

Exchange surfaces and surface area to volume ratio

Combined Science - Biology - KS4

Cell Biology

(Downloadable student document)

Miss Wong



Exam question

OCR, Jun 2019 J250/01

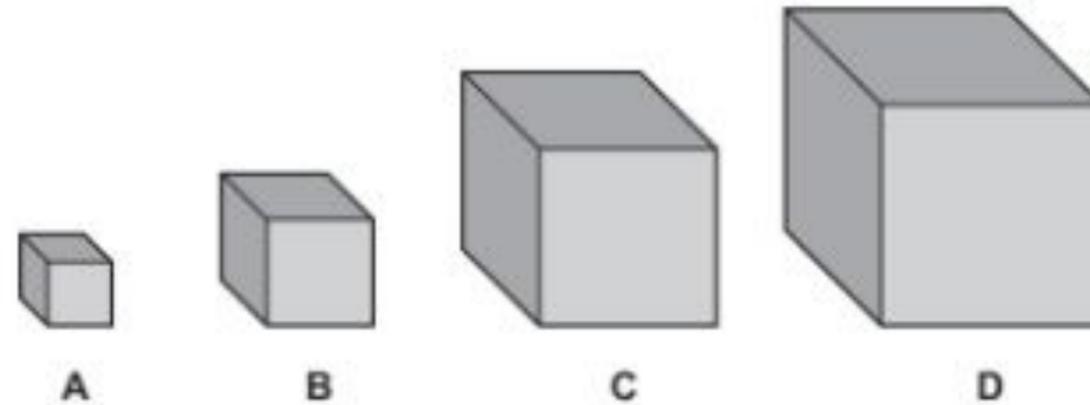
$$\text{surface area} = 8 \times 8 \times 6 = 384$$

$$\text{volume} = 8 \times 8 \times 8 = 512$$

Surface area is important for gas exchange in living organisms.

Scientists investigate the relationship between surface area and volume.

The diagram shows four cubes.



The table shows some data about the cubes.

Cube	Height of cube (cm)	Surface area (cm ²)	Volume (cm ³)	Surface area to volume ratio
A	2	24	8	3.0 : 1
B	4	96	64	1.5 : 1
C	6	216	216	1.0 : 1
D	8	0.8 : 1

Calculate the surface area and volume for cube D.

Write your answers in the table.

[2]



Exam question

OCR, Jun 2019 J250/01

3 marks

Look at the picture. It shows a salamander larva with external gills.



The salamander larva has skin that is a gas exchange surface. The external gills are also a gas exchange surface.

A salamander larva needs external gills to be able to grow larger.

Explain why developing external gills helps gas exchange.

Use ideas about how having gills changes the:

- surface area
- surface area to volume ratio
- distance needed for gases to diffuse.



Answers

- increase the surface area (for gas exchange)
- increase the surface area to volume ratio (for gas exchange)
- reduce the distance (for diffusion into blood)



Exam question

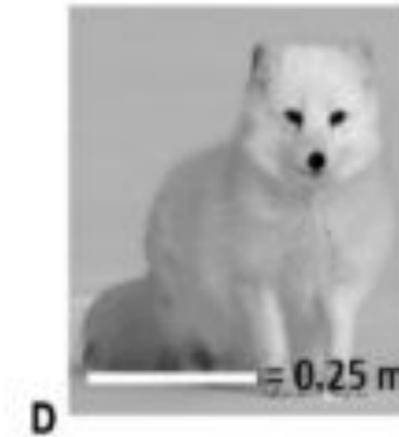
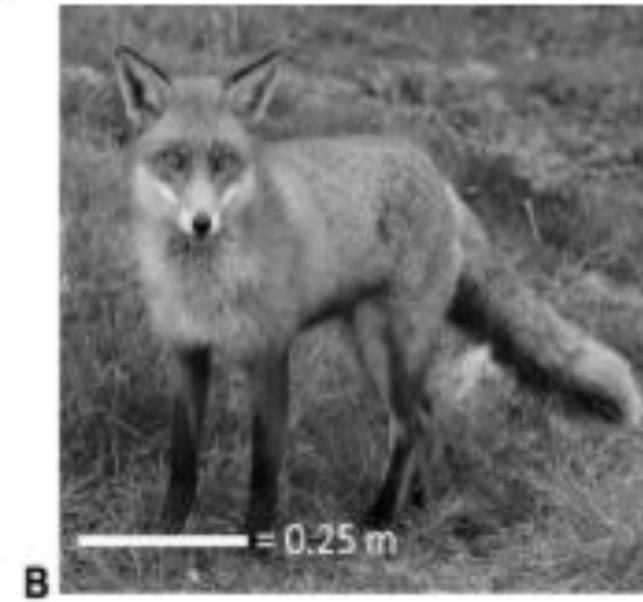
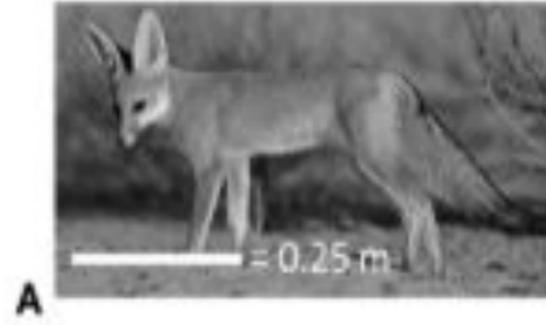
OCR, Specimen

J247/01

Answer: A

The pictures show four foxes from different parts of the world.

Which fox has the largest surface area:volume ratio?



Your answer



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OCR, Jun 2019 J250/01

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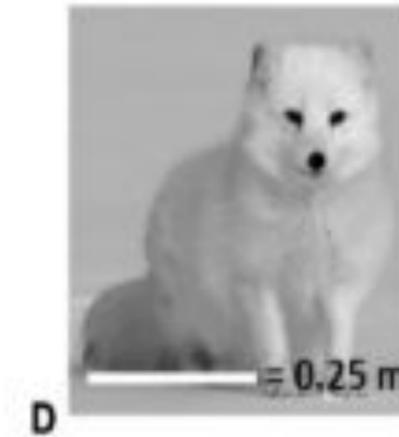
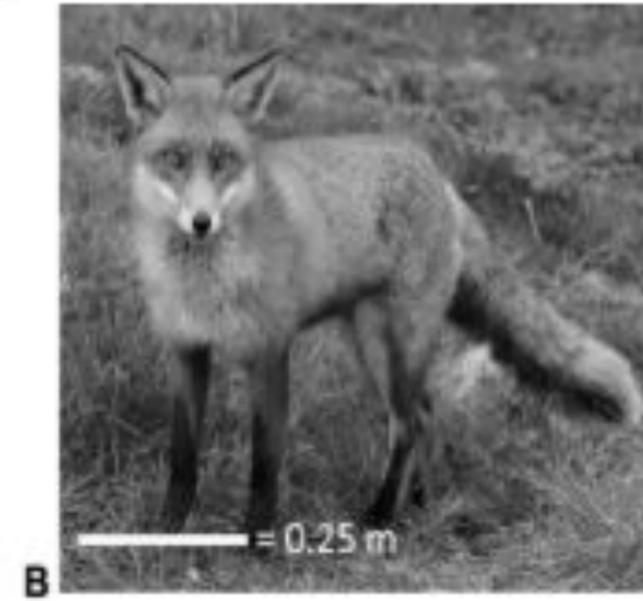
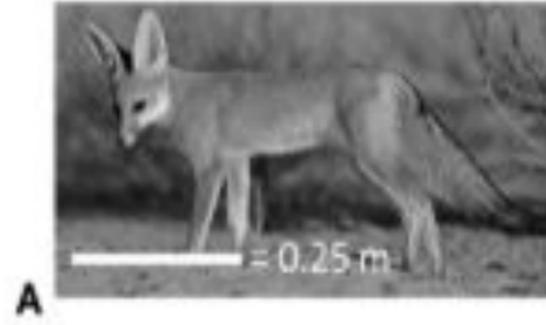
OCR, Specimen

J247/01

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Your answer



Independent practice

1. Why is the wall of alveoli and villi only one-cell thick?
2. Why do we need specific surfaces for exchange of substances?
3. What is diffusion?
4. What is the meaning of a large surface area to volume ratio?
5. What is the importance of having constant blood supply to the gills of fish?
6. What is the name of the organ for gas exchange in fishes' gills?
7. What are the adaptations of the villi? List three.
8. Why do root hair cells contain lots of mitochondria?
9. There is a cube of dimensions $2 \times 2 \times 2$ cm. What is its surface area to volume ratio?



Answers to independent practice

1. To minimise the diffusion distance.
2. Because we are multicellular animals. Our body surfaces are often impermeable to water and air.
3. Diffusion is the movement of particles from an area of high concentration to an area of low concentration.
4. It means that a large area is folded to fit into a small space(volume).
5. To maintain a concentration gradient to ensure constant diffusion of gases.
6. Lamellae
7. It has a good blood supply. It has thin walls and it has a large surface area to volume ratio.
8. The large amount of mitochondria release more energy for the cell to absorb minerals.
9. Volume = 8 cm^3 . Surface area = $2 \times 2 \times 6 = 24 \text{ cm}^2$. The ratio is $24 : 8 = 3 : 1$.

