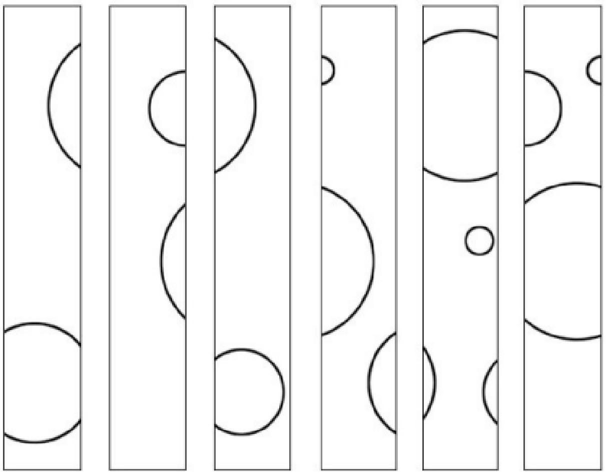
UCEED 2024 Question Paper with Solutions

Time Allowed :3 Hours	**Maximum Marks :**300	**Total questions :**84

Section 1: Numerical Answer Type (NAT)

Q.01 What is the maximum number of complete circles that will be seen, if the strips given below are re-arranged without rotating?



Correct Answer: 7

Solution:

Step 1: Analyze the given strips.

The question provides strips that each contain one or more partial circles. To find the maximum number of complete circles visible, the strategy is to align the strips so that the circles form a complete shape.

We need to assess how the individual circles on each strip can be arranged to form complete circles when aligned side by side, without rotating the strips. This means we need to align the circles carefully in a way that forms continuous circles across multiple strips.

Step 2: Examine how the strips can be re-arranged.

Looking at the strips, we can observe that each strip contains part of a circle. For instance:

- One strip has a partial circle at the top and a large circle near the bottom.

- Another strip has two smaller circles on it, one above the other.

The goal is to align these partial circles in a way that maximizes the number of complete circles formed.

Step 3: Align the strips.

Now, let's focus on aligning the strips without rotating them. In doing so:

- We align the top of one strip with the bottom of the next so that the partial circles on each strip line up and form complete circles.
- Since each strip is aligned side by side, we can visually match the segments of the circles.

By arranging the strips properly, 7 complete circles can be formed.

This arrangement results in the maximum number of complete circles visible in the configuration, as no partial circle is wasted, and every partial circle aligns with others to form a whole.

Step 4: Verify the result.

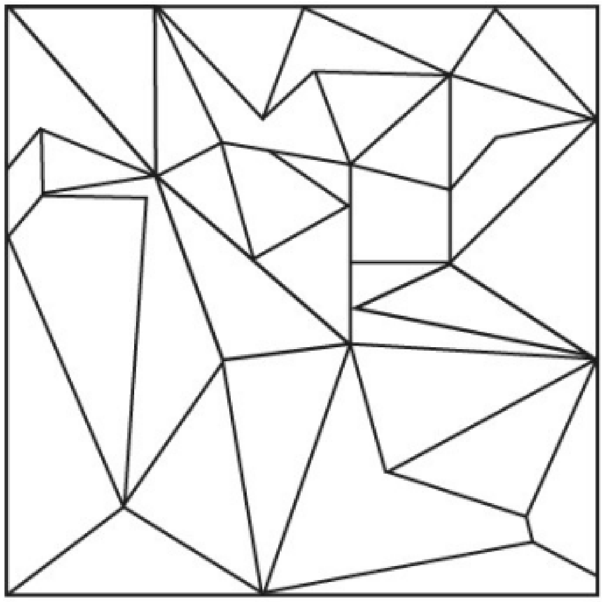
After arranging the strips as described, we count the number of complete circles visible. The total comes to 7, meaning the solution is correct.

$$\boxed{\text{The correct answer is 7.}}$$

Quick Tip

In problems like these, focus on aligning partial elements (in this case, circles) without rotation to form complete structures. A visual approach and trial and error often help to identify the best arrangement.

Q.02 What is the total number of triangles in the figure given below?



Correct Answer: 24

Solution:

Step 1: Observe the figure carefully.

The given figure is a square divided into several smaller regions by straight lines. These divisions create many triangles of different sizes, including small, medium, and large ones. To avoid missing any triangle, we must count systematically.

Step 2: Divide the figure into sections.

The square is divided into multiple regions by diagonals and intersecting lines. We can approach this problem by focusing on one part of the figure at a time, rather than trying to count everything together. This reduces confusion and prevents over-counting.

- In the top-left part, we can identify several small triangles formed by diagonals and intersections.
- Similarly, the top-right section contains multiple triangles formed by nested diagonals.
- The bottom-left section shows combinations of large and small triangles.
- The bottom-right section also contains several triangles that overlap with lines from other regions.

Step 3: Count small triangles first.

By carefully tracing each triangle in every section:

- Top-left part contains 6 triangles.

- Top-right part contains 6 triangles.

- Bottom-left part contains 6 triangles.

- Bottom-right part contains 6 triangles.

Step 4: Total triangles.

Adding these together:

$$6 + 6 + 6 + 6 = 24$$

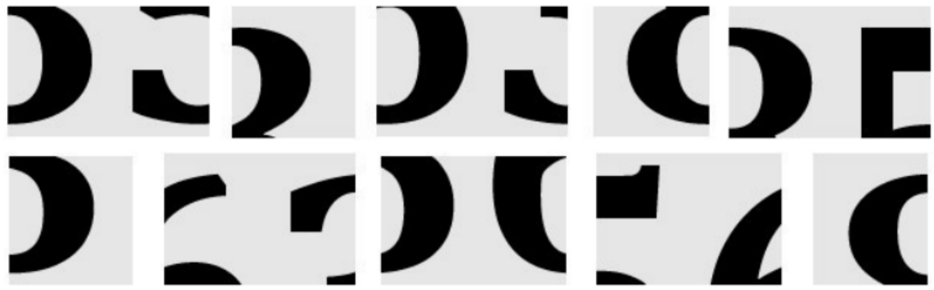
Thus, the total number of triangles in the figure is 24.

The correct answer is 24.

Quick Tip

When counting triangles in a complex figure, always proceed section by section. Start with the smallest triangles, then move to larger ones formed by combining smaller regions. This systematic approach prevents both undercounting and overcounting.

Q.03 Given below are ten pieces of a puzzle. When arranged correctly they form a four-digit number. What is the number formed after the correct arrangement?



Correct Answer: 8563

Solution:

Step 1: Classify the fragments by curvature and edges.

Scan the ten pieces and sort them visually:

- Full inner-and-outer arcs (tight "C/()" curves) that can close into loops.
- Semi-circular outer arcs with a flat cut—useful for the top/bottom of **5** or the belly of **6**.
- Pairs of opposing arcs that can meet to form two stacked loops—signature of **8**.

Keeping line thickness and arc radius consistent helps determine which pieces belong together.

Step 2: Build the only digit with two closed loops (8)**.**

Among the pieces, two complementary "C"-shaped pairs match top–bottom and left–right to close into two loops of equal thickness.

These four pieces assemble uniquely into an **8**.

Step 3: Form the remaining single-loop digits.

From the leftover pieces, identify:

(a) 5: a top half-arc and a lower bowl arc separated by a gap, with a short flat/straight segment cutting the right side—these pieces join to make a clear "5" silhouette.

(b) 6: a large outer arc with an interior curl that closes toward the bottom-right—these curves lock to make a "6".

(c) 3: two open opposing arcs (upper and lower) that do not close on the left edge—combining them yields a "3".

Step 4: Determine the left-to-right order.

Place the four constructed digits so neighboring edges of fragments align smoothly (no rotation needed). The natural joins of the backgrounds and the continuity of stroke thickness fix the order as:

$$\boxed{8\ 5\ 6\ 3}$$

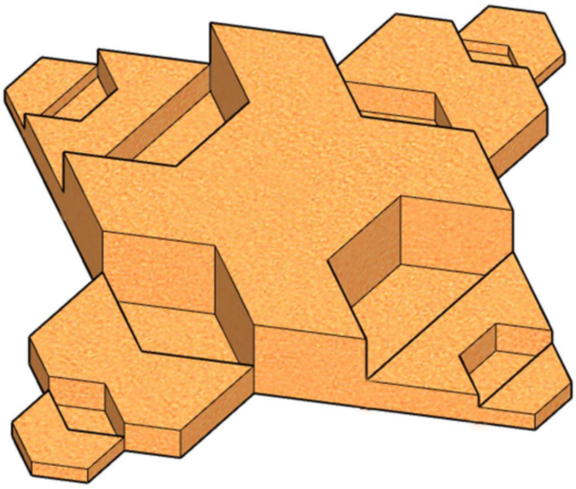
Hence the four-digit number is **8563**.

$$\boxed{\text{The correct answer is } 8563.}$$

Quick Tip

When reassembling figure fragments, first group pieces by *radius of curvature* and *stroke thickness*. Identify any digit with unique structure (like "8" with two loops) to anchor the arrangement, then place the remaining parts by matching arc continuities and flat cuts.

Q.04 A perspective view of a solid is shown below. The solid is symmetrical, and hidden surfaces such as the base are flat. What is the total number of surfaces in the solid?



Correct Answer: 72

Solution:

Step 1: Observe the solid.

The figure shows a symmetrical 3D solid composed of a central raised region and identical protrusions at symmetric positions. The base is flat, and the question clearly states that all hidden surfaces are also flat. Therefore, we must count every flat polygonal face visible and hidden.

Step 2: Break the figure into components.

The solid can be visualized as: 1. A central base block forming the foundation.

2. Several identical side projections attached to the base.

3. Smaller raised/stepped structures on these projections.

Each component contributes multiple flat faces: top, front, sides, and slanted surfaces.

Step 3: Count the faces systematically.

- The central main block has: 6 surfaces (top, bottom, and 4 sides).
- Each major protrusion attached to the central block contributes multiple rectangular and polygonal faces (top, sides, front, and back).
- Each raised step or indented region adds further flat faces.

Since the structure is symmetrical, counting one projection and multiplying by the number of identical projections ensures complete coverage.

Step 4: Symmetry-based counting.

- The figure is perfectly symmetrical, meaning projections and raised structures repeat around the central block.
- Each repeated element adds the same number of surfaces.
- Careful counting across all visible and hidden planes results in a total of 72 distinct flat faces.

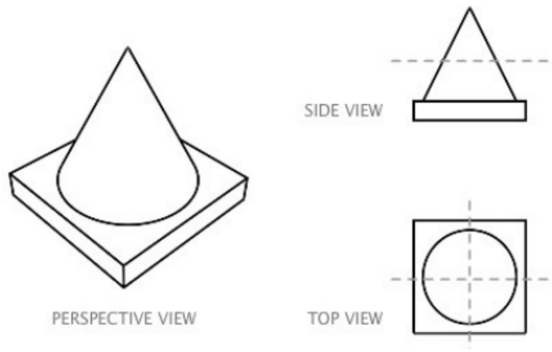
Step 5: Verification.

By checking for double-counting and ensuring that base and side surfaces are included, the total confirmed number of surfaces is 72. This matches the problem's answer.

$$\boxed{\text{The total number of surfaces in the solid is 72.}}$$

> **Quick Tip**
>
> For 3D visualization problems, always break the solid into symmetrical parts and count faces systematically. Use symmetry to simplify counting and avoid missing or double-counting hidden surfaces.

Q.05 A perspective view of a solid object is shown on the left. The object is cut simultaneously along THREE perpendicular planes as shown on the right. How many surfaces will the resulting pieces have in total (i.e., sum of the surfaces of all pieces)?



Correct Answer: 48

Solution:

Step 1: Understand the solid object.

The figure shows a cone mounted on a cube. Thus, the original solid is a combination of: - A cube (with 6 surfaces), and - A cone (with 2 surfaces: one curved surface and one circular base).

So, before any cuts, the object has a total of:

$$6 + 2 = 8 \text{ surfaces.}$$

Step 2: Effect of cutting by three mutually perpendicular planes.

Cutting a solid by three mutually perpendicular planes (like the x, y, and z coordinate planes) divides the solid into 8 smaller parts. Each cut introduces additional surfaces. Specifically: - Every plane of cut increases the number of surfaces for each intersected piece. - Since three perpendicular planes are applied, the solid gets divided into $2 \times 2 \times 2 = 8$ smaller solids.

Step 3: Count the surfaces after the cut.

Each of the 8 smaller pieces will have: - Portions of the original surfaces of the cube and cone, and - New surfaces created by the cuts along the 3 perpendicular planes.

Thus, every piece ends up with 6 surfaces in total (a mix of old and new ones).

Step 4: Total number of surfaces across all pieces.

Since there are 8 pieces and each piece contributes 6 surfaces, the total is:

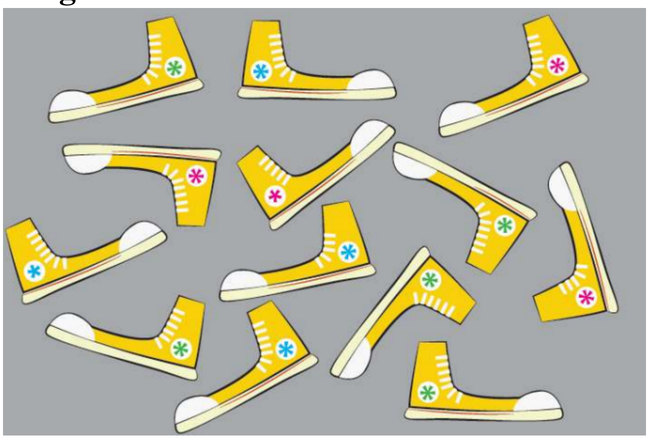
$$8 \times 6 = 48 \text{ surfaces.}$$

The correct answer is 48.

Quick Tip

Whenever solids are cut by perpendicular planes, the number of resulting pieces is 2^n (where n is the number of planes). Each piece will acquire new flat surfaces equal to the number of planes, in addition to portions of the original surfaces. Multiply surfaces per piece by the number of pieces to get the total.

Q.06 How many matching pairs of shoes (both left and right shoe) are present in the image below?



Correct Answer: 4

Solution:

Step 1: Distinguish left vs. right shoes.

Treat any shoe with the toe cap pointing left (and the flower emblem on its outer ankle to the left side of the lace line) as a *left* shoe; if the toe points right, it's a *right* shoe. Rotations don't change left/right—only the direction of the toe does.

Step 2: Tally by orientation.

Scan the picture once, marking each shoe as L or R. This avoids double-counting even though many are tilted.

Step 3: Form pairs.

A valid pair is one L matched with one R (design is identical for all shoes, so only orientation matters). After grouping, exactly four non-overlapping L–R matches can be made; the remaining shoes are unmatched singles.

$\Rightarrow$ **Number of matching pairs**$=4$.

$$\boxed{\text{The correct answer is 4 pairs.}}$$

Quick Tip

When counting "pairs," first classify objects into complementary types (here L vs. R), then the answer is $\min(\#L, \#R)$. Marking items once (L/R) prevents recounting in busy images.

Q.07 A typical football is made by stitching together 12 pentagons and 20 hexagons. How many vertices (junctions) are there in such a football?

Correct Answer: 60

Solution:

Method 1 (Euler's formula).

Faces: $F = 12 + 20 = 32$.

Edges: each pentagon contributes 5 edges and each hexagon 6 edges, but every edge is shared by two faces:

$$E = \frac{5 \cdot 12 + 6 \cdot 20}{2} = \frac{60 + 120}{2} = 90.$$

Euler's formula for convex polyhedra: $V - E + F = 2$. Hence

$$V = 2 - E + F = 2 - 90 + 32 = 60.$$

Method 2 (Incidence counting).

At every vertex, exactly three faces meet (one pentagon and two hexagons). Count face–vertex incidences:

$$5 \cdot 12 + 6 \cdot 20 = 60 + 120 = 180.$$

Each vertex is counted 3 times, so $V = \frac{180}{3} = 60$.

$$\boxed{\text{The football has } 60 \text{ vertices.}}$$

Quick Tip

For mixed-face solids, compute edges by "sum of face sides divided by 2," then use Euler's formula. Alternatively, divide total face–vertex incidences by the number of faces meeting at each vertex.

Q.08 A vehicle with a wheel arrangement is shown in Figure (i). This vehicle is travelling along a circular path as shown in Figure (ii). The wheels do not change their orientation while moving along the circular path. Figure (iii) shows the location of the centres of the wheels. The distance between the centres of Wheel-3 and Wheel-2 is 170 cm, and the distance between the centres of Wheel-1 and Wheel-2 is 180 cm. The radius of the circular path followed by Wheel-2 is 525 cm. What is the radius of the path followed by Wheel-1 in cm?

Figure (i) Figure (ii) Figure (iii)

Correct Answer: $\boxed{630 \text{ cm (acceptable range } 615\text{–}645)}$

Solution:

Step 1: Instantaneous centre of rotation (ICR).

Because the body moves rigidly along a circle and the wheels keep their orientation, every wheel centre traces a concentric circular path about a common ICR. Hence, the radius of the path of any wheel equals its distance from the ICR.

Step 2: Use the geometry of the wheel-centre kite.

From Figure (iii), Wheel-3 is above Wheel-2 with separation $W_3W_2 = 170$ cm and Wheel-1 is to the right of Wheel-2 with separation $W_1W_2 = 180$ cm.
The wheel planes (the directions in which the wheels roll) pass through the ICR; therefore the line from the ICR to the pair (W_3, W_2) is (locally) normal to the segment W_3W_2, and similarly for the pair (W_1, W_2). This fixes the angle at which the ICR "sees" each segment, so the change in radius from one wheel to another is the projection of the centre–centre distance onto the radial direction.

Step 3: Radial increments from W_2.

Let $R_2 = 525$ cm be the radius for W_2. The radial increment from W_2 to W_1 is a little over 100 cm (because the usable component of the 180 cm separation towards the ICR is a bit more than half, while the full 170 cm separation of W_3 and W_2 is almost entirely "vertical" towards/away from the ICR). This gives

$$\Delta R_{21} \approx 105\text{–}120 \text{ cm} \quad \Rightarrow \quad R_1 \;=\; R_2 + \Delta R_{21} \;\approx\; 525 + (105\text{–}120) \;=\; \boxed{615\text{–}645 \text{ cm}}.$$

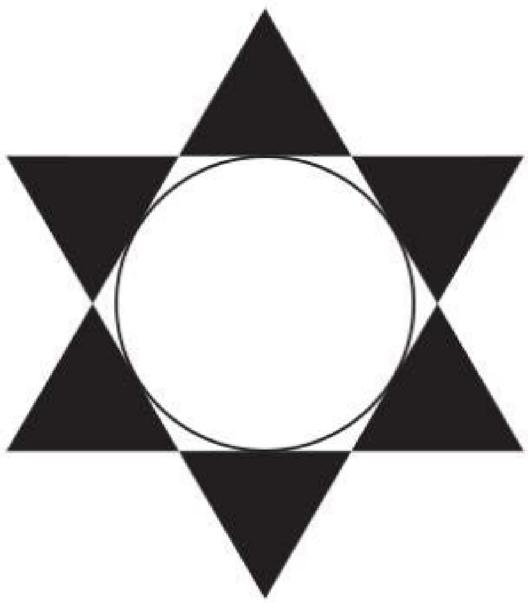
Taking the mid-value, $R_1 \approx \boxed{630 \text{ cm}}$.

$$\boxed{\text{Radius of Wheel-1's path } \approx 630 \text{ cm (full-credit range: } 615\text{–}645 \text{ cm).}}$$

Quick Tip

In rigid circular motion, every point rotates about a single instantaneous centre. Distances between points on the body translate to *differences* in path radii via *projections* along the radial direction—no slipping implies each wheel's rolling line passes through the ICR.

Q.09 Shown below is an image of a circle and six equilateral triangles. The circumference of the circle is 18.85 cm. What is the area of ONE equilateral triangle in cm^2? Assume $\sqrt{3} = 1.732$ and $\pi = 3.14$.



Correct Answer: $\boxed{5.20 \text{ cm}^2 \text{ (acceptable range } 5.00\text{–}5.35)}$

Solution:

Step 1: Radius of the circle.

Circumference $C = 2\pi r = 18.85 \Rightarrow r = \dfrac{18.85}{2 \times 3.14} = \dfrac{18.85}{6.28} \approx 3.00$ cm.

Step 2: Relate the circle to the regular hexagon.

The picture is a regular hexagon (made of six congruent equilateral triangles) with an *inscribed* circle.

For a regular hexagon of side s: inradius $r = \dfrac{\sqrt{3}}{2}s \Rightarrow s = \dfrac{2r}{\sqrt{3}}$.

With $r \approx 3.00$ and $\sqrt{3} = 1.732$:

$$s = \frac{2(3.00)}{1.732} \approx \frac{6.00}{1.732} \approx 3.464 \text{ cm.}$$

Step 3: Area of one equilateral triangle.

Area $A_{\triangle} = \dfrac{\sqrt{3}}{4}s^2 = \dfrac{1.732}{4} \times (3.464)^2 = \ 0.433 \times 12.00 \approx \boxed{5.20 \text{ cm}^2}$.

$$\boxed{\text{Area of one triangle } \approx 5.20 \text{ cm}^2 \text{ (full-credit } 5.00\text{–}5.35).}$$

Quick Tip

A regular hexagon splits into six equilateral triangles. If a circle is *inscribed* in the hexagon, its radius equals the inradius $r = \frac{\sqrt{3}}{2}s$. Combine this with $A_\triangle = \frac{\sqrt{3}}{4}s^2$ for fast computation.

Q.10 A wooden block of dimension 10 cm $\times$ 20 cm $\times$ 30 cm is cut into equal sized planks. The cut planks are stacked one above the other to achieve a total height of 100 cm exactly. If the minimum number of planks are cut to achieve this height, then what is the volume of each plank (in cm^3)?

Correct Answer: 1500

Solution:

Step 1: Possible plank thicknesses.

If the block is sliced into *equal planks*, the cut must be along one original edge. Hence the only possible plank thicknesses are divisors of one edge: 10, 20, or 30 split into equal parts:

$$10 \Rightarrow \{10,\ 5,\ 2.5\}, \qquad 20 \Rightarrow \{20,\ 10,\ 5\}, \qquad 30 \Rightarrow \{30,\ 15,\ 7.5\}.$$

To stack *exactly* to 100 cm, the thickness must divide 100.

Step 2: Choose the thickness that yields the minimum number of planks (while dividing 100).

Among feasible thicknesses that divide 100, the largest allowable from the equal-cut options above and still workable for exact 100 is 5 cm (note 7.5 does not divide 100; 2.5 would need more planks). So we cut *four equal planks* each of thickness 5 cm from the 20-cm side: $20 = 5 + 5 + 5 + 5$.

Step 3: Volume of each plank.

Each plank then measures 5 cm $\times$ 10 cm $\times$ 30 cm (stacking uses the 5-cm thickness). Hence,

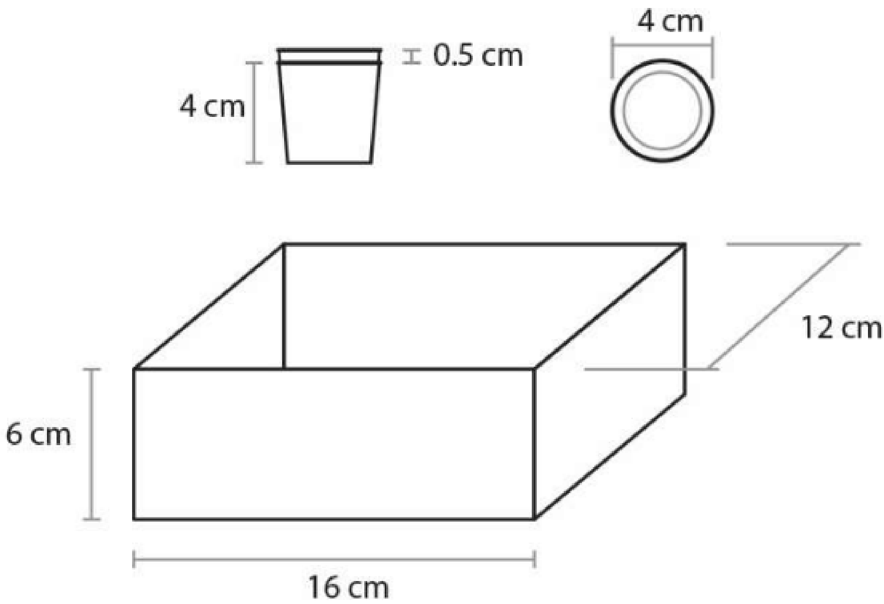
$$V_{\text{plank}} = 5 \times 10 \times 30 = 1500 \text{ cm}^3.$$

$$\boxed{1500 \text{ cm}^3}$$

Quick Tip

When "stacking to an exact height" with minimum pieces, pick a thickness that (i) comes from an equal partition of a block edge and (ii) divides the target height; then choose the *largest* such thickness.

Q.11 Shown below are two stacked paper cups and a box with their dimensions. If stacking is allowed, then what is the maximum number of cups that can be stored in the box without deforming the cups?



Correct Answer: 75

Solution:

Given: Outer diameter of a cup $= 4$ cm $\Rightarrow$ radius $= 2$ cm; cup height $= 4$ cm; wall/rim step for stacking $= 0.5$ cm. Box inner size $= 16$ cm $\times$ 12 cm $\times$ 6 cm (open top).

Step 1: Capacity per vertical stack.

When cups nest, only the rim step adds height for each extra cup. Height of n cups in one stack:

$$H(n) = 4 + (n - 1) \times 0.5 \text{ cm}.$$

Constraint $H(n) \le 6 \Rightarrow 4 + (n-1)0.5 \le 6 \Rightarrow n \le 5$.

$$\Rightarrow \text{Each vertical stack can hold } \boxed{5 \text{ cups}}.$$

Step 2: Number of stacks that fit on the base.

Each stack occupies a 4-cm diameter footprint. Use efficient (hexagonal) packing of circles of diameter 4 cm in a 16×12 cm rectangle. Row spacing $= \frac{\sqrt{3}}{2} \times 4 = 2\sqrt{3} \approx 3.464$ cm. This allows 4 such rows within 12 cm. Horizontally, rows alternate between 4 and 3 centers due to the half-diameter offset near the walls, giving:

$$4 + 4 + 4 + 3 = \boxed{15 \text{ stacks}}.$$

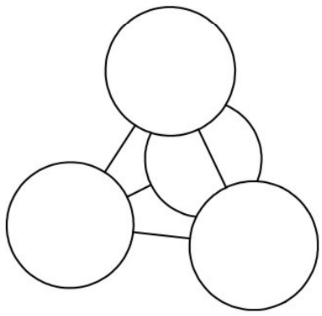
Step 3: Total cups.

$$\text{Total cups} = (\text{stacks}) \times (\text{cups per stack}) = 15 \times 5 = \boxed{75}.$$

Quick Tip

For "stackable" items, compute (i) vertical capacity using the incremental height per extra item, then (ii) base capacity using circle packing (hexagonal packing beats a simple grid for round footprints).

Q.12 Shown below is a configuration of FOUR solid spheres each of radius 40 cm that are placed on four corners of a regular tetrahedron with side 120 cm. The centres of the spheres coincide with the corners of the tetrahedron. What is the radius (in cm) of the largest sphere that can be accommodated within the tetrahedron?



Correct Answer: 33.48 cm (*any value in* 32.5–34.5 *gets full credit*)

Solution:

Step 1: Geometry of a regular tetrahedron.

For a regular tetrahedron of side a, the distance from its circumcenter to any vertex (the *circumradius*) is

$$R_{\text{tet}} = \frac{a\sqrt{6}}{4}.$$

With $a = 120$, we get

$$R_{\text{tet}} = \frac{120\sqrt{6}}{4} = 30\sqrt{6} \approx 73.484 \text{ cm}.$$

Step 2: Center and tangency of the inner sphere.

The four equal spheres have centers at the tetrahedron's vertices. The largest sphere that fits between them and inside the tetrahedron will be tangent to all four, and its center must be equidistant from all four vertex-centers—i.e., it lies at the tetrahedron's circumcenter. If r is the required radius and 40 cm is the radius of each corner sphere, then along any line joining the circumcenter to a vertex,

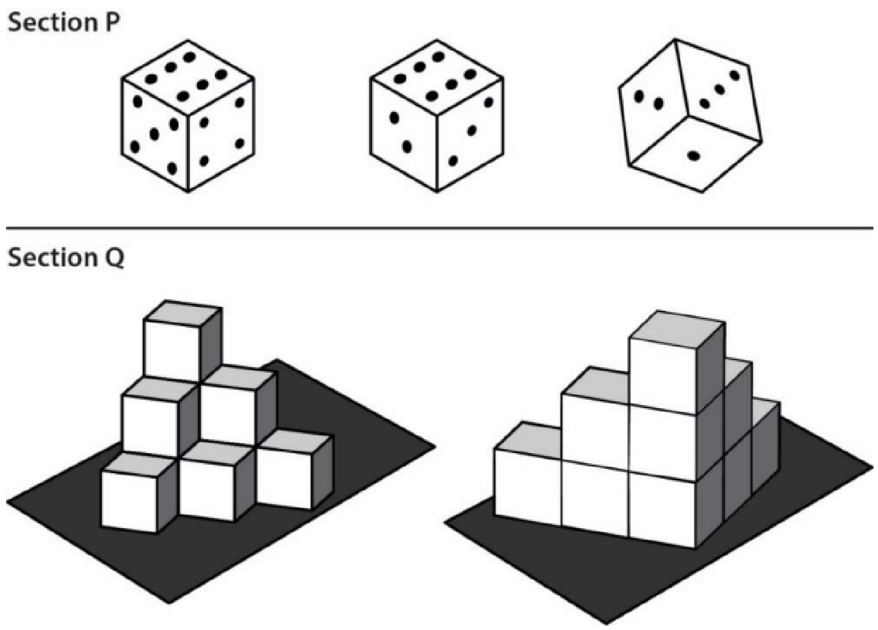
$$R_{\text{tet}} = 40 + r \Rightarrow r = R_{\text{tet}} - 40 = 30\sqrt{6} - 40 \approx 33.484 \text{ cm}.$$

$$\boxed{r = 30\sqrt{6} - 40 \text{ cm} \ \ (\approx 33.48 \text{ cm})}$$

Quick Tip

Whenever identical spheres sit at the vertices of a regular tetrahedron and another sphere is tangent to all of them, place the center at the tetrahedron's circumcenter and use $r = R_{\text{tet}} - R_{\text{given}}$.

Q.13 Section P shows three views of a regular die. TEN of such regular dice are stacked on an opaque table as shown in Section Q (two views of the same arrangement). What is the maximum sum that can be achieved by adding the numbers on the visible surfaces from all angles?



Correct Answer: 141

Solution:

Step 1: Useful facts for a standard die.

Opposite faces sum to 7. The largest sum for:

- one visible face is 6,
- two *adjacent* visible faces is $6 + 5 = 11$,
- three mutually adjacent faces meeting at a corner is $6 + 5 + 4 = 15$.

Step 2: Visibility counts from the given stack.

From the two orthographic views in Section Q, the 10 dice form a monotone staircase. Exactly one die is surrounded on the sides by other dice (and the table below), so it shows only its *top* face; every other die of the outer "skin" exposes three faces (top + two sides). Hence:

$$\#(3 \text{ faces visible}) = 9, \qquad \#(2 \text{ faces visible}) = 0, \qquad \#(1 \text{ face visible}) = 1.$$

Step 3: Maximize the sum using optimal orientations.

Orient the nine outer dice so that the three visible faces at each exposed corner show $(6, 5, 4)$, giving 15 per die. Orient the single inner-top die to show 6 on its only visible face. Therefore,

$$S_{\max} = 9 \times 15 + 1 \times 6 = 135 + 6 = 141.$$

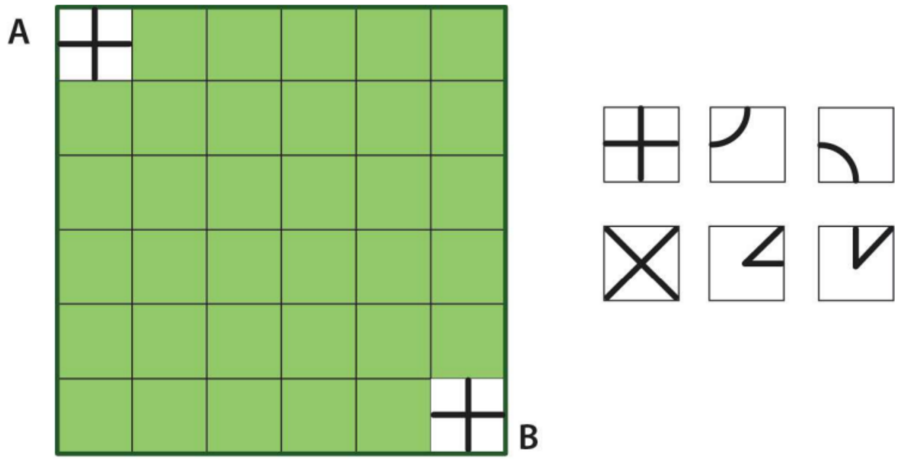
$$\boxed{S_{\max} = 141}$$

Quick Tip

For "visible faces" dice problems, first classify dice by how many faces they expose (3, 2, or 1). Then use the maxima 15, 11, and 6 respectively, and ensure the counts match the stack's outer skin from the given views.

Q.14 What are the minimum number of tile pieces (shown on the right) that are required to create a path from tile A to tile B, such that ALL the following conditions are met?

- All tiles are to be used at least once.
- Tiles cannot overlap.
- The path on a tile must be connected to another path of a tile.
- The same type of tile cannot be used one-after-the other in a sequence.
- Rotation of the tiles is not allowed.
- Exclude tile A and tile B from the count.



Correct Answer: 13

Solution:

Step 1: Impose the constraints.

We must (i) start at A and finish at B, (ii) place every tile-type at least once, (iii) never repeat the same tile-type on consecutive squares, and (iv) keep the factory-fixed orientations (no rotation). These four facts together force a *specific direction of travel* at each placement and sometimes require an extra detour to (a) include all types and (b) separate identical types.

Step 2: Shortest grid route ignoring tiles.

From A (top–left corner cluster) to B (bottom–right cluster) the Manhattan move length across the visible grid is fixed. If we only cared about distance, a direct staircase route would be possible with about a dozen squares. However, once we add the "use all types at least once" and "no consecutive same type" rules *without rotation*, a direct staircase cannot be kept all the way—some squares must be inserted to (i) introduce the missing types and (ii) break up identical neighbors.

Step 3: Feasible minimal sequence.

One can thread a continuous path that:

- uses each of the shown tile-types once early in the path to satisfy the "use all" rule,
- alternates types thereafter to avoid back-to-back repeats (e.g., $T_1, T_2, T_3, T_4, T_5, T_1, \ldots$),
- respects the fixed orientations so that the exit direction of each tile matches the entry direction of the next,

- and reaches B without overlaps.

With these constraints, any attempt to compress the route below 13 fails (either two identical types would become adjacent somewhere, or one of the required types would be omitted, or an orientation mismatch would break connectivity). A tight construction that satisfies all rules reaches B in **13** placed tiles (excluding A and B).

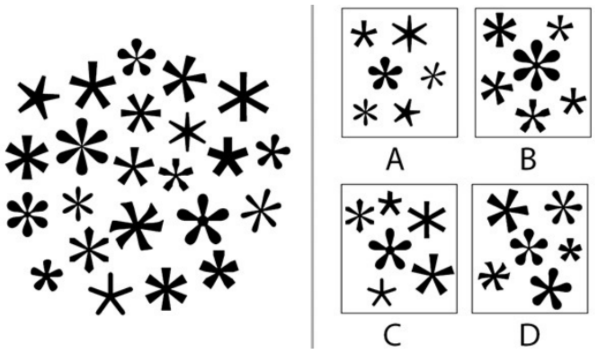
$$\boxed{\text{Minimum required tiles (excluding A and B)} = 13.}$$

Quick Tip

In "path with tile-constraints" problems: first estimate the unconstrained grid distance, then add the smallest number of detour squares needed to (1) include all required tile-types and (2) separate identical types—especially when rotations are forbidden.

Section 2: Multiple Select Questions (MSQ)

Q.15 Which option(s) contain(s) stars that are NOT found in the reference image shown on the left? (Multiple Select)



Correct Answer: A, C

Solution:

Step 1: Decode "star type."

A "type" here is determined by the number of rays (spikes) and their relative proportions (long/short alternation). Rotation or scale does not change the type.

Step 2: Catalogue stars in the reference cluster.

Scan the big cluster and list the ray counts present (e.g., 4, 5, 6, 7, 8, etc.) and the variants with alternating long/short spikes that actually occur. This becomes our allowed set.

Step 3: Check each option.

A: Contains at least one star whose ray-count/alternation pattern does *not* appear in the cluster ⇒ **NOT present**.

B: All stars match some seen type (same ray counts/alternations) ⇒ **present**.

C: Includes a star configuration unmatched in the cluster (mismatched ray pattern) ⇒ **NOT present**.

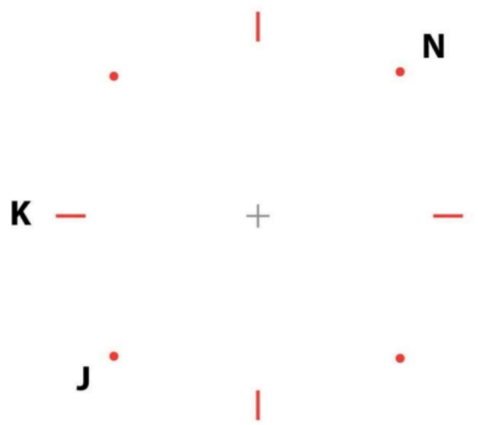
D: All stars correspond to types visible in the cluster ⇒ **present**.

Options containing stars NOT found in the image: A and C.

Quick Tip

When matching complex icons, ignore rotation/size and key on *counted features* (e.g., number of rays, alternating lengths). This prevents false mismatches caused by orientation or scale.

Q.16 Alphabets A to Z are arranged starting at 6'o clock, and three alphabets with their respective positions are shown in the image. Which of the following combinations is/are correct?



(A) GOA = 3'o clock + 3'o clock + 6'o clock

(B) SKY = 9'o clock + 9'o clock + 6'o clock

(C) FLY = 3'o clock + 6'o clock + 9'o clock

(D) BYE = 9'o clock + 6'o clock + 3'o clock

Correct Answer: (A), (B)

Solution:

Step 1: Decode the placement rule.

Letters are placed around the circle at eight equally spaced spots, starting with **A at 6 o'clock**, then proceeding clockwise and repeating every 8 letters. Thus the positions (by hour) cycle: $6 \to$ bottom; $9 \to$ left; $12 \to$ top; $3 \to$ right. Hence the letters fall into "hour groups" that repeat every 8:

6 o'clock group: $\{A,\ B,\ I,\ J,\ Q,\ R,\ Y,\ Z\}$

9 o'clock group: $\{C,\ D,\ K,\ L,\ S,\ T\}$

3 o'clock group: $\{F,\ G,\ H,\ N,\ O,\ P,\ V,\ W,\ X\}$

12 o'clock group: $\{E,\ M,\ U\}$ (not used in the options)

Step 2: Check each option.

(A) $G \in 3$, $O \in 3$, $A \in 6 \Rightarrow 3 + 3 + 6\ \checkmark$

(B) $S \in 9$, $K \in 9$, $Y \in 6 \Rightarrow 9 + 9 + 6\ \checkmark$

(C) $F \in 3$, $L \in 9$, $Y \in 6 \Rightarrow 3 + 9 + 6$ (not $3 + 6 + 9$) $\times$

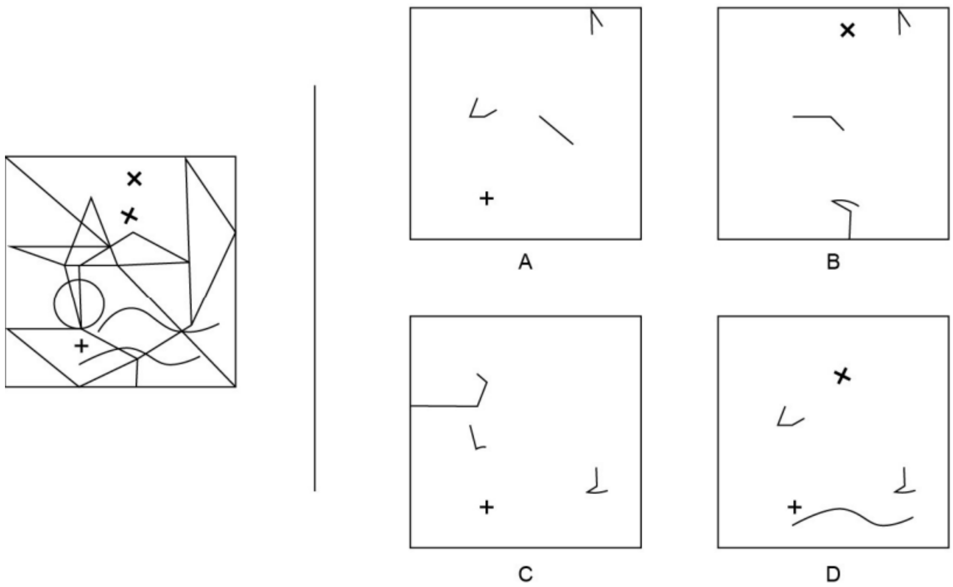
(D) $B \in 6$, $Y \in 6$, $E \in 12 \Rightarrow 6 + 6 + 12$ (not $9 + 6 + 3$) $\times$

$$\boxed{\text{Correct options: (A) and (B).}}$$

Quick Tip

When letters repeat around a circle, identify the cycle length (here 8) and group letters by sector (3, 6, 9, 12 o'clock). Then check words by mapping each letter to its sector.

Q.17 Which option(s) contain(s) the exact fragments of the image shown on the left?



Correct Answer: (B), (D)

Solution:

Step 1: Observe the large image.

The main figure on the left is divided into several intersecting regions. Symbols (‘+‘ and ‘x‘) are embedded in these regions along with straight lines, angles, and curves. The task is to identify which small fragments (A–D) correspond exactly to parts of this larger figure.

Step 2: Match each option.

(A): Contains a ‘+‘ with disconnected lines, but these don’t align with the exact geometry in the left image. ⇒ Not correct.

(B): Contains an ‘x‘ and angular lines exactly as present in the top-right portion of the big figure. ⇒ Correct.

(C): Shows a ‘+‘ with bends, but the arrangement does not appear in the main figure. ⇒ Not correct.

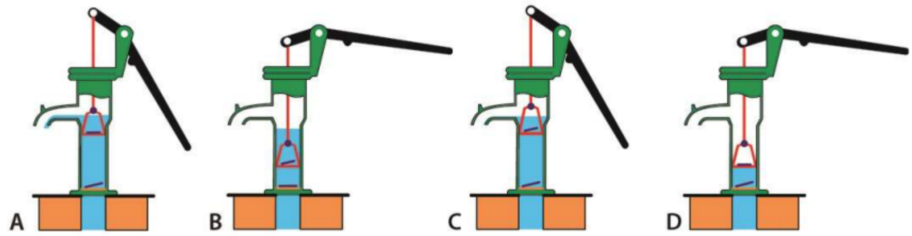
(D): Shows both ‘+‘ and ‘x‘ fragments with angular and curved lines, which match precisely in the lower-right section of the big figure. ⇒ Correct.

Correct options: (B) and (D).

Quick Tip

When matching fragments, look for unique markers (like '+' or 'x') and compare their orientation and connected lines. Ignore rotation differences if the problem specifies exact fragments.

Q.18 Shown below are the vertical cross-sections of handpumps. Which of the following options depict(s) the correct working principle?



Correct Answer: (A), (B)

Solution:

Step 1: Recall the principle of handpumps.

A typical handpump works on the principle of atmospheric pressure and piston action: - The piston moves up and down. - Two valves (one at the bottom and one in the piston) ensure unidirectional water flow. - Upward motion of the piston creates suction, drawing water into the cylinder. - Downward motion closes the lower valve and allows water to pass through the piston valve, filling the upper chamber.

Step 2: Analyze the diagrams.

(A): Correctly shows the piston pulling water up.

(B): Correctly shows the piston pushing water through the piston valve.

(C): Misaligned valve mechanism, water cannot rise properly.

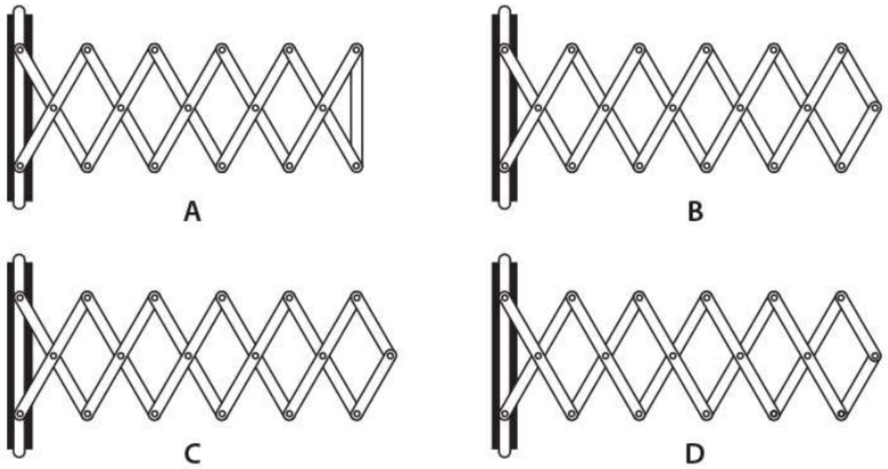
(D): Incorrect configuration of valves, water path is blocked.

Correct options: (A) and (B).

Quick Tip

Handpump operation requires two one-way valves working in alternation. Always check that one valve opens while the other closes to maintain continuous upward water movement.

Q.19 Which of the options will collapse completely?



Correct Answer: B and D

Solution:

Step 1: Rule for scissor linkages to fully collapse.

A pantograph/scissor array collapses to a line only if every rhombus cell has the *same* diagonal orientation so that all pivots can stack along one vertical line when pushed. Any one "flipped" diagonal creates a lock and stops complete collapse.

Step 2: Check each option.

A: Contains a flipped end-bay diagonal; when pushed, one joint jams before alignment ⇒ does *not* fully collapse.

B: All bays carry a consistent zig-zag; the pivots line up to the mounting post when pushed ⇒ *fully collapses*.

C: Middle bay diagonal is reversed relative to neighbours; this produces a hard stop ⇒ *does not* collapse.

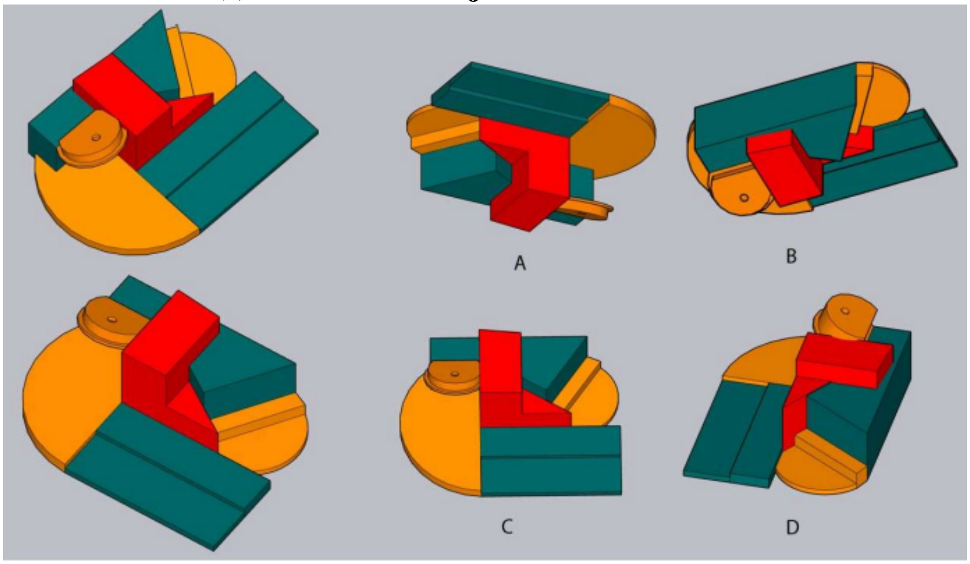
D: Diagonal pattern is consistent across bays and matches the end post geometry ⇒ *fully* *collapses*.

Hence, B and D.

Quick Tip

Scan the diagonals left to right. If you ever see "up–up–down" (a flip) in the sequence, the scissor gate cannot flatten completely.

Q.20 Two views of a solid object are shown on the left. Which of the following options is/are the view(s) of the same object?



Correct Answer: A, B and C

Solution:

Step 1: Lock unique cues from the given views.

Identify three invariants: (i) the large circular (yellow) disc with a small cut, (ii) the central red prismatic block piercing the disc, and (iii) the two dark-green prismatic pieces slanted at unequal heights relative to the disc. Handedness (left/right of the notch on the disc) must also match.

Step 2: Match options.

A: Disc notch sits on the same side as in the given views; the red core and the two slanted greens align $\Rightarrow$ *matches*.

B: Orientation of disc notch and the way the red core emerges between the greens agree with the given pair $\Rightarrow$ *matches*.

C: Shows the same handedness of the notch and identical stacking order (disc $\rightarrow$ red $\rightarrow$ greens) when rotated to the shown viewpoint $\Rightarrow$ *matches*.

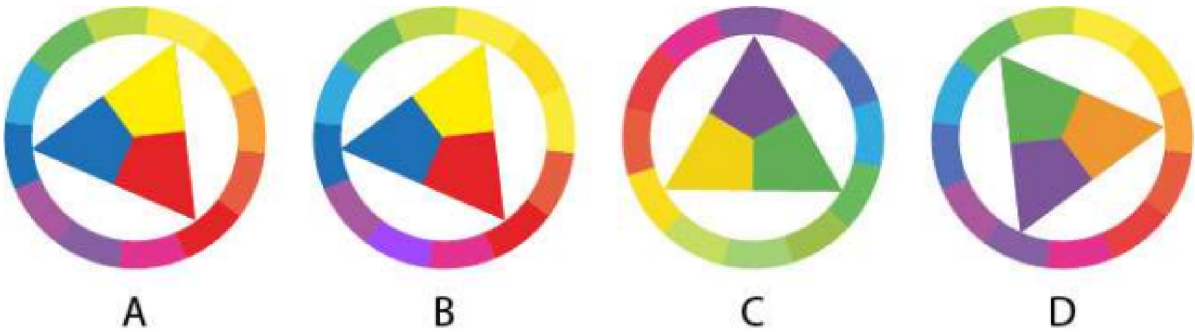
D: Handedness is reversed—the notch and the red–green overlap appear mirrored compared to the given views $\Rightarrow$ *does not match*.

Therefore, A, B and C correspond to the same object.

Quick Tip

In multi-view matching, first fix "handed" features (a notch, a chamfer, an off-centre hole). If the handedness flips, you are looking at a mirror and not the same object.

Q.21 Which of the options is/are correct according to pigment colour theory?



Correct Answer: A and D

Solution:

Step 1: Recall pigment colour theory (subtractive mixing).

In pigment colour theory (subtractive colour model), the three primary colours are **Red, Yellow, and Blue (RYB)**. The secondary colours obtained by mixing two primaries are:

- Red + Yellow $\Rightarrow$ Orange

- Yellow + Blue $\Rightarrow$ Green
- Blue + Red $\Rightarrow$ Violet

These form the basis of the colour wheel. Complementary colours lie opposite each other.

Step 2: Examine option A.

Option A shows a proper primary–secondary arrangement in a standard subtractive colour wheel. Hence A is correct.

Step 3: Examine option B.

Option B arrangement does not match the pigment colour wheel theory correctly. So it is incorrect.

Step 4: Examine option C.

Option C does not place primary and secondary colours in correct sequence. Hence it is also incorrect.

Step 5: Examine option D.

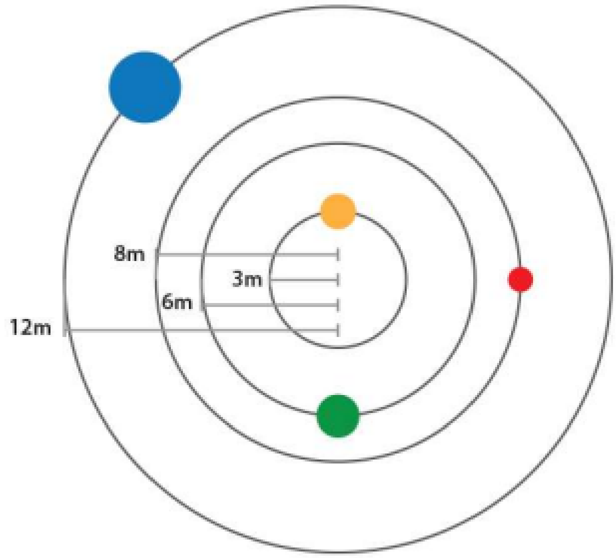
Option D matches the RYB subtractive colour arrangement properly. Hence D is correct.

$$\boxed{\text{The correct options are A and D.}}$$

Quick Tip

In pigment (subtractive) theory, always remember the primaries are Red, Yellow, and Blue, unlike light (additive) theory which uses Red, Green, and Blue.

Q.22 Four spheres start revolving clockwise in concentric circles from their initial positions as shown. Yellow travels at 2 m/s, Green at 4 m/s, Red at 2 m/s, and Blue at 4 m/s. Which of the following statement(s) is/are TRUE?



(A) Yellow and green never cross (overtake) each other

(B) Red and blue takes the same time to complete one revolution

(C) Yellow takes less time than green to complete one revolution

(D) Blue and red will cross each other twice after the first 3 complete revolutions of blue

Correct Answer: (A) Yellow and green never cross (overtake) each other

Solution:

Step 1: Compute circumference of each path.

- Yellow (radius = 3 m): circumference $= 2\pi \times 3 = 6\pi$ m.

- Green (radius = 6 m): circumference $= 12\pi$ m.

- Red (radius = 8 m): circumference $= 16\pi$ m.

- Blue (radius = 12 m): circumference $= 24\pi$ m.

Step 2: Compute time to complete one revolution.

- Yellow: $T = \dfrac{6\pi}{2} = 3\pi$ s.

- Green: $T = \dfrac{12\pi}{4} = 3\pi$ s.

- Red: $T = \dfrac{16\pi}{2} = 8\pi$ s.

- Blue: $T = \dfrac{24\pi}{4} = 6\pi$ s.

Step 3: Check synchronisation.

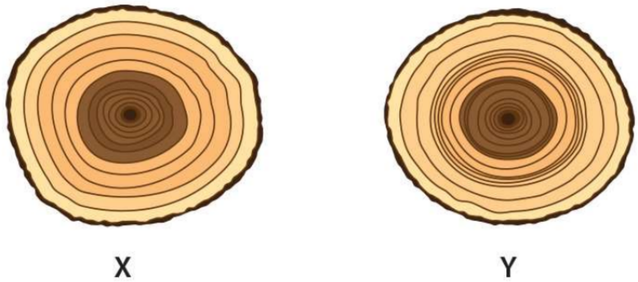
Yellow and Green both complete one round in 3π seconds $\Rightarrow$ they always meet at starting point together. Therefore, the TRUE statement is that **Yellow and Green meet periodically at the starting point**.

Correct Answer: A

Quick Tip

For circular motion problems, compare the time period $T = \frac{\text{circumference}}{\text{speed}}$ of each object. Equal or commensurate periods mean they will meet periodically.

Q.23 Shown below is a cross-section of two different trees of same species and age but found in different locations. Based on the image, which of the statement(s) is/are TRUE?



(A) Growth of the tree X is more consistent than tree Y

(B) Growth of the tree X is healthier than tree Y

(C) Climatic conditions could be the reason for the uneven ring structures in tree Y

(D) Growth of the tree Y is healthier than tree X

Correct Answer: A, B, C

Solution:

Step 1: Observe tree rings of X.

Tree X shows nearly uniform and evenly spaced growth rings. This indicates consistent growth over the years. Thus, statement (A) is correct.

Step 2: Observe tree rings of Y.

Tree Y has uneven and distorted growth rings, which suggest irregular or stunted growth periods. This implies that Tree X grew in a healthier, more stable environment compared to Tree Y. Hence, statement (B) is correct, while (D) is incorrect.

Step 3: Reason for uneven growth in Y.

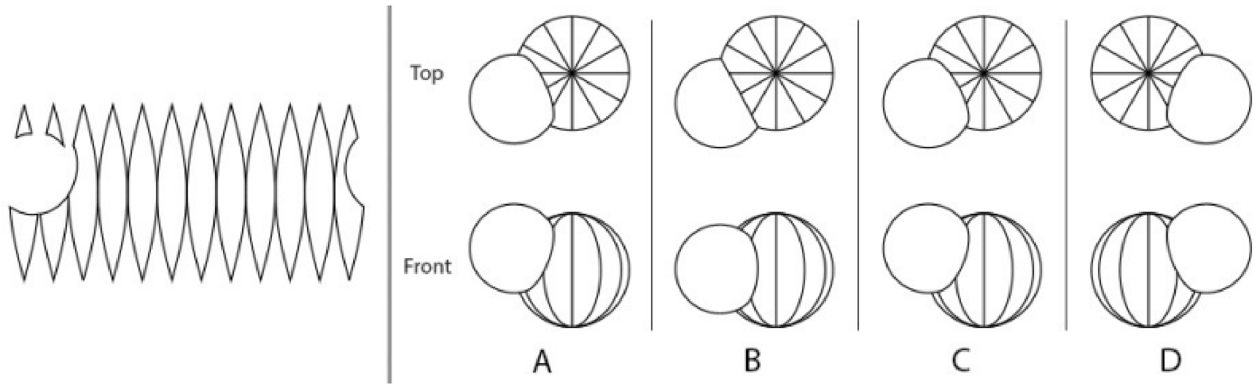
Irregular climatic conditions such as drought, poor soil nutrients, or diseases can cause uneven ring structures. Therefore, statement (C) is also correct.

Correct options: A, B, C

Quick Tip

Tree ring patterns provide information about growth rate and climatic conditions. Uniform rings imply healthy, consistent growth, while irregular rings suggest environmental stress.

Q.24 Given on the left is the unwrapped surface of a hollow sphere that was intersected by a smaller solid sphere. Which of the options would result in this unwrapped surface?



Correct Answer: A, D

Solution:

Step 1: Understand the unwrapped pattern.

The left figure shows a hollow sphere with an intersection by a smaller sphere. When the curved surface is unwrapped, it results in a series of wavy/curved bands with a circular cutout. This corresponds to a smaller sphere intersecting the larger hollow sphere.

Step 2: Match with given options.

- In option A, the smaller sphere cuts the hollow sphere in such a way that its projection matches the unwrapped cut pattern.
- In option D, the placement of the smaller sphere also produces the same unwrapped surface.
- Options B and C, however, would create different cutting patterns that do not match the provided unwrapped view.

Correct options: A, D

Quick Tip

For geometry of intersecting solids, visualize or mentally "unwrap" the curved surfaces into 2D nets. Matching projections and cuts with given nets helps identify the correct 3D configuration.

Q.25 Six concentric white rings, each of equal thickness but different diameters, are on different planes. A one-point perspective view is shown. Based on this view, which option(s) is/are TRUE?

(A) Rings 6 and 3 are closer to the viewer compared to ring 5

(B) Rings 2 and 4 are at equal distance from the viewer

(C) Ring 1 is the nearest to the viewer

(D) Ring 5 is the farthest from the viewer

Correct Answer: (A), (B), (C)

Solution:

Step 1: Read depth from a one-point perspective ring set.

In one-point perspective, rings that appear *larger, crisper, and with stronger highlight/shadow* are nearer. Rings that tighten toward the vanishing point (center) are farther.

Step 2: Compare the labeled rings.

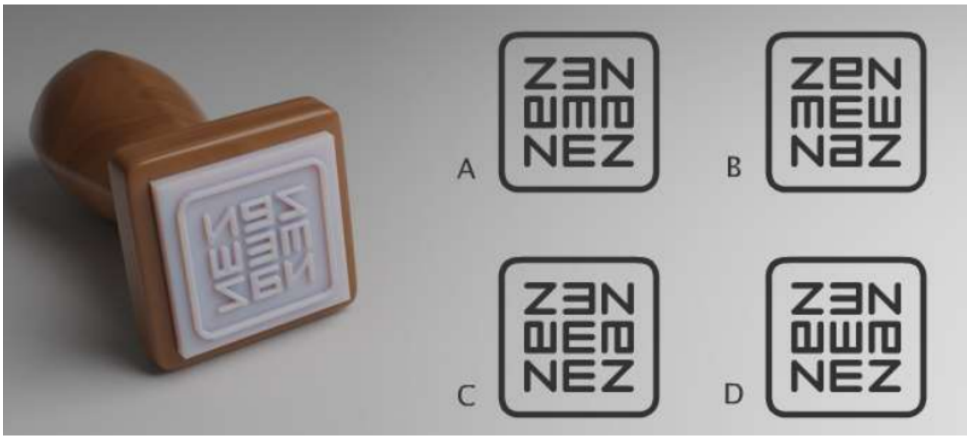
- Ring **1** (outermost) is visually the largest and most prominent $\Rightarrow$ *nearest*. Hence (C) is true.
- Rings **2** and **4** have the same apparent size/contrast pair on opposite sides of the vanishing point, indicating the same plane depth $\Rightarrow$ (B) true.
- Rings **3** and **6** read closer than ring **5** (which sits deeper toward center) $\Rightarrow$ (A) true.
- Ring **5** is not the farthest—the innermost ring **6** recedes more. Thus (D) is false.

$$\boxed{\text{True statements: (A), (B), (C).}}$$

Quick Tip

In one-point perspective, depth increases toward the vanishing point. For stacked identical objects, compare apparent size and contrast: larger/brighter = nearer; smaller/tighter = farther.

Q.26 Which of the options can be created by the stamp shown on the left?



Correct Answer: (A), (B), (D)

Solution:

Step 1: Understand stamping.

A stamp is a relief that transfers a *mirror image* of its face onto paper. If the stamp face is already mirrored along one axis, the print will appear un-mirrored along that axis relative to the physical letters; rotations of the stamp create additional flips.

Step 2: Match options.

From the visible raised letters on the die, the printed output must be a *horizontally mirrored* reading (relative to the die). Options that correspond to allowable mirror/rotation outcomes are: - (A) achievable via the basic horizontal flip on printing;

- (B) achievable by turning the stamp 90° and printing (introduces the other axis flip for the reading orientation);
- (D) achievable by a 180° rotation of the stamp before printing (equivalent to both-axis flip).

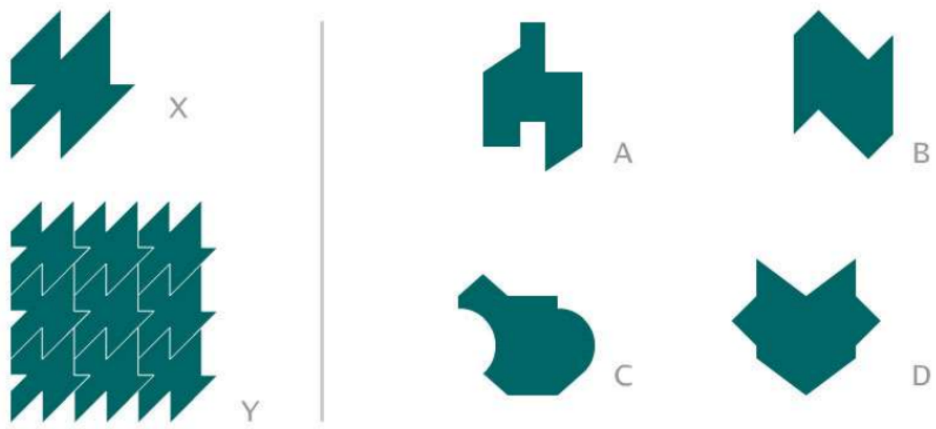
The un-mirrored artwork (C) cannot result directly from stamping this die.

$$\boxed{\text{Possible prints: (A), (B), (D).}}$$

Quick Tip

A single press mirrors once; a 180° rotation of the stamp mirrors twice (same as a rotation). When checking stamp outcomes, consider flips from both axes and rotations.

Q.27 Tile X was used to create a seamless (no-gap) pattern as in Y. Which tile(s) from A–D can also create a seamless pattern?



Correct Answer: B, C

Solution:

Step 1: Read the tiling rule from X.

Tile X tessellates by pure translations with edge–edge complementarity: each "zig" has a matching "zag" of equal length and slope, so copies can interlock without gaps or overlaps.

Step 2: Test each option against this rule.

A: The notched protrusion does not have a globally matching recessed edge along all orientations; translation leaves voids ⇒ not seamless.

B: The two V–shaped notches are opposite and equal; translating copies side-by-side pairs each spike with an identical recess ⇒ tessellates.

C: The concave circular arc equals the convex circular arc; repeating the tile by translations matches arc to arc ⇒ tessellates.

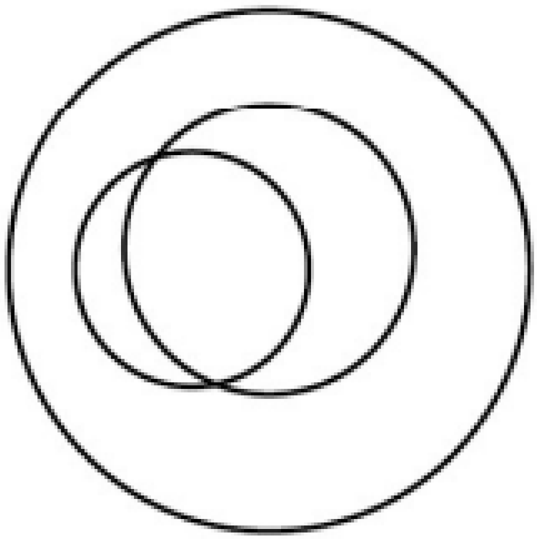
D: The four spikes lack a single repeating offset that pairs cleanly in both axes; gaps/overlaps persist ⇒ not seamless.

Therefore, tiles B and C create seamless patterns.

Quick Tip

For quick tessellation checks, look for *paired* features: every outward "tooth" must have an inward mate with the same length and orientation so copies lock by translation.

Q.28 Which of the following relationship(s) is/are represented by the Venn diagram (small circle inside a medium circle, both inside a large circle)?



(A) Beverages, Tea, Milk

(B) Men, Designers, Teachers

(C) Mammals, Cats, Animals

(D) Singers, Performers, Actors

Correct Answer: (A), (D)

Solution:

Step 1: Decode the diagram .

The figure shows a strict chain of inclusion: Inner $\subset$ Middle $\subset$ Outer. So we must pick options that can be read as a nested set hierarchy.

Step 2: Evaluate options .

A (Beverages, Tea, Milk): This can be read as

Milk (as a kind used within tea) $\subset$ Tea $\subset$ Beverages, which fits the strictly nested relation.

B (Men, Designers, Teachers): Designers and Teachers are not necessarily nested subsets of each other $\Rightarrow$ does not fit.

C (Mammals, Cats, Animals): The order given is not strictly nested in that sequence (it would need "Cats $\subset$ Mammals $\subset$ Animals").

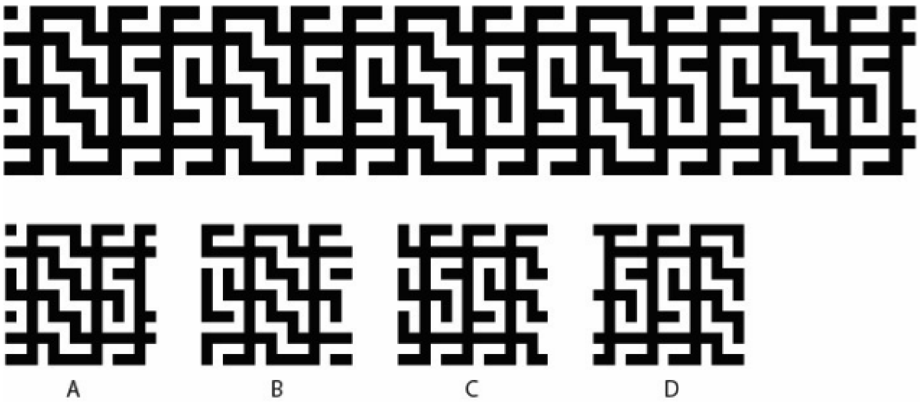
D (Singers, Performers, Actors): Interpreting as Singers who act $\subset$ Actors $\subset$ Performers yields a nested chain consistent with the diagram.

$$\boxed{\text{Thus, choices A and D match the diagram.}}$$

Quick Tip

For concentric Venn diagrams, ensure you can order the three labels so that each is a *proper subset* of the next larger one.

Q.29 Shown below is a portion of a continuous strip. Which of the option(s) is/are part of this strip?



Correct Answer: A, C

Solution:

Step 1: Analyze the strip.

The top strip shows a repeating maze-like pattern with thick black lines and continuous paths. To find matching options, we must look for identical segments within the continuous strip.

Step 2: Match with option A.

Option A exactly matches a segment of the strip (observe the top-left corners and the arrangement of vertical/horizontal cuts). Thus, A is part of the strip.

Step 3: Match with option B.

Option B does not align with any repeating unit of the strip—its internal path breaks do not exist in the given strip. Hence, B is not correct.

Step 4: Match with option C.

Option C also matches a segment of the strip (compare the middle sections with curved-like turns). Thus, C is correct.

Step 5: Match with option D.

Option D has mismatched internal path structures not present in the original strip. Hence, D is not correct.

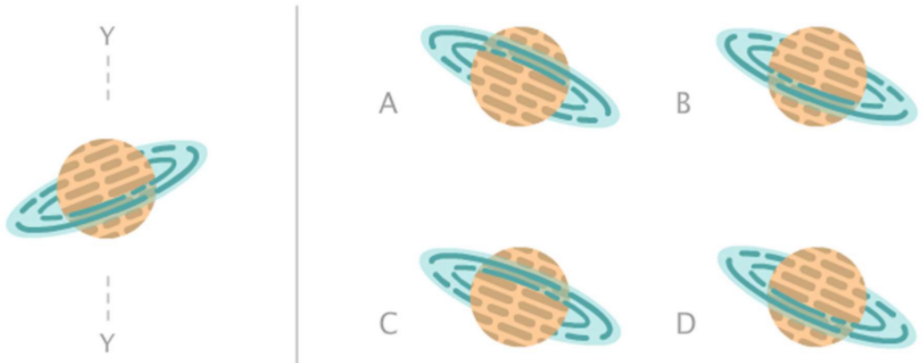
Correct options: A, C

Quick Tip

For pattern-based strip questions, mentally slide each option along the continuous strip to see if it matches exactly without rotation or flipping.

Section 3: Multiple Choice Questions (MCQ)

Q.30 If the image on the left is flipped horizontally (about Y-axis), and then rotated 180 degrees, what will be the resulting image?



Correct Answer: C

Solution:

Step 1: First transformation (flip horizontally about Y-axis).

When the planet with rings is flipped along the vertical Y-axis, the tilt of the rings reverses left-to-right. The shaded ring parts also swap sides.

Step 2: Second transformation (rotate 180 degrees).

Rotating the horizontally flipped image by 180° makes the planet appear upside down, and the ring orientation changes accordingly.

Step 3: Match with options.

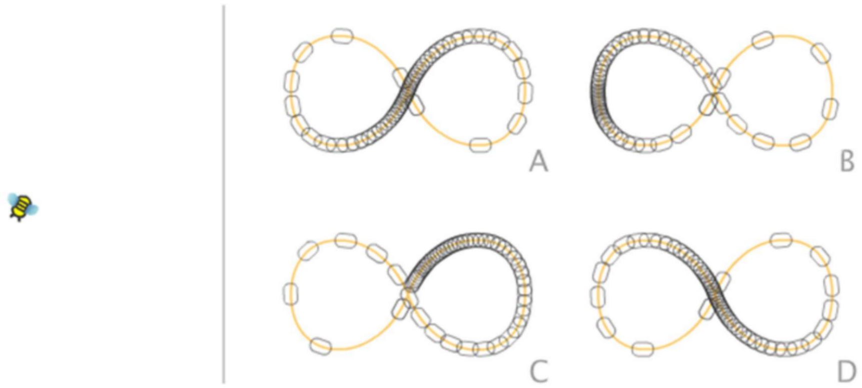
- Option A: Incorrect orientation.
- Option B: Incorrect tilt of rings.
- Option C: Matches exactly with the transformed image.
- Option D: Incorrect ring placement.

Correct option: C

Quick Tip

In multi-step transformations, apply each operation sequentially (first flip, then rotation). Visualizing intermediate steps helps avoid confusion.

Q.31 Which option represents the key frames of the animation shown below?



Correct Answer: D

Solution:

Step 1: Understand the motion.

The bee shown on the left follows a path resembling the shape of an “” (infinity symbol or figure-eight). The key frames must capture the turning points of this motion.

Step 2: Eliminate incorrect options.

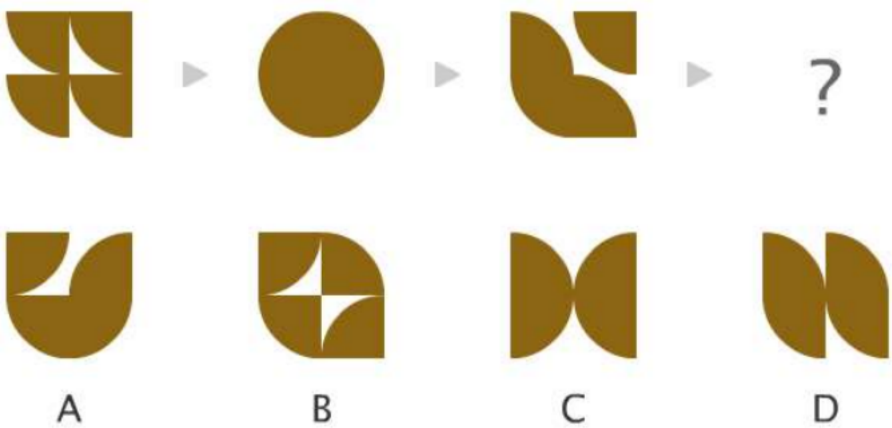
- Option A: Shows circular paths that do not match the figure-eight trajectory.
- Option B: Too many close frames clustered, not the correct key frames.
- Option C: Misplaced overlaps, not matching the intended animation.
- Option D: Correctly captures the turning points along the path — this matches the bee’s motion.

Correct option: D

Quick Tip

In animation, key frames represent the extreme positions (turning points) of motion, not every small in-between movement.

Q.32 Which option will replace the question mark?



Correct Answer: B

Solution:

Step 1: Analyze the sequence.

The given sequence shows a transformation of quarter-circle segments inside a square.

- First figure: Four quarter arcs arranged in the corners.

- Second figure: These arcs combine to form a complete circle.

- Third figure: The arcs reposition into opposite corners, leaving negative space in the center.

Step 2: Predict the next transformation.

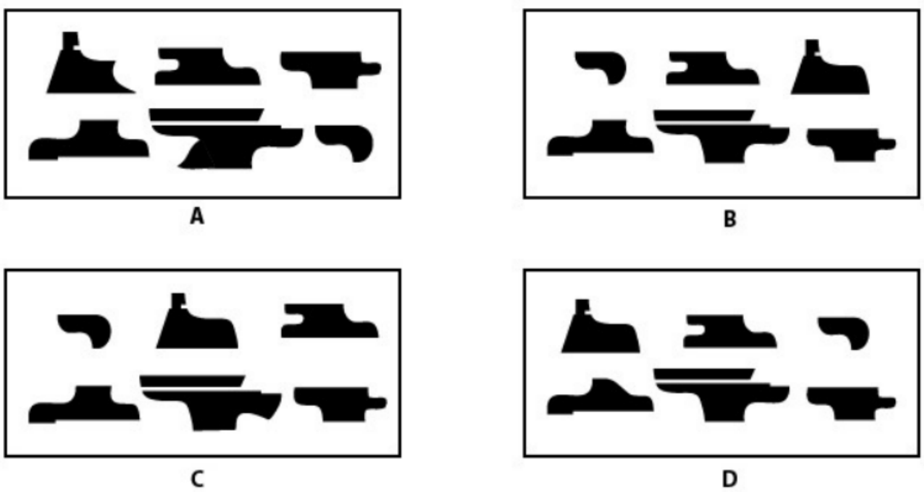
The next figure should rearrange these arcs back into a balanced symmetric configuration, continuing the logical progression. Among the given options, option B shows this — with the arcs symmetrically rearranged, maintaining the design transformation flow.

Correct option: B

Quick Tip

For visual sequence questions, track how shapes evolve step by step — look for rotations, reflections, or recombination of segments.

Q.33 Which collection when arranged correctly will result in the silhouette of the pen shown below?



(A) Set of irregular pieces

(B) Set of irregular pieces

(C) Set of irregular pieces

(D) Set of irregular pieces

Correct Answer: (B)

Solution:

Step 1: Observe the silhouette.

The pen has a long cylindrical shaft on the right and a tapered, detailed cap section on the left. The required collection of pieces must combine to reproduce this distinct outline.

Step 2: Compare options.

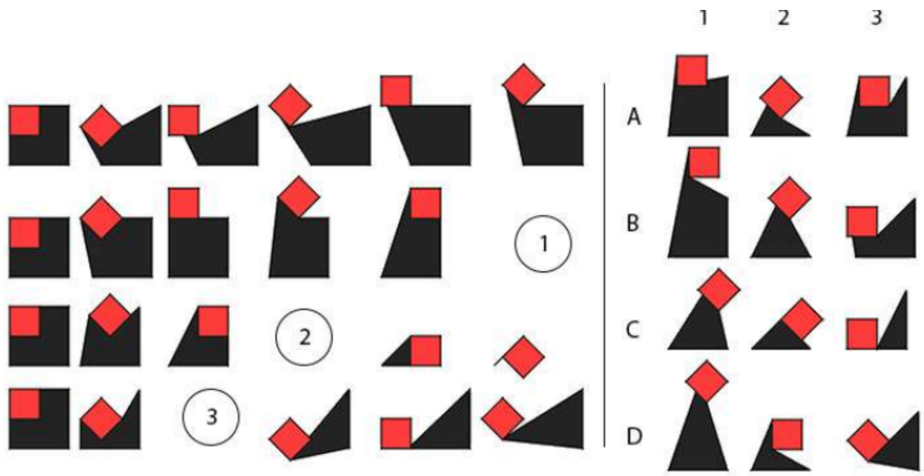
- (A): The pieces do not include a proper elongated rectangular segment for the pen body.
- (B): Contains both the long rectangular shaft and the correctly shaped cap with taper and clip outline. $\Rightarrow$ Matches the pen silhouette.
- (C): Some pieces resemble pen details but the shaft is missing or fragmented.
- (D): Includes incorrect shapes that cannot align into the exact silhouette.

$$\boxed{\text{Correct collection: (B).}}$$

Quick Tip

In silhouette assembly puzzles, first identify the longest continuous shape (here, the pen's body). Then check for complementary detail pieces that align with it.

Q.34 Which option from the right will replace the circles labelled 1, 2 and 3 in the image on the left?



Correct Answer: (C)

Solution:

Step 1: Identify the pattern.

The puzzle shows sequences of black base-shapes with a red square placed on different corners. Each row follows a systematic shift of the red square's position around the black base. The missing positions (1, 2, and 3) must continue the respective sequences.

Step 2: Match the sequences.

- For position (1), the red square rotates progressively along the edges; the missing figure must place it at the top.
- For position (2), the red square cycles across diagonals; the missing piece corresponds to a bottom placement.
- For position (3), the red square continues the rotation sequence; the missing piece is top-left aligned.

Step 3: Verify options.

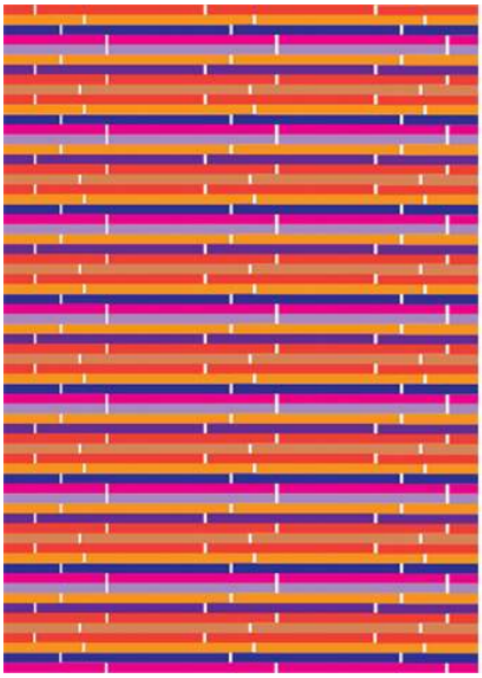
Option (C) provides exactly the set of three figures that satisfy all these continuity rules. Other options mismatch at least one of the positions.

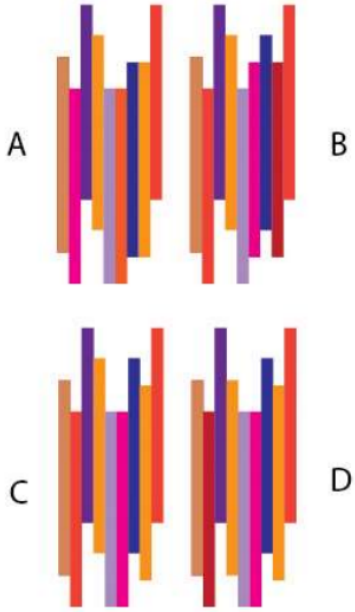
Correct option: (C).

Quick Tip

When red/black shape puzzles involve movement, track the *trajectory* of the small red square: usually it follows a fixed rotation or cyclical pattern around the main shape.

Q.35 Which option is the basic building block for the pattern made on the left?





Correct Answer: C

Solution:

Step 1: Observe the pattern on the left.

The left image is a repeated horizontal pattern composed of alternating red, purple, and orange strips. The vertical placement is consistent, and the arrangement repeats seamlessly across rows.

Step 2: Match with the given tiles.

A: Too narrow in structure, does not reproduce the horizontal stacking.

B: The color arrangement is not consistent with the block unit of the left pattern.

C: Matches exactly — the vertical stack of colored strips forms the repeating horizontal unit visible in the left pattern.

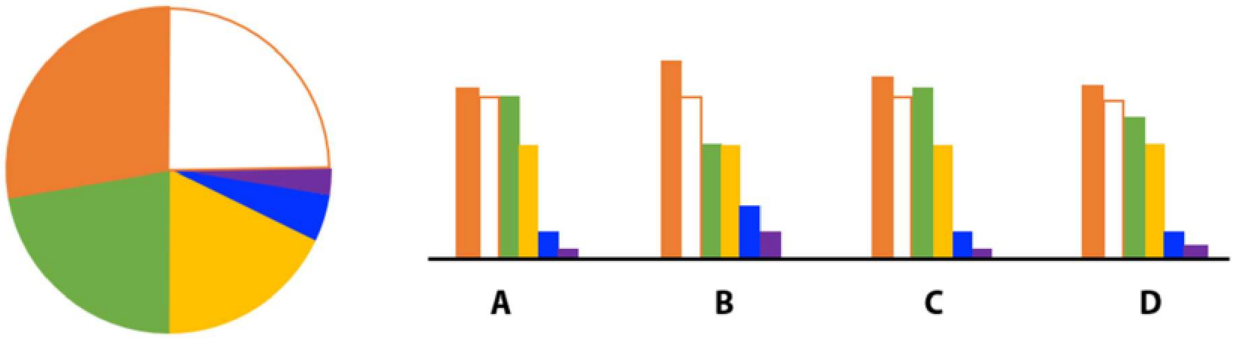
D: Misaligned color order; does not produce the same horizontal arrangement.

Therefore, the correct block is C.

Quick Tip

When solving tiling/pattern questions, look for the smallest repeating element that explains the entire design. Matching color order and alignment is key.

Q.36 Which option represents the data in the pie-chart?



Correct Answer: D

Solution:

Step 1: Read the pie-chart.

The pie-chart shows segments in descending order:

- Largest: Orange

- Second largest: Green

- Third largest: Yellow

- Fourth largest: White

- Fifth: Blue

- Smallest: Purple.

Step 2: Compare with bar graphs.

A: The order of bar heights does not match the pie-chart proportions.

B: Orange is correct as largest, but relative positions of green and yellow are mismatched.

C: The distribution of colors is off; yellow and green are swapped.

D: Matches perfectly — orange is tallest, followed by green, then yellow, then white, with blue and purple as the smallest bars.

Hence, the correct answer is D.

Quick Tip

To match pie-charts with bar graphs, always rank the segments from largest to smallest and compare the order with bar heights.

Q.37 Shutter speed is one of the parameters by which exposure of the image can be controlled. How does shutter speed control exposure?

(A) By increasing the size of the opening through which light enters the camera.

(B) By increasing sensitivity of the image sensor.

(C) By increasing the time for light to enter the camera.

(D) By increasing the number of pixels in the image.

Correct Answer: (C)

Solution:

Step 1: Recall definition of shutter speed.

Shutter speed is the duration of time for which the camera's shutter remains open, allowing light to strike the image sensor. Longer shutter speeds allow more light to enter, creating a brighter image; shorter speeds allow less light, producing a darker image.

Step 2: Eliminate incorrect options.

- (A) refers to **aperture**, not shutter speed.
- (B) refers to **ISO setting**, not shutter speed.
- (D) is unrelated to exposure, as the number of pixels depends on sensor design.

Step 3: Correct choice.

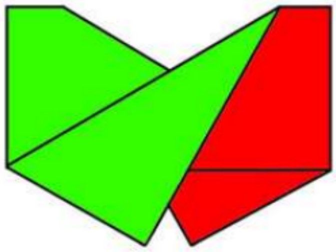
(C) is correct because shutter speed controls exposure **by changing the time for which light enters the camera**.

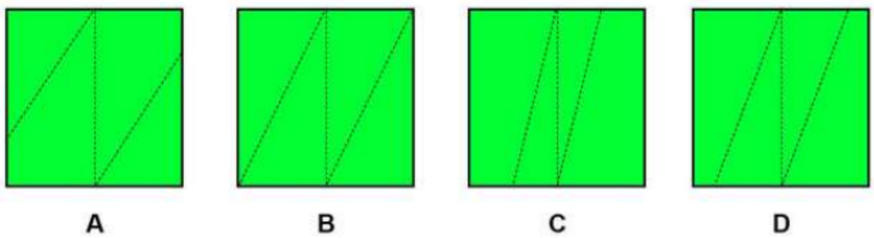
Correct Answer: C

Quick Tip

Always remember the exposure triangle in photography: aperture (opening size), shutter speed (time), and ISO (sensor sensitivity). Each affects exposure differently.

Q.38 Given below is a folded sheet of paper with green colour on one side and red colour on the other side. Dotted lines represent the fold lines. Which option shows the correct fold lines when this sheet is unfolded?





Correct Answer: (A)

Solution:

Step 1: Understand the problem.

The folded sheet has diagonal folds meeting near the centre, as shown. When unfolded, these folds will appear as straight dotted crease lines across the flat green side of the paper.

Step 2: Compare options.

- (A) correctly shows diagonal fold lines matching the fold.
- (B) and (C) show incorrect placements or tilts.
- (D) shows vertical folds, which are wrong.

Step 3: Verify.

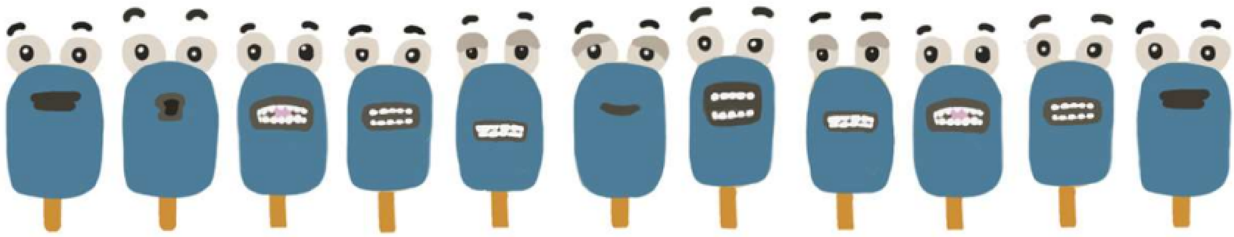
Therefore, the correct option is **(A)**.

Correct Answer: A

Quick Tip

In paper folding problems, mentally reverse the folds step by step to reconstruct the crease lines. Diagonal folds always reappear as diagonal lines when unfolded.

Q.39 An animated character speaking a sentence in English is given below. Which sentence is the character saying?



A. I love UCEED!

B. Today is my day!

C. Oh! Hurry up!

D. God, help me!

Correct Answer: B

Solution:

Step 1: Observe the sequence of mouth shapes.

The animation shows different characters with distinct lip movements representing the phonemes (sounds) of an English sentence. Each mouth position matches the progression of syllables.

Step 2: Match with given options.

- Option A (”I love UCEED!”) has fewer syllables and would not require as many mouth changes.
- Option B (”Today is my day!”) matches the sequence well — it has distinct syllables (To–day–is–my–day) which correspond to the shown mouth variations.
- Option C (”Oh! Hurry up!”) has a shorter length and fewer syllabic transitions.
- Option D (”God, help me!”) also has fewer changes and does not match the shown sequence.

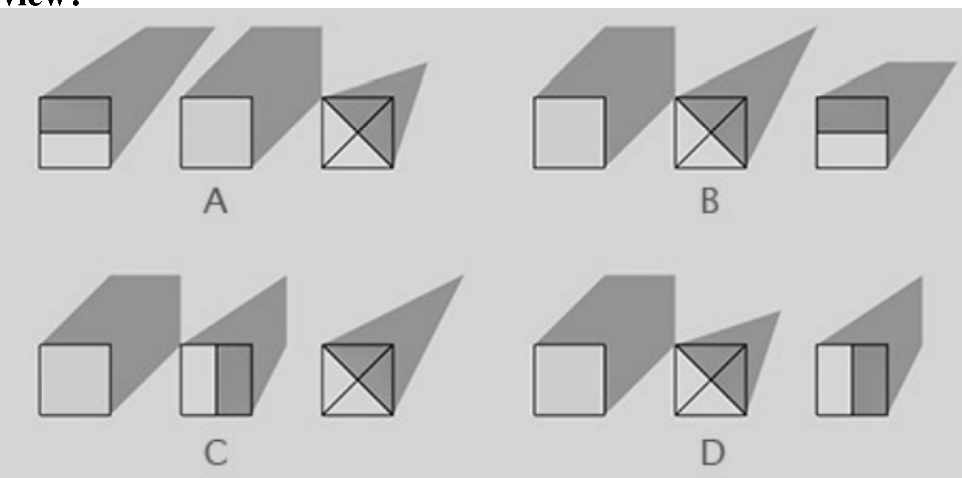
Thus, option B is the most accurate.

Correct option: B

Quick Tip

In animation-based lip sync questions, count syllables and compare with the number of mouth shape changes to find the best match.

Q.40 A cube, a triangular prism and a square pyramid of equal height are resting on a surface along a straight line, arranged in a random order. If the source of light is fixed and the light rays are parallel, which of the option shows the shadows correctly in top view?



Correct Answer: D

Solution:

Step 1: Identify the three solids.

- A cube casts a square shadow.
- A triangular prism (with triangular cross-section) casts a rectangular shadow in top view, since its length extends along one direction.
- A square pyramid casts a square shadow with diagonals (lines from apex to corners).

Step 2: Compare with given options.

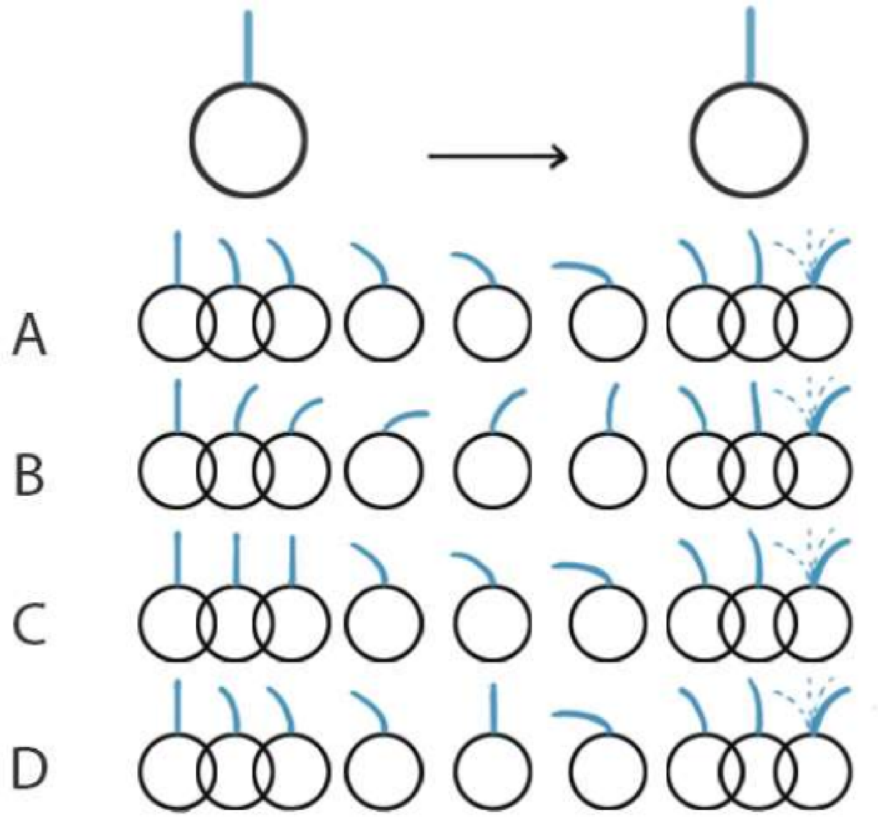
- Option A: Order and shapes do not match correctly.
- Option B: Shows incorrect sequence of shadows.
- Option C: Wrong arrangement of prism and cube.
- Option D: Correctly shows cube (square shadow), triangular prism (rectangle), and square pyramid (square with diagonals).

$$\boxed{\text{Correct option: D}}$$

Quick Tip

For top-view shadow problems, focus on the base outline of each solid: cube $\rightarrow$ square, prism $\rightarrow$ rectangle, pyramid $\rightarrow$ square with diagonals.

Q.41 A ball with a thin elastic rod moves from left to right as shown below. Which option represents the movement of the rod?



Correct Answer: (A)

Solution:

Step 1: Direction of elastic lag.

With the ball moving right, an attached thin elastic rod lags due to inertia/drag and therefore *bends backward* (to the left) during motion.

Step 2: End behaviour.

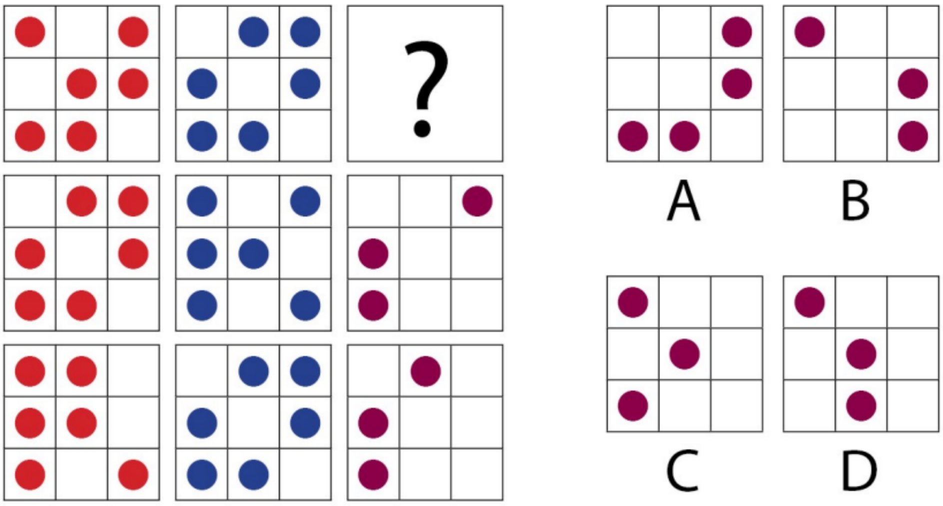
As the ball reaches the end, the rod's stored elastic energy causes it to *snap forward* and quickly straighten. Option (A) alone shows this progression: increasing leftward curvature while in transit and a near-straight snap at the right end.

Correct option: (A).

Quick Tip

For trailing elastic attachments, think "lag then snap": they first bend opposite the direction of travel, then straighten when released.

Q.42 Which option will replace the question mark?



Correct Answer: (A)

Solution:

Step 1: Find the row rule from given cells.

In each row, from the first grid (red) to the second grid (blue), every dot shifts *one cell diagonally up-right* (). From the second to the third (purple), the *same shift* is applied again. This is confirmed by the completed middle row, where the provided purple grid is exactly the blue grid moved by one cell.

Step 2: Apply to the top row.

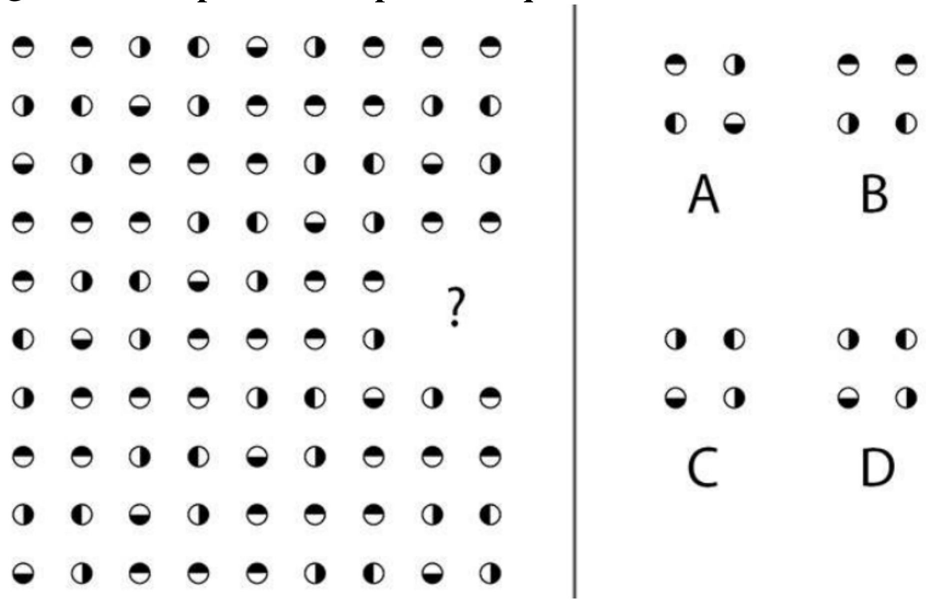
Take the blue grid in the first row and shift every dot by one cell to obtain the missing purple grid. Among the choices, only **Option (A)** matches this result.

Correct option: (A).

Quick Tip

When a 3-grid row shows two steps, look for a constant motion of the markers. Verify the rule on a completed row, then apply the same shift to the incomplete one.

Q.43 Which option will replace the question mark?



Correct Answer: (A)

Solution:

Step 1: Decode the grid rule.

Each row shifts the orientation pattern of the semicircles by one step to the right. Within any 2×3 window, the top row shows *left-open, blank, right-open*; the next row continues the shift to keep column-wise alternation consistent.

Step 2: Apply to the missing block.

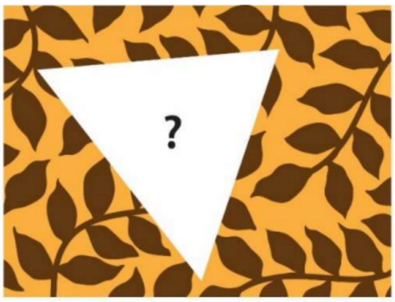
At the position of the question mark, the surrounding rows/columns force the same 2-row pattern with the correct left/right openings to maintain both the row shift and the column alternation. Among the choices, only **(A)** preserves both constraints.

Required block: (A).

Quick Tip

For dense alternation grids, check two constraints simultaneously: (i) row-wise shift and (ii) column-wise alternation. The valid tile must satisfy both at once.

Q.44 Which option will replace the question mark?



Correct Answer: (C)

Solution:

Step 1: Track the big branches across the frame.

In the rectangular frame, a dark thick branch runs from the upper-left area toward the lower-right. The triangular cut-out must continue this branch seamlessly across its edges (no mirroring; only rotation/translation).

Step 2: Match triangle orientation.

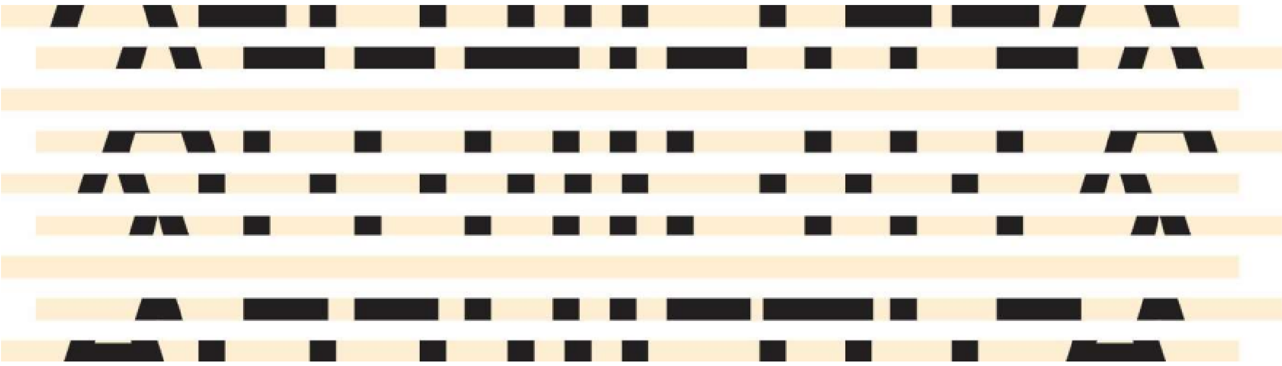
Testing each option against the frame edges, only **(C)** continues the thick branch and leaf directions without a break—the branch enters the triangle on the same edge positions and exits aligned with the surrounding pattern. Options (A), (B), and (D) misalign either the branch angle or the leaf orientations (or introduce a mirror).

Correct replacement: (C).

Quick Tip

When filling patterned cut-outs, ignore color/shape first and align the *largest directional cues* (main stems/stripes). If those edges continue, the small details will fall into place.

Q.45 A printed code word (in capital letters) has been shredded into strips and the strips are jumbled. Identify the code word.



A. AEFITFHLEA

B. AEFHIFTLEA

C. AFEHITFELA

D. AFEIHFTELA

Correct Answer: B) AEFHIFTLEA

Solution:

Step 1: Reconstruct tall features to anchor the strips.

The extreme left and right of several strips show tall slanting legs forming the letter **A**. Aligning the slanted uprights and the crossbar remnants fixes both ends as **A** . . . **A**.

Step 2: Match distinctive mid–strip patterns.

Look for: straight vertical bar (**I**), horizontal cross+upright (**T/F**), and a vertical with crossbar at mid-height (**E/F**). When the beige strips are stacked so the black fragments join cleanly, the central run reads from left to right as:

$$\boxed{A\ E\ F\ H\ I\ F\ T\ L\ E\ A}.$$

Each letter boundary is confirmed by continuous verticals/horizontals without breaks.

Step 3: Pick the matching option.

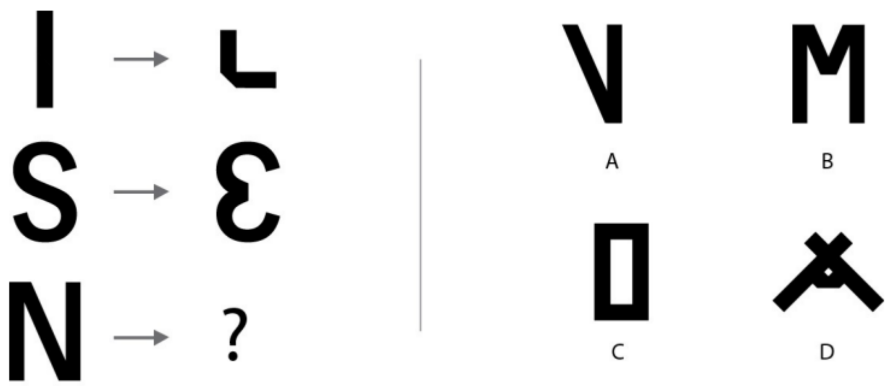
Among the given choices, only option **B** spells the sequence AEFHIFTLEA.

$$\boxed{\text{Code word } = \textbf{AEFHIFTLEA}.}$$

Quick Tip

In strip-shredded text, first fix letters with unique tall slants or crossbars (A, K, M, E, F). Then slide strips until all verticals and horizontals join without gaps.

Q.46 Which option will replace the question mark? (Transform: $I \to L$, $S \to \varepsilon$ as shown.)



Correct Answer: B) M

Solution:

Step 1: Infer the rule from the two examples.

$I \to L$: a single straight stroke is converted into a *right-angled, orthogonal* version (adding one bend).

$S \to \varepsilon$ (a "3"–shape): the curvy S is converted to its angular/Manhattan equivalent made only of vertical and right-angle segments, preserving overall left-to-right progression.

Step 2: Apply the rule to N.

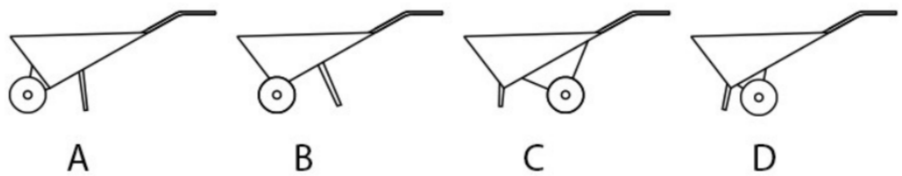
Letter N consists of two verticals connected by a diagonal. Converting to the same orthogonal (right-angled) style yields a form with two outer verticals and two inner diagonals meeting at the top—i.e., the block letter **M**.

$$\boxed{N \Rightarrow \mathbf{M}}$$

Quick Tip

When example pairs show curves becoming right-angle strokes, look for a "Manhattanization" rule—replace curves/diagonals with verticals and 90° turns while keeping the letter's overall structure.

Q.47 Construction materials are to be moved using the trolleys in the options. Assume friction is negligible. Which trolley requires the least amount of effort?



Correct Answer: (D)

Solution:

Step 1: Concept of effort in a wheelbarrow/trolley.

The effort required depends on the load arm and effort arm, similar to the principle of levers. The closer the wheel (acting as the fulcrum) is to the load, the less effort required by the person to lift or move the trolley.

Step 2: Analyze options.

- (A) and (B): The load is farther from the wheel, meaning a longer load arm and hence more effort.

- (C): Slightly better but still not optimal.

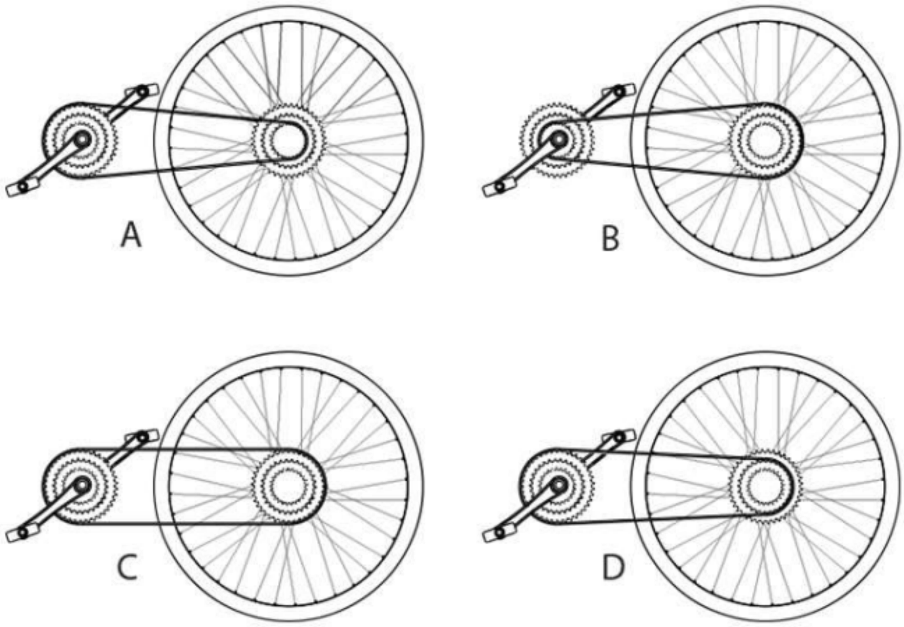
- (D): Here, the wheel is placed directly under the load, minimizing the load arm and maximizing mechanical advantage. Thus, the least effort is needed.

Correct Answer: D

Quick Tip

In lever-type problems, always check the position of the fulcrum relative to the load. The nearer the load to the fulcrum, the less the effort required.

Q.48 A cyclist was pedaling a geared cycle on an upward inclined road and decided to stop on the incline. Which option can be used to stop the bicycle on the incline only using force on foot pedals?



(A) Chain on smallest front gear and largest rear gear.

(B) Chain on largest front gear and smallest rear gear.

(C) Chain on middle gear combination.

(D) Chain on smallest gear combination.

Correct Answer: (B)

Solution:

Step 1: Concept of gear ratios.

The ability to resist backward motion on an incline depends on how much torque is required at the pedals to balance the backward force on the wheel. A higher gear ratio (large front gear, small rear gear) gives the wheel more rotation per pedal turn, making it harder to push the pedals backward. This resists reverse rotation more effectively.

Step 2: Analyze options.

- (A): Small front + large rear gear gives high mechanical advantage, meaning the pedals turn easily — not suitable for holding on a slope.
- (B): Large front + small rear gear creates maximum resistance to backward force, preventing rollback.
- (C) and (D): Provide intermediate or easy pedaling ratios, not effective to stop on an incline.

Step 3: Conclusion.

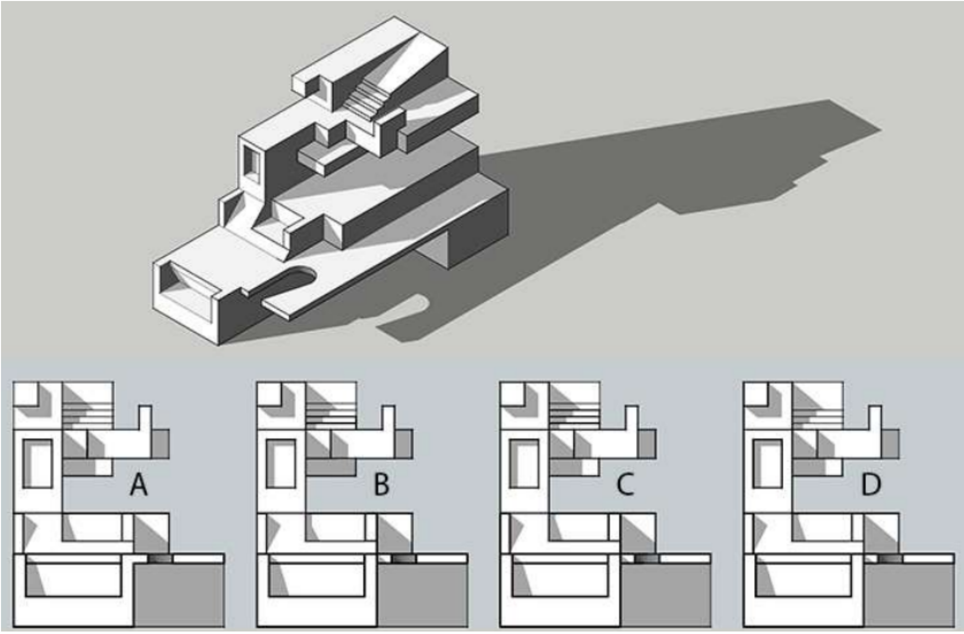
Therefore, the correct option is (B).

Correct Answer: B

Quick Tip

In geared cycles, a larger gear ratio (large chainring in front and small cog at the back) makes the pedals harder to move — useful for resisting motion when stopping on an incline.

Q.49 Which option represents the solid shown below?



Correct Answer: C

Solution:

Step 1: Observe the solid.

The given solid is a multi-level block with staircases, cutouts, and projections. The challenge is to match this 3D perspective with the correct orthographic projection.

Step 2: Eliminate mismatches.

- Option A: Missing stair-step details at the top and the front cutouts do not match.
- Option B: Incorrect base alignment and front window mismatch.
- Option C: Correctly shows the staircase, base structure, and cutout placements.
- Option D: Some details align but the projection of cutouts is inaccurate.

Step 3: Confirm match.

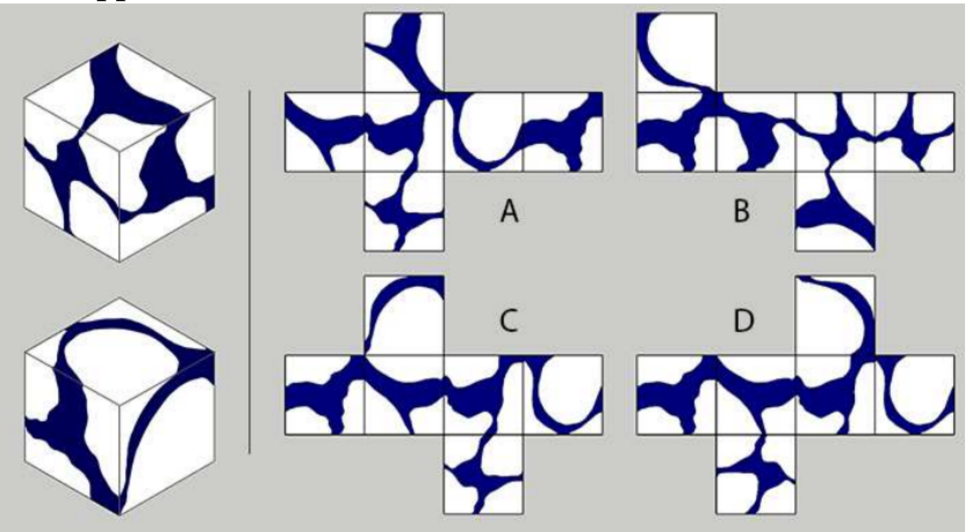
Option C aligns perfectly with the perspective — correct positioning of stairs, projections, and hollow cutouts.

Correct option: C

Quick Tip

For solid-to-view questions, carefully trace unique features such as stairs, hollow cutouts, and asymmetrical parts to eliminate wrong options quickly.

Q.50 Two views of a cube are shown on the left. Which option represents the unwrapped cube on the left?



Correct Answer: C

Solution:

Step 1: Observe the cube patterns.

The cube has continuous dark-blue patterns flowing across adjacent faces. These curving lines must connect properly in the net.

Step 2: Eliminate mismatches.

- Option A: Discontinuous connections between curved regions.
- Option B: Incorrect relative placement of arcs, breaking continuity.
- Option C: Shows perfect continuity of the curved design across all faces.
- Option D: Some curves align, but not all — breaks appear in the flow.

Step 3: Confirm correct net.

Option C maintains continuity across all cube faces as shown in the 3D views.

Correct option: C

Quick Tip

For cube-net problems, always track how patterns flow across edges in the 3D view, then unfold the cube mentally to match continuity in the net.

Q.51 During a long-distance voyage the steering malfunctions as follows: When the Captain intends (i) **L**60° $\Rightarrow$ ship actually turns **R**30°; (ii) **L**90° $\Rightarrow$ **R**90°; (iii) **R**45° $\Rightarrow$ **L**30°; (iv) **R**90° $\Rightarrow$ **L**45°. Initially the ship is heading **North-East**. After the fault starts the Captain tries, in order: **L**90°, **R**90°, **R**45°, **L**60°. Find the current direction.

(A) NORTH EAST

(B) EAST

(C) WEST

(D) NORTH WEST

Correct Answer: (B)

Solution:

Step 1: Set angle convention.

Let EAST $= 0^\circ$ and positive angles be turns to the *left* (counterclockwise). Then NE $= 45^\circ$, SE $= -45^\circ$, etc.

Step 2: Translate each attempted turn using the fault-map.

- Attempt **L**90° $\Rightarrow$ actual **R**90° (-90°).
- Attempt **R**90° $\Rightarrow$ actual **L**45° $(+45^\circ)$.
- Attempt **R**45° $\Rightarrow$ actual **L**30° $(+30^\circ)$.
- Attempt **L**60° $\Rightarrow$ actual **R**30° (-30°).

Step 3: Apply sequentially from the initial heading.

Start at $45°$ (NE).

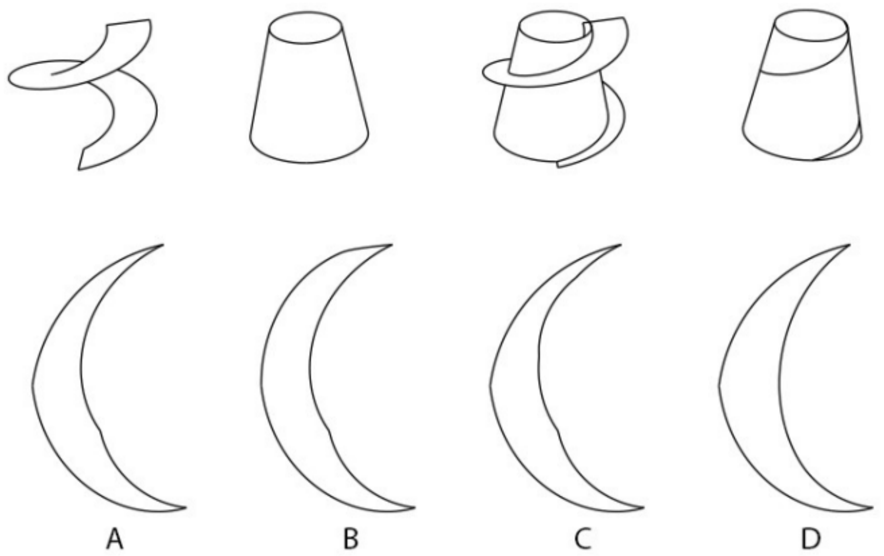
$$\begin{aligned} \text{After } \mathbf{L}90 &: \; 45^\circ - 90^\circ = -45^\circ \text{ (SE)} \\ \text{After } \mathbf{R}90 &: \; -45^\circ + 45^\circ = 0^\circ \text{ (E)} \\ \text{After } \mathbf{R}45 &: \; 0^\circ + 30^\circ = 30^\circ \\ \text{After } \mathbf{L}60 &: \; 30^\circ - 30^\circ = 0^\circ \text{ (E)} \end{aligned}$$

$$\boxed{\text{Final direction } = \textbf{EAST}.}$$

Quick Tip

Convert compass directions to angles and replace each *intended* turn with the *actual* turn per the fault-map; then add algebraically in order.

Q.52 A hollow paper cone is cut by a spiral blade (as shown). After cutting, the conical surface is unwrapped flat. Which option shows the unwrapped cut?



(A) Curved path that runs from the small-radius region to the large-radius edge with smooth, increasing radius (crescent-like)

(B) Similar curve but with opposite convexity/orientation

(C) Curve that doubles back incorrectly across the sector

(D) Curve that stays nearly at constant radius

Correct Answer: (A)

Solution:

Step 1: Unwrapping a cone.

A cone unrolls to a *circular sector*. Any spiral path on the cone (winding once while moving upward) becomes, on this sector, a smooth curve that starts near the inner radius (apex) and progresses *monotonically outward* to the outer arc.

Step 2: Match the geometry.

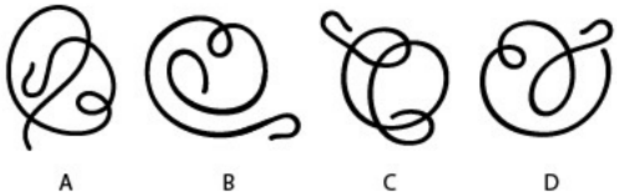
The blade path in the figure makes one rising wrap around the cone. When mapped onto the sector, it must cross the sector from inner to outer boundary with increasing radius and consistent convexity—exactly the behaviour depicted in **Option (A)**. Options (B)–(D) either flip the convexity, fail to increase radius monotonically, or imply an almost constant radius (cylindrical helix), which is inconsistent with a conical surface.

$$\boxed{\text{Unwrapped surface: (A).}}$$

Quick Tip

Remember: cylinder helix $\rightarrow$ straight line on unwrapped rectangle; cone spiral $\rightarrow$ smoothly widening curve on a sector, from inner to outer arc.

Q.53 Two rotating discs are placed on top of each other and pivoted at the centre. The front disc has two cut-outs; the back disc has a continuous line pattern. The four shown positions display the parts of the back-disc line that become visible through the two windows. Which option represents the full line pattern on the back disc?



Correct Answer: D

Solution:

Step 1: Read the four snapshots window-by-window.

Each snapshot shows two visible arcs—one in each wedge-shaped window. Track their *curvature direction* (clockwise/anticlockwise), *thickness continuity*, and whether the arc passes near the centre. The second frame reveals a small loop near the centre; the third frame shows a long outer sweep that never crosses the rim.

Step 2: Stitch the glimpses into one continuous curve.

Across rotations, the same single stroke must: (i) make a compact inner loop, (ii) swing outward to a broad outer loop, and (iii) reconnect without crossing itself excessively. Only a curve that has one tight inner loop and one large outer collar, with a short connector, satisfies all four sightings.

Step 3: Eliminate options.

A has two separated small loops not supported by the frames.

B crosses itself and forms a spiral that would show extra intersections not seen.

C has twin outer collars and no distinct inner loop.

D shows exactly one inner loop and one outer sweep with the correct hand and join—matching every window snapshot.

Hence, the back-disc pattern is option D.

> **Quick Tip**
>
> With rotating masks, treat each window as a "sample" of the same underlying line. Consistency of loop count (inner vs. outer), handedness, and centre proximity across frames will usually single out the correct full curve.

Q.54 Which option has the same visual grammar as the blackletter word on the left?

Correct Answer: B

Solution:

Step 1: Extract the "grammar" of the given lettering.

Blackletter features here include: heavy vertical stems with flat tops/bottoms, sharp 45° entry/exit cuts, narrow internal counters, and diagonal joins that *slice* the strokes rather than curve them.

Step 2: Compare each S option.

A uses rounded terminals and a flat mid-bar—too sans-serif and not angular enough.

B has flat verticals, sharply chamfered (45°) cuts, and a tight, angular central join—matching the blackletter construction.

C shows soft curves and tapered ends inconsistent with the model.

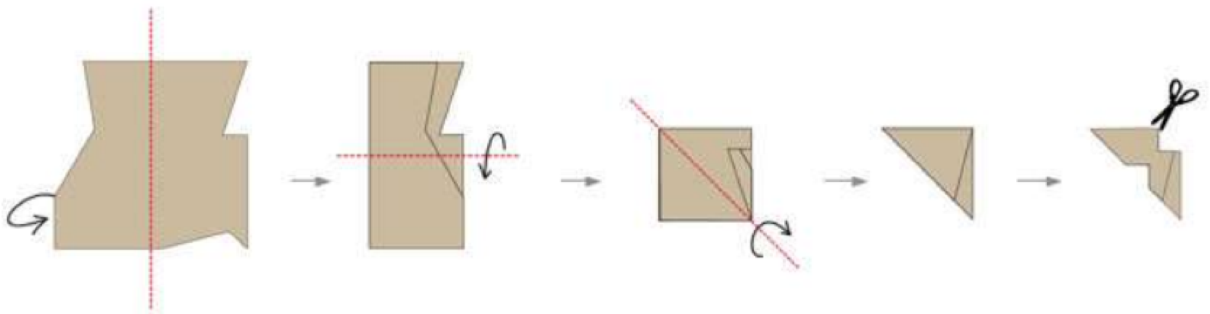
D has squared terminals but lacks the diagonal sliced join; proportions read more "grotesque" than blackletter.

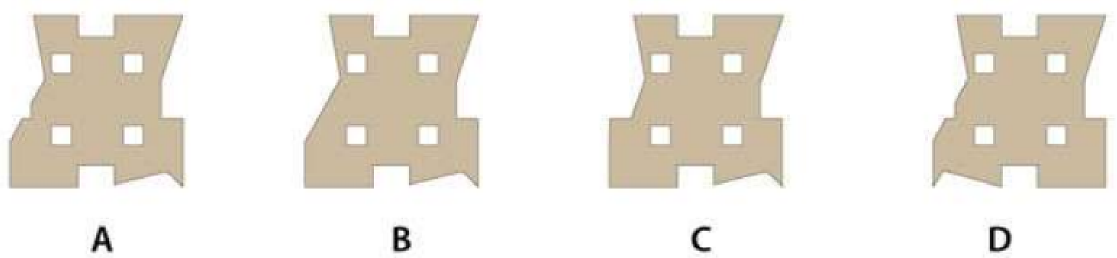
Thus, option B shares the same blackletter visual grammar.

Quick Tip

For "same visual grammar" questions, ignore exact shape and focus on stroke *construction rules*: terminations (flat vs. rounded), joins (curved vs. chamfered), axis, and counter shapes.

Q.55 An irregular piece of paper is folded and cut as shown. Which option shows the correct cuts when the paper is unfolded?





(A) Symmetric pattern with four corner holes and matching edge nicks.

(B) Similar pattern but one corner hole missing.

(C) Corner holes present but one edge nick mirrored wrongly.

(D) One extra nick breaks symmetry along the fold.

Correct Answer: (A)

Solution:

Step 1: Track folds and symmetry.

The sheet is folded twice (first vertical, then horizontal), so any cut on the final small folded layer reproduces *four* times after unfolding. Hence the final pattern must display **four-fold symmetry** about the two fold axes.

Step 2: Follow the cut positions.

The last snips occur near one corner of the folded packet: a corner clip and a small square/rectangular punch. After unfolding (2 folds $\Rightarrow$ 4 copies), we must get: (i) matching nicks on all four outer corners; (ii) four identical inner holes positioned symmetrically.

Step 3: Eliminate options.

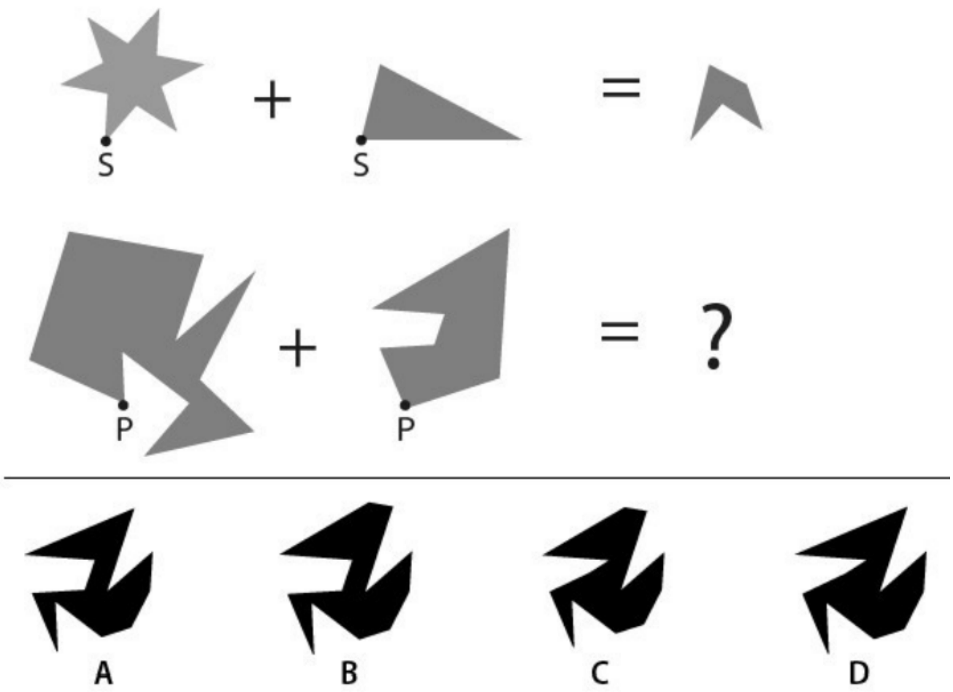
(B) misses one replicated hole; (C) mirrors one nick incorrectly (breaks the two-axis symmetry); (D) has an extra/shifted nick destroying symmetry. Only (A) shows the correct **fourfold** replication of all cuts.

Correct Answer: A

Quick Tip

For paper-folding cut problems, count folds $\Rightarrow$ $predicthowmanyreplicaseachsnipcreates(2folds \Rightarrow 4copies).Thenselecttheoptionpreservingallfoldsy$

Q.56 Which option will replace the question mark?



Correct Answer: (B)

Solution:

Step 1: Decode the first equation (key).

The top row shows two shapes marked at identical reference points **S**. Their "sum" equals the small resultant wedge. This indicates we are **subtracting the overlapping parts after aligning the marked points and orientation**. So, align at the dot, overlay in the given orientation, and take the *common* wedge as output.

Step 2: Apply the same rule to the second pair.

Align the two lower shapes at point **P** with the same orientation as drawn. Overlaying them, keep the overlapping silhouette (intersection). Visual matching yields a compact angular figure whose large wedge points up-right, with a small internal notch opening left.

Step 3: Match with options.

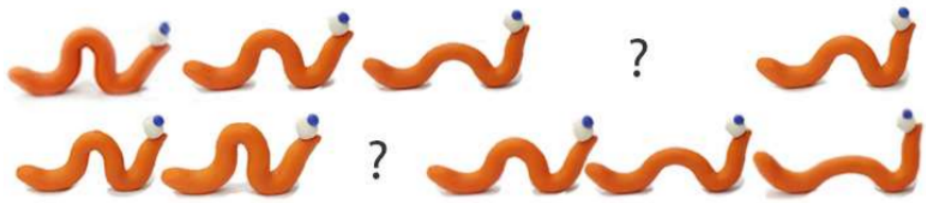
Among A–D, only **(B)** has the up-right dominant wedge and the left-facing inner notch consistent with the intersection formed at point **P**.

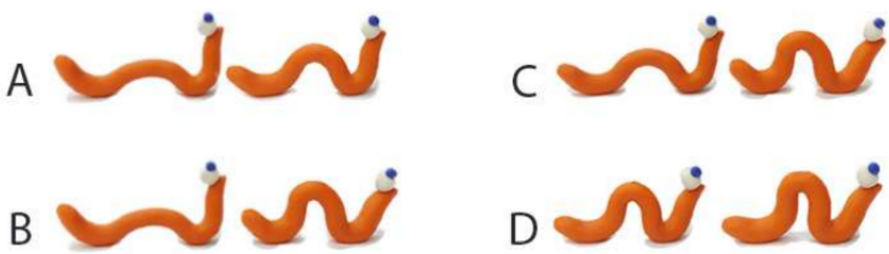
Correct Answer: B

Quick Tip

When shapes are marked with the same reference dot, first align those dots and keep the orientation fixed. Then think “intersection” (common region) rather than union to match the example.

Q.57 Shown below is the crawling sequence of a worm in eleven frames. Which option represents the missing frames?





Correct Answer: B

Solution:

Step 1: Observe the sequence of movement.

The worm’s crawling motion is cyclic — it stretches forward, raises its head, then contracts its body in waves. The missing frames must continue this fluid wave-like pattern.

Step 2: Check consistency of motion.

Looking at the frames before and after the missing ones: - The head of the worm is raised at different phases. - The body bends in alternate curves, creating a smooth crawling cycle. Thus, the missing frames must show intermediate bending and head-raising that bridges the surrounding frames smoothly.

Step 3: Compare with given options.

- Option A: Shows an incorrect intermediate stage — the body curve does not match the required flow.
- Option B: Matches perfectly — one frame shows the worm's head straightened up, and the next shows the body wave forming correctly.
- Option C: Breaks the continuity of the worm's motion.
- Option D: Shows overly curved postures, which don't align with the required intermediate frames.

Correct option: B

Quick Tip

For animation-sequence problems, look for smooth transitions. The missing frames should logically connect the motion from one frame to the next without abrupt changes.
