3\end{aligned}$$

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14. C Volume (247452)

$$\begin{aligned}\text{Area (face)} &= (9 \times 13) + \left(\frac{1}{2} \times 13 \times 7\right) \\ &= 162.5 \text{ cm}^2\end{aligned}$$

$$\begin{aligned}\text{Volume} &= Ah \\ &= 162.5 \times 6 \\ &= 975 \text{ cm}^3\end{aligned}$$

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15. C Volume (247434)

$$\begin{aligned}\text{Area (triangle)} &= \frac{1}{2} \times b \times h \\ &= \frac{1}{2} \times 9 \times 12 \\ &= 54 \text{ cm}^2\end{aligned}$$

$$\begin{aligned}\text{Volume} &= A \times h \\ &= 54 \times 7 \\ &= 378 \text{ cm}^3\end{aligned}$$

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16. C Volume (247175)

$$\text{Radius} = \frac{23}{2} = 11.5 \text{ cm}$$

$$\begin{aligned}\text{Volume} &= \frac{4}{3}\pi r^3 \\ &= \frac{4}{3} \times \pi \times 11.5^3 \\ &= 6370.626\ldots \\ &= 6370.6 \text{ cm}^3 \text{ (to 1 d.p.)}\end{aligned}$$

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17. C Area and Surface Area (246181)

$$\begin{aligned}\text{Surface Area} &= 2\pi r^2 + 2\pi rh \\ &= 2\pi(1.6)^2 + 2\pi \times 1.6 \times 4.2 \\ &= 58.307\ldots \\ &= 58.31 \text{ m}^2 \text{ (2 d.p.)}\end{aligned}$$

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18. C Area and Surface Area (246349)

$$\begin{aligned}\text{SA} &= (10 \times 10) + 4 \times (\frac{1}{2} \times 10 \times 15) \\ &= 100 + 4(75) \\ &= 400 \text{ cm}^2\end{aligned}$$

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19. C Area and Surface Area (157659)

S.A. of 1 face of cube $= 8 \times 8 = 64$ cm^2
Height of triangle $= 11 - 8 = 3$ cm

$$\therefore \text{ S.A. (triangular prism)} = 2 \times \left(\frac{1}{2} \times 8 \times 3\right) + 2 \times (5 \times 8)$$
$$= 24 + 80$$
$$= 104 \text{ cm}^2$$

$$\therefore \text{ Total S.A.} = 5 \times 64 + 104$$
$$= 424 \text{ cm}^2$$

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20. B Area and Surface Area (246057)

One strategy:
Calculate the surface area (S.A.) of the 2 objects joined separately and deduct the area where they join.

S.A. (large cube) $= 6 \times 6 \times 6 = 216$ cm^2
S.A. (2 smaller cubes joined together)
$= 2 \times (3 \times 3) + 4 \times (6 \times 3)$
$= 90$ cm^2
S.A. to be deducted (where cubes are attached)
$= 2 \times (6 \times 3)$
$= 36$ cm^2

$$\therefore \text{ S.A. (new object)} = 216 + 90 - 36$$
$$= 270 \text{ cm}^2$$

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21. B Area and Surface Area (118400)

Flatten out the half cylinder,

$$\text{Width} = \frac{1}{2} \times \text{circumference}$$
$$= \frac{1}{2} \times \pi \times 3.8$$
$$= 5.969\ldots$$

$$\therefore \text{ Sheeting required} = 10 \times 5.969\ldots$$
$$= 59.69\ldots$$
$$= 60 \text{ m}^2 \text{ (nearest m}^2\text{)}$$

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22. B Volume (247465)

$$\text{Volume (cube)} = 5 \times 5 \times 5$$
$$= 125 \text{ m}^3$$

$$\text{Volume (pyramid)} = \frac{1}{3}Ah$$
$$= \frac{1}{3} \times 5 \times 5 \times 3$$
$$= 25 \text{ cm}^3$$

Total volume $= 125 + 25 = 150$ m^3

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23. B Volume (026191)

i. $V = l \times b \times h$

$= 21 \times 8 \times 9$

$= 1512 \text{ cm}^3$

ii. Volume of each hole

$= \pi r^2 h$

$= \pi \times 1.4^2 \times 8$

$= 49.260\ldots \text{ cm}^3$

$\therefore$ Volume of clay still in brick

$= 1512 - (3 \times 49.260\ldots)$

$= 1364.219\ldots$

$= 1364 \text{ cm}^3$ (nearest whole)

iii. Percentage of clay removed

$= \dfrac{(3 \times 49.260\ldots)}{1512} \times 100$

$= 9.773\ldots$

$= 9.8\%$ (1 d.p.)

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24. B Area and Surface Area (246337)

i. Let $s =$ slant height

$s^2 = 6^2 + 8^2$

$= 100$

$s = 10 \text{ m}$

ii. $\text{SA} = (12 \times 12) + 4 \times (\frac{1}{2} \times 12 \times 10)$

$= 144 + 4(60)$

$= 384 \text{ m}^2$

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25. B Area and Surface Area (246092)

$\text{Total Area} = (2 \times 12) + 2 \times (3 \times 5) + (8 \times 3)$

$= 78 \text{ cm}^2$

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26. B Area and Surface Area (246199)

$\text{Surface Area (half cylinder)} = \dfrac{1}{2}(2\pi r^2 + 2\pi rh)$

$= \dfrac{1}{2}(2\pi \times 17.5^2 + 2\pi \times 17.5 \times 40)$

$= 3161.227\ldots \text{ cm}^2$

$\text{Area (rest)} = (35 \times 40) + 2(35 \times 30) + 2(40 \times 30)$

$= 1400 + 2(1050) + 2(1200)$

$= 5900 \text{ cm}^2$

$\text{SA (total)} = 3161 + 5900 = 9061 \text{ cm}^2$

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27. B+ Volume (246665)

The face of the pool is a rectangle and trapezium (composite).

$\text{Area (face)} = (2.3 \times 4) + \dfrac{1}{2}h(a + b)$

$= 9.2 + \dfrac{1}{2} \times 8(2.3 + 1.1)$

$= 22.8 \text{ m}^2$

$\text{Volume} = Ah$

$= 22.8 \times 6$

$= 136.8 \text{ m}^3$

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28. B+ Volume (246626)

Volume $= Ah$ where A is the area of a trapezium

$A = \dfrac{1}{2}h(a + b)$

$= \dfrac{1}{2} \times 8(11 + 5)$

$= 64 \text{ cm}^2$

$\therefore V = Ah = 64 \times 9 = 576 \text{ cm}^3$

COMMENT: Note that h in the "area" formula is different to the h used in the "volume" formula.

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29. B+ Volume (247079)

Since diameter sphere $= 12$ cm

$\Rightarrow$ Radius of cylinder $= 6$ cm

Height of cylinder $= 2 \times$ diameter of sphere

$= 2 \times 12$

$= 24$ cm

$\therefore$ Volume cylinder $= \pi r^2 h$

$= \pi \times 6^2 \times 24$

$= 2714.336\ldots$

$= 2714$ cm^3

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30. B+ Volume (118521)

Converting megalitres to m^3 (using 1 m^3 = 1000 L):

$$1.26 \text{ ML} = \frac{1.26 \times 10^6}{10^3}$$

$$= 1.26 \times 10^3 \text{ m}^3$$

$$= 1260 \text{ m}^3$$

Mean mark 48%.

$$V = \pi r^2 h$$

$$1260 = \pi \times 9^2 \times h$$

$$h = \frac{1260}{\pi \times 9^2}$$

$$= 4.951\ldots$$

$$= 4.95 \text{ m (2 d.p.)}$$

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31. A Volume (247101)

Volume $=$ Area of annulus $\times\ h$

$= \left(\pi R^2 - \pi r^2\right) \times 2.8$

$= \left(\pi \times 0.45^2 - \pi \times 0.35^2\right) \times 2.8$

$= 0.7037\ldots$

$= 0.70$ m^3

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32. A Area and Surface Area (246160)

Surface area of 1 face of the cube

$$= \frac{150}{6}$$

$= 25$ cm^2

Let $x =$ length of 1 side

$x^2 = 25$

$\therefore\ x = 5$ cm

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33. A Area and Surface Area (246356)

$r = 6$ cm, $l = 10$ cm

$\text{SA} = \pi r^2 + \pi r l$

$= \pi \times 6^2 + \pi \times 6 \times 10$

$= 301.592\ldots$

$= 301.59$ cm^2 (2 d.p.)

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34. A Area and Surface Area (246166)

Let $w =$ width of the brick

Surface Area $= 2 \times [8w + 22w + (8 \times 22)]$

$982 = 2(30w + 176)$

$982 = 60w + 352$

$60w = 630$

$\therefore\ w = 10.5$ cm

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35. A Area and Surface Area (195581)

Mean mark 50%.

$$\begin{aligned}\text{S.A. of Cylinder} &= \pi r^2 + 2\pi rh \\ &= \pi\left(2^2\right) + 2\pi(2)(3) \\ &= 16\pi \text{ cm}^2\end{aligned}$$

$$\begin{aligned}\text{S.A. of Hemisphere} &= \frac{1}{2} \times 4\pi r^2 \\ &= 2\pi\left(3^2\right) \\ &= 18\pi \text{ cm}^2\end{aligned}$$

$$\begin{aligned}\text{Area of Annulus} &= \pi R^2 - \pi r^2 \\ &= \pi\left(3^2\right) - \pi\left(2^2\right) \\ &= 5\pi \text{ cm}^2\end{aligned}$$

$$\begin{aligned}\text{Total S.A.} &= 16\pi + 18\pi + 5\pi \\ &= 39\pi \\ &= 122.522\ldots \\ &= 122.5 \text{ cm}^2 \quad \text{(to 1 d.p.)}\end{aligned}$$

36. A Volume (247488)

Radius (original cone) $= 12$ cm

Radius (small cone) $= 6$ cm

$$\begin{aligned}\text{Volume} &= \text{Original cone} - \text{Small cone} \\ &= \left(\frac{1}{3} \times \pi \times 12^2 \times 60\right) - \left(\frac{1}{3} \times \pi \times 6^2 \times 30\right) \\ &= 7916.81\ldots \\ &= 7916 \text{ cm}^3 \quad (\text{nearest cm}^3)\end{aligned}$$

37. A+ Area and Surface Area (246153)

$$\begin{aligned}&\text{S.A. of rectangular prism} \\ &= 2 \times (h \times h) + 4 \times (2h \times h) \\ &= 2h^2 + 8h^2 \\ &= 10h^2\end{aligned}$$

$$\text{S.A. of cube} = 6 \times (h \times h) = 6h^2$$

$$\begin{aligned}&\therefore \text{ Ratio of rectangular prism to cube} \\ &= 10h^2 : 6h^2 \\ &= 5:3\end{aligned}$$