Geometry of 3-D Objects: Faces, Vertices, Edges & Nets

MARKING GUIDELINE

MARKS	DURATION	QUESTIONS
34	55 minutes	3

Name: _____ Class: _____

Date: _____

MARK _____ / 34

INSTRUCTIONS AND INFORMATION

1. Answer **ALL** the questions in this question paper.
2. Answer QUESTION 1 by **circling** the letter (A–D) in the answer grid at the end of that section.
3. Show **ALL** calculations clearly.
4. Show all units where applicable.
5. Number the answers correctly according to the numbering system used in this question paper.
6. A non-programmable calculator may be used, unless stated otherwise.
7. Write neatly and legibly.

QUESTION 1 [10 MARKS]

Four options are given as possible answers to the following questions. Choose the correct answer and circle the letter (A–D) in the grid at the end of this section. If you want to change your choice, put a cross through the wrong letter and circle your new choice.

1.1 A net is made of 1 square and 4 identical triangles. When it is folded, it makes a ... (1)

A) triangular prism
B) square pyramid ✓
C) tetrahedron
D) cube

Answer: B — The square is the base and the four triangles fold up to meet at the apex.

- **A** — the net of a triangular prism has 2 triangles and 3 rectangles
- **C** — the net of a tetrahedron has 4 triangles and no square
- **D** — the net of a cube has 6 squares

1.2 A tetrahedron has 4 faces and 4 vertices. Its number of EDGES is ... (1)

A) 6 ✓
B) 8
C) 12
D) 4

Answer: A — Each of the 4 vertices is joined to the other 3: $4 \times 3 \div 2 = 6$ edges. (Check: $4 + 4 - 6 = 2$.)

- **B** — added instead of using the formula
- **C** — that is a cube
- **D** — assumed edges equal faces

1.3 A prism with a hexagonal cross-section has ... faces. (1)

A) 12
B) 6
C) 7
D) 8 ✓

Answer: D — Six rectangles plus the two hexagonal ends.

- **A** — that is the number of vertices
- **B** — counted only the rectangles
- **C** — that is a hexagonal PYRAMID

1.4 The difference between a prism and a pyramid is that a pyramid has ... (1)

A) no vertices

B) ONE base and triangular faces meeting at an apex ✓

C) only curved surfaces

D) two identical parallel bases

> **Answer: B** — A prism has two identical parallel ends; a pyramid tapers to a point.
>
> - **A** — a pyramid has an apex, which is a vertex
> - **C** — a pyramid has flat faces
> - **D** — that describes a PRISM

1.5 Which solid has NO vertices at all? (1)

A) square pyramid

B) cube

C) cone

D) sphere ✓

> **Answer: D** — A sphere is a single smooth curved surface.
>
> - **A** — a square pyramid has 5
> - **B** — a cube has 8
> - **C** — a cone has one, at its apex

1.6 A net of a cube consists of ... (1)

A) 6 rectangles

B) 8 squares

C) 6 squares ✓

D) 4 squares

> **Answer: C** — One for each face.
>
> - **A** — the faces of a cube are squares
> - **B** — a cube has only 6 faces
> - **D** — that would leave two faces open

1.7 A cylinder has ... (1)

A) 2 flat faces, 1 curved surface and 2 curved edges ✓

B) 3 flat faces and 2 edges

C) 1 curved surface and no edges

D) 2 flat faces and 4 vertices

> **Answer: A** — Two flat circles, one curved surface joining them, and a circular edge where each circle meets the curved surface.
>
> - **B** — the side of a cylinder is curved, not flat
> - **C** — that describes a sphere
> - **D** — a cylinder has no vertices — its edges are circles

1.8 An octahedron has 8 faces and 12 edges. Its number of VERTICES is ... (1)

A) 20

B) 4

C) 6 ✓

D) 8

> **Answer: C** — $8 + V - 12 = 2$ gives $V = 6$.
>
> - **A** — 20 vertices belong to a dodecahedron
> - **B** — that is a tetrahedron
> - **D** — confused vertices with faces

1.9 Which one of the following is NOT a Platonic solid? (1)

A) octahedron
B) cube
C) square pyramid ✓
D) tetrahedron

> **Answer: C** — A Platonic solid has identical regular faces; a square pyramid mixes a square with triangles.
> - **A** — eight identical triangles
> - **B** — six identical squares
> - **D** — four identical triangles

1.10 Every point on the surface of a sphere is the same distance from ... (1)

A) the top of the sphere
B) the centre of the sphere ✓
C) the nearest edge
D) the lowest point

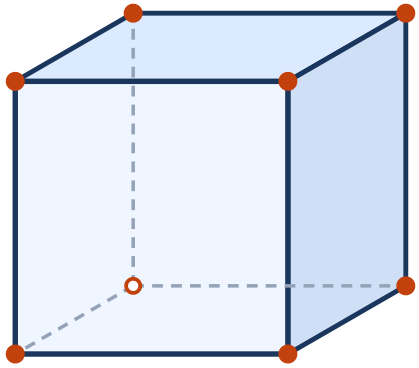
> **Answer: B** — That distance is the radius of the sphere.
> - **A** — the distance to the top changes from point to point
> - **C** — a sphere has no edges
> - **D** — the distance to the lowest point changes from point to point

ANSWER GRID — MARKING GUIDELINE

1.1	A	(B)	C	D
1.2	(A)	B	C	D
1.3	A	B	C	(D)
1.4	A	(B)	C	D
1.5	A	B	C	(D)
1.6	A	B	(C)	D
1.7	(A)	B	C	D
1.8	A	B	(C)	D
1.9	A	B	(C)	D
1.10	A	(B)	C	D

QUESTION 2 [12 MARKS]

The solid below is a cube.



a cube

2.1 Write down the number of faces, vertices and edges. (3)

> F = 6 *(1)*, V = 8 *(1)*, E = 12 *(1)*

2.2 Verify Euler's formula for this solid, and explain how the formula helps you to check a count. (3)

> F + V − E = 6 + 8 − 12 = **2** ✓ *(2)*
> If the three counts do not give 2, one of them has been miscounted *(1)*

2.3 A different solid has 5 faces and 6 vertices. Use Euler's formula to find its number of edges, and name the solid. (3)

> 5 + 6 − E = 2 *(1)*
> **E = 9** *(1)*
> It is a **triangular prism** *(1)*

2.4 The net of a cylinder is 2 circles and 1 rectangle. The circles have a radius of 7 cm. Explain how long the long side of the rectangle must be, and calculate it. Use $\pi = \frac{22}{7}$. (3)

> The rectangle wraps exactly once around each circle, so its long side equals the circumference *(1)*
> $C = 2\pi r = 2 \times \frac{22}{7} \times 7$ *(1)*
> = **44 cm** *(1)*

QUESTION 3 [12 MARKS]

Answer the questions below about 3-D objects. F is the number of faces, V the number of vertices and E the number of edges.

3.1 Name the Platonic solid whose faces are 12 regular pentagons, and write down its numbers of vertices and edges. (3)

> **Dodecahedron** *(1)*
> **20 vertices** *(1)*
> **30 edges** *(1)*

3.2 An octahedron has 8 faces, 6 vertices and 12 edges. Verify Euler's formula for it, and then determine how many edges meet at each vertex. **(3)**

> $8 + 6 - 12 = \mathbf{2}$ ✓ *(2)*
> Each edge has 2 ends, so $12 \times 2 \div 6 = \mathbf{4}$ **edges** meet at every vertex *(1)*

3.3 A prism has a hexagonal cross-section. Determine its number of faces, vertices and edges. **(4)**

> F $= 6$ rectangles $+ 2$ hexagons $= \mathbf{8}$ *(1)*
> V $= 6 + 6 = \mathbf{12}$ *(1)*
> E $= 6 + 6 + 6 = \mathbf{18}$ *(1)*
> Check: $8 + 12 - 18 = 2$ ✓ *(1)*

3.4 Explain the difference between a prism and a pyramid. **(2)**

> A prism has two identical parallel faces joined by rectangles *(1)*; a pyramid has ONE base and all its other faces are triangles meeting at an apex *(1)*

TOTAL: 34 marks

This question paper consists of 3 questions.

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