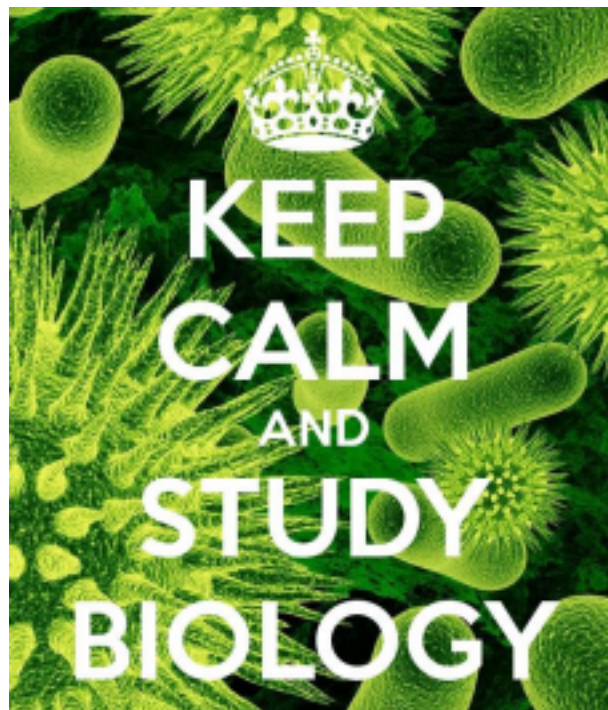


Transition Pack for A Level Biology

**A guide to help you get ready
for A-level Biology.**



What you need to do

1. You need to work through every section of the 'pre-knowledge topics' and do all of the questions.
2. You should self-mark all of the questions in sections 1-4 using the answers at the back of this booklet and correct any that are wrong.
3. Print and hand in the rest of the work for checking by the end of the first week back.

What you will be tested on

1. You will sit a 'transition test' on the contents of this booklet early in Term 1 and expected to get at least 40%.

If you do not score 40% you will not be able to continue with the course.

Pre-Knowledge Topics

Below are five topics that are essential foundations for your study of A-Level Biology. Each topic has example questions and links where you can find out more information as you prepare for next year.

1) Prefixes

At A level, unlike GCSE, you need to remember all symbols, units and prefixes. Below is a list of quantities you may have already come across and will be using during your A level course.

Prefix	Symbol	Power of ten
Pico	p	$\times 10^{-12}$
Nano	n	$\times 10^{-9}$
Micro	μ	$\times 10^{-6}$
Milli	m	$\times 10^{-3}$
Centi	c	$\times 10^{-2}$
Kilo	k	$\times 10^3$
Mega	M	$\times 10^6$
Giga	G	$\times 10^9$

Please complete the table below:

Proton diameter		$1 \times 10^{-15} \text{ m}$
Gamma-ray wavelength	1 pm	
Carbon atom diameter	160 pm	:
X-ray wavelength	500 pm	
Glucose molecule diameter		$8 \times 10^{-10} \text{ m}$
Phospholipid length	2.5 nm	$2.5 \times 10^{-9} \text{ m}$
DNA width		$3 \times 10^{-9} \text{ m}$
Hepatitis B virus diameter	42 nm	
Ultraviolet wavelength		$6 \times 10^{-8} \text{ m}$
Bacteriophage diameter	200 nm	$2 \times 10^{-7} \text{ m}$
<i>E. coli</i> bacterium length	:	$2 \times 10^{-6} \text{ m}$
Mitochondrion diameter	4 μm	$4 \times 10^{-6} \text{ m}$
Red blood cell diameter	7 μm	$7 \times 10^{-6} \text{ m}$
Infrared wavelength		$1.5 \times 10^{-5} \text{ m}$
Human ovum diameter	120 μm	$1.2 \times 10^{-4} \text{ m}$
Dust mite length	300 μm	$3 \times 10^{-4} \text{ m}$
10p coin diameter		$2.5 \times 10^{-2} \text{ m}$
Hummingbird length	10 cm	:
<i>Tyrannosaurus rex</i> length		$7 \times 10^0 \text{ m}$
Eiffel Tower height		$3.2 \times 10^2 \text{ m}$
Mariana Trench depth	10.9 km	:

2) Standard Form

At A level, quantity will be written in standard form, and it is expected that your answers will be too.

This means answers should be written as $\dots \times 10^y$. E.g. for an answer of 1200kg we would write $1.2 \times 10^3 \text{ kg}$. NB this task is identical to the Physics summer work, so if you are doing both subjects, you only need to complete this task once!

2. Write 280 in standard form.
3. Write 0.77 in standard form.
4. Write 0.0091 in standard form.
5. Write 1 872 000 in standard form.
6. Write 12.2 in standard form.
7. Write 2.4×10^{-2} as a normal number.
8. Write 3.505×10^{-1} as a normal number.
9. Write 8.31×10^{-6} as a normal number.
10. Write 6.002×10^{-2} as a normal number.
11. Write 1.5×10^{-4} as a normal number.
12. Write 4.3×10^3 as a normal number.

3) Significant figures

At A level you will be expected to use an appropriate number of significant figures in your answers. The number of significant figures you should use is the same as the number of significant figures in the data you are given. NB this task is identical to the Physics summer work, so if you are doing both subjects, you only need to complete this task once!

The website below summarises the rules and how to round correctly.

<http://www.purplemath.com/modules/rounding2.htm>

Give the following to 3 significant figures:

1. 3.4527

2. 40.691

3. 0.838991

4. 1.0247

5. 59.972

Calculate the following to a suitable number of significant figures:

6. $63.2/78.1$

7. $39+78+120$

8. $(3.4+3.7+3.2)/3$

9. 0.0256×0.129

10. $592.3/0.1772$

4) Flipped learning task 1

This task will prepare you for Mrs Johnston's side of the course on transport in multicellular organisms.

Use the following video link to understand the importance of surface area to volume ratio in a cell in the exchange of nutrients, waste and thermal energy:

1. <https://www.khanacademy.org/science/ap-biology/cell-structure-and-function/cell-size/v/surface-area-to-volume-ratio-of-cells>

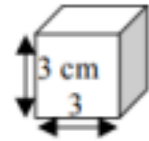
The following video links revisit how to calculate surface area to volume ratio and explain the importance of the respiratory and circulatory systems in multicellular (lots of cells) organisms to exchange and transport gases around the body.

2. <https://www.youtube.com/watch?v=DHGWH3NdAjc>
3. <https://ib.bioninja.com.au/standard-level/topic-1-cell-biology/11-introduction-to-cells/sa--vol-ratio.html>

Read and complete all the questions on page 6. Make sure you use the mark scheme at the then of the booklet to mark and improve your answers.

CALCULATING SURFACE AREA TO VOLUME RATIOS

- First of all, the **SURFACE AREA** (abbreviation = **SA**) is the **area of material that it would take to completely cover an object** (for example, the amount of wrapping paper it would take to precisely wrap an expensive gift to your biology teacher☺).
- For a **simple cube shape**, surface area is simply the length of one side times the height of one side times the number of sides (all cubes have, incidentally, 6 sides). The formula can be written like this.



$$\text{Surface Area} = \text{Length} \times \text{Height} \times 6$$

- For example, a cube that was 3 cm on each side would have a surface area of:

$$\text{SA} = 3 \text{ cm} \times 3 \text{ cm} \times 6 = 54 \text{ cm}^2$$

Notice that the units are "square" units.

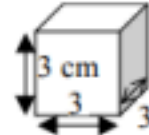
- VOLUME** (V) is the amount of space inside an object.
- Volume for a simple cube is equal to the **length** times the **height** times the **depth** of an object.

$$V = L \times H \times D$$

For the above example of a 3 cm cube, the volume would be:

$$V = 3 \text{ cm} \times 3 \text{ cm} \times 3 \text{ cm} = 27 \text{ cm}^3$$

Notice that the units are "CUBIC" units.



The **surface area to volume ratio** (SA:V) is the proportion of area of material covering an object to amount of material within the object. i.e. it is a measure of how much covers the object for each unit of interior volume.

For the above example:

$$\text{SA:V}$$

$$54:27$$

(this ratio can be reduced to smaller numbers similar to the way that fractions can be reduced. It is customary to reduce SA:V ratios so that V is equal to 1. This can be done by dividing the SA by V and V by V as below)

$$54/27 : 27/27$$

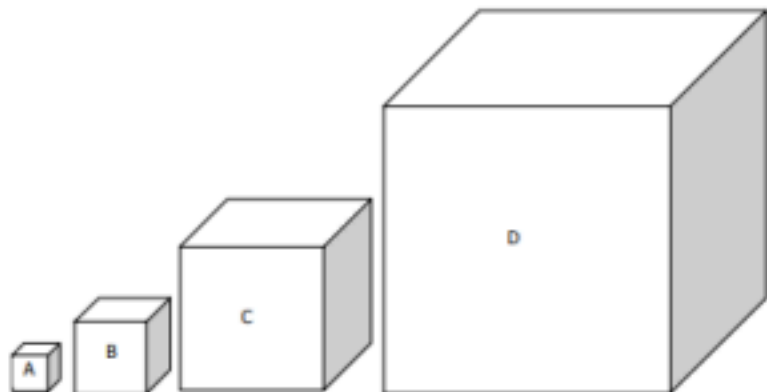
$$2:1$$

- The surface area to volume ratio for the above cube is equal to 2:1. That is, *for every 2 units of surface area covering the outside of the cube, there is 1 unit of volume in the inside of the cube.* If this cube were a cell, we could further say that *there are 2 units of cell membrane for every unit volume of cytoplasm in its interior.*

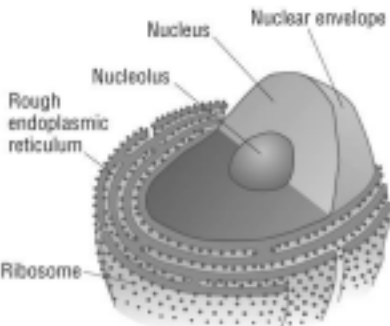
Now you try: Key is on other side -- DO NOT LOOK until you've solved these problems on your own.

- For the four cubes below, **measure** (in cm) each with a ruler, and **calculate** the surface area, the volume, and the surface area to volume ratio. Reduce the SA:V ratio so that the "V" is = 1.

Cube A	
Surface Area	
Volume	
S:V ratio (reduced)	
Cube B	
Surface Area	
Volume	
S:V ratio (reduced)	
Cube C	
Surface Area	
Volume	
S:V ratio (reduced)	
Cube D	
Surface Area	
Volume	
S:V ratio (reduced)	

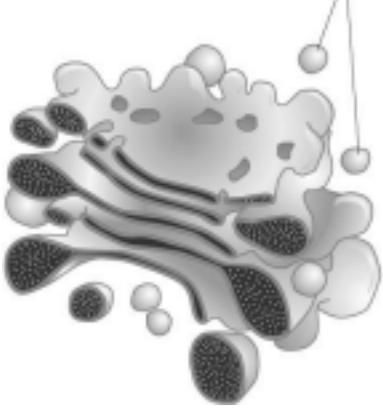


- What trend do you notice as the size of the cells increases?
- Why is this important to living cells?
- What can cells do about it?

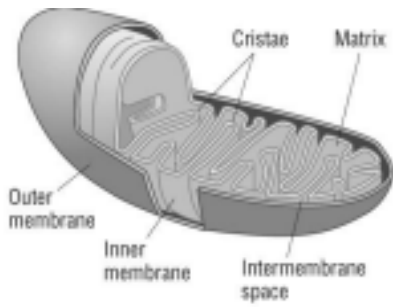
<p>Endoplasmic reticulum (ER)</p>  <p>The diagram shows a cross-section of a cell nucleus. At the center is a smaller, denser nucleolus. The nucleus is enclosed by a nuclear envelope, which is a double membrane. Surrounding the nucleus is the endoplasmic reticulum, which is shown as a series of flattened, interconnected sacs. The rough endoplasmic reticulum is characterized by the presence of small, dark dots representing ribosomes on its surface. The smooth endoplasmic reticulum is shown as a network of tubular membranes without ribosomes.</p>	<p>Rough:</p> <p>Smooth:</p>	

Golgi apparatus

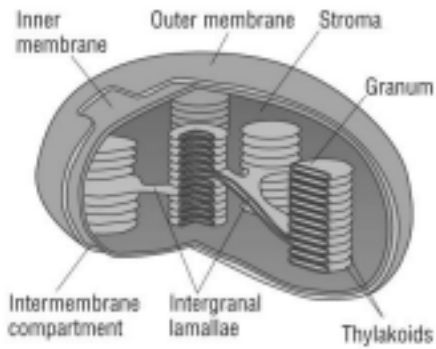
Vesicles bringing materials to and from the Golgi apparatus



Mitochondria (singular mitochondrion)



Chloroplasts



Lysosomes

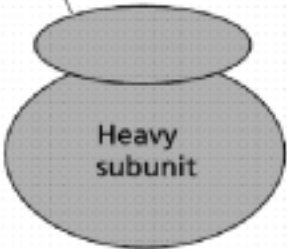
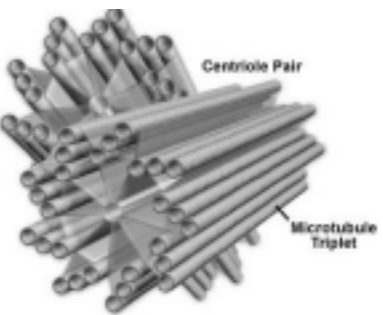


Rednock School

10

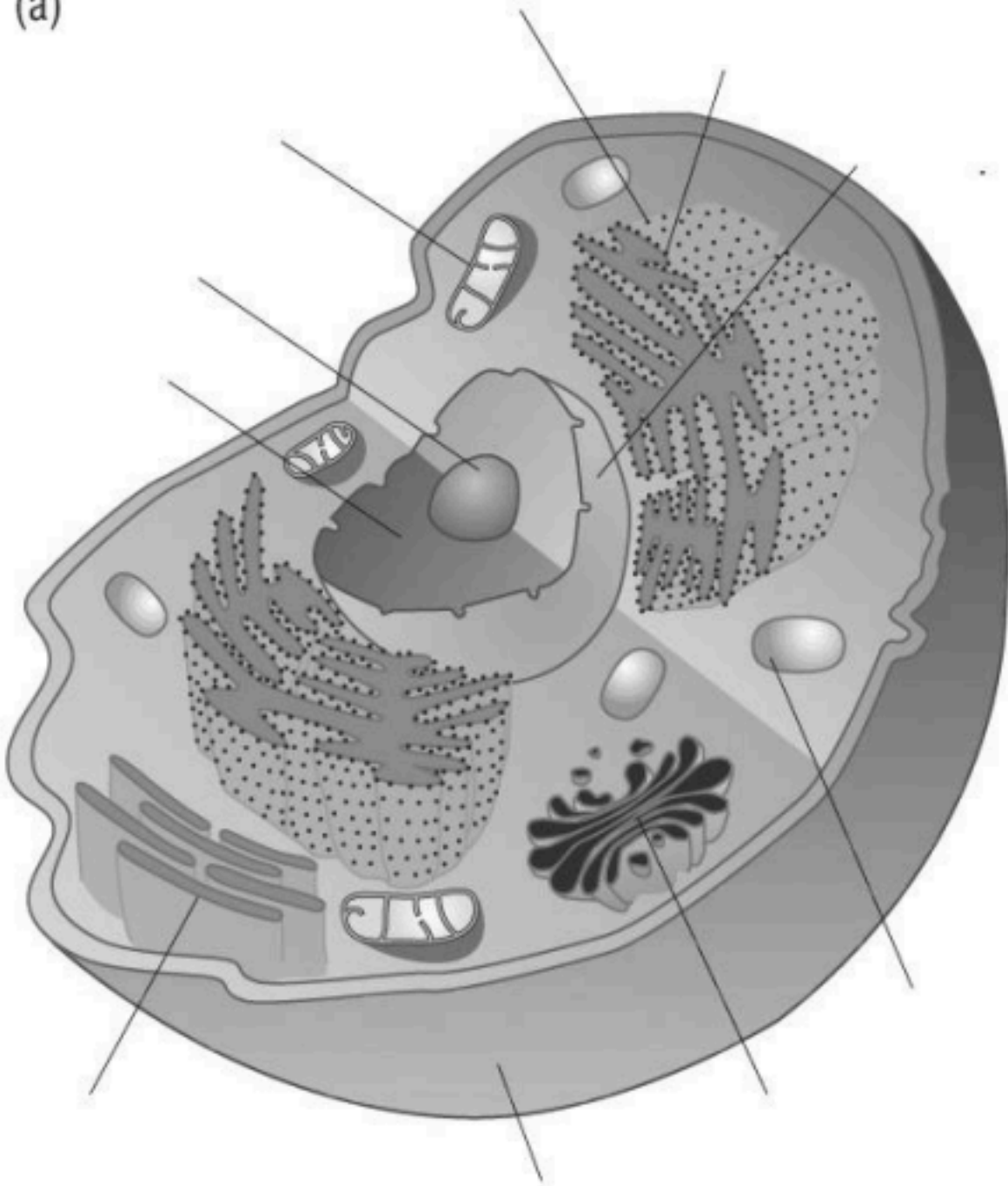
Science Department

Non-membrane bound organelles	Describe the structure	Summarise the function

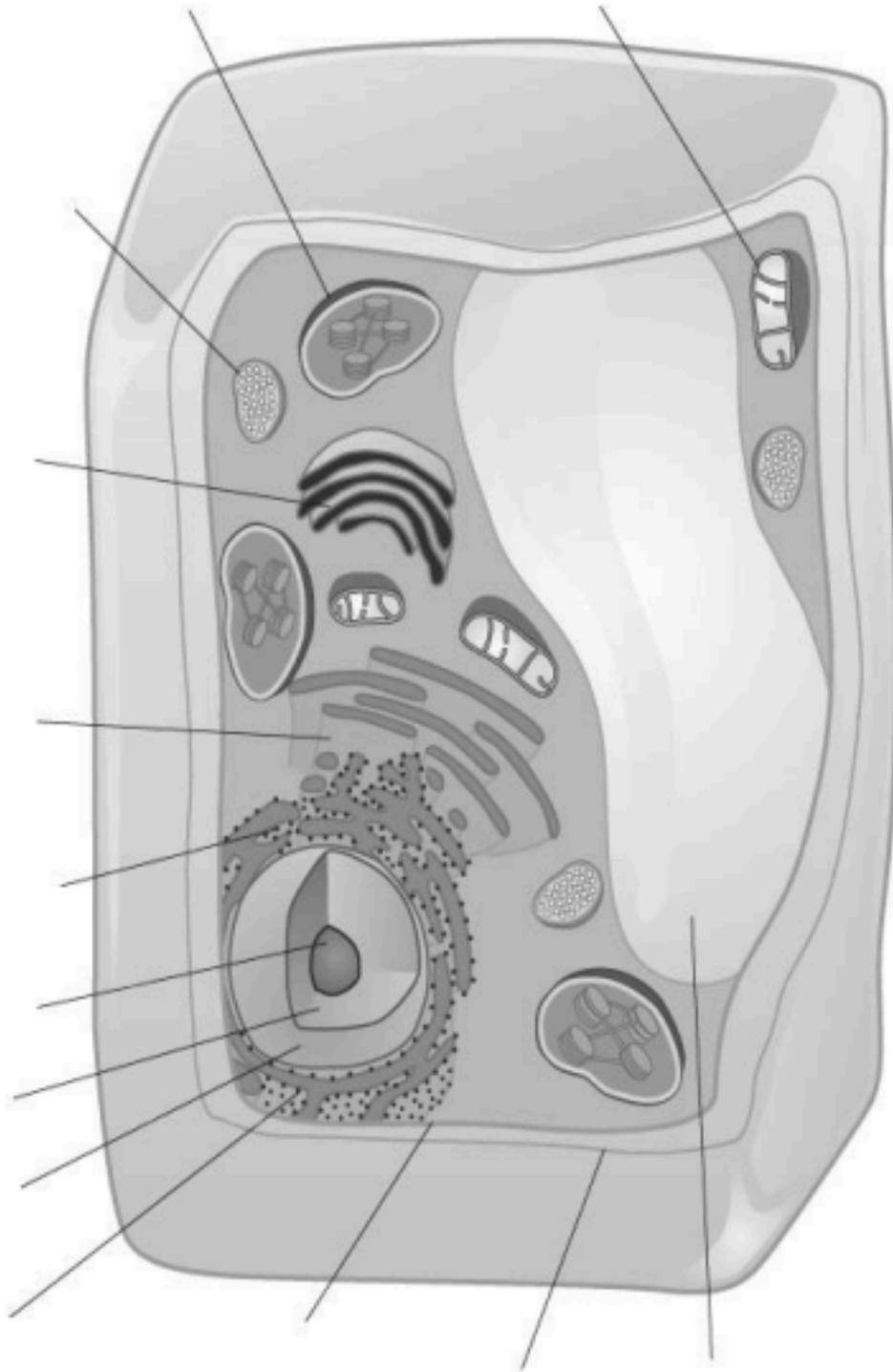
<p>Ribosomes</p> <p>Light subunit</p>  <p>Heavy subunit</p>		
<p>Centrioles</p>  <p>Centriole Pair</p> <p>Microtubule Triplet</p>		

- Using your new found knowledge label the organelles typically found within (a) animal cells and (b) plant cells on the diagrams below.

(a)



(b)



Answers to summer work problems:

Symbols and prefixes

Proton diameter	1 fm	1×10^{-15} m
Gamma-ray wavelength	1 pm	1×10^{-12} m
Carbon atom diameter	160 pm	1.6×10^{-10} m
X-ray wavelength	500 pm	5×10^{-10} m
Glucose molecule diameter	800 pm	8×10^{-10} m
Phospholipid length	2.5 nm	2.5×10^{-9} m
DNA width	3 nm	3×10^{-9} m
Hepatitis B virus diameter	42 nm	4.2×10^{-8} m
Ultraviolet wavelength	60 nm	6×10^{-8} m
Bacteriophage diameter	200 nm	2×10^{-7} m
<i>E. coli</i> bacterium length	2 μ m	2×10^{-6} m
Mitochondrion diameter	4 μ m	4×10^{-6} m
Red blood cell diameter	7 μ m	7×10^{-6} m
Infrared wavelength	15 μ m	1.5×10^{-5} m
Human ovum diameter	120 μ m	1.2×10^{-4} m
Dust mite length	300 μ m	3×10^{-4} m
10p coin diameter	25 mm	2.5×10^{-2} m
Hummingbird length	10 cm	1×10^{-1} m
<i>Tyrannosaurus rex</i> length	7 m	7×10^0 m
Eiffel Tower height	320 m	3.2×10^2 m
Mariana Trench depth	10.9 km	1.09×10^4 m

Standard Form:

1. 2.53
2. 2.8
3. 7.7
4. 9.1
5. 1.872
6. 1.22
7. 2400
8. 35.05
9. 8 310 000
10. 600.2
11. 0.00015
12. 4300

Rearranging formulae

1. $h = E / (m \times g)$
2. $I = Q/t$
3. $m = (2 \times E)/v^2$ or $E/(0.5 \times v^2)$
4. $v = \sqrt{(2 \times E)/m}$

5. $u = v - at$
6. $a = (v-u)/t$
7. $s = (v^2 - u^2) / 2a$

8. $u = \sqrt{v^2 - 2as}$

KEY: You're not sneaking a peek before attempting the questions, are you?

Cube A	
Surface Area	1.5 cm ²
Volume	0.125 cm ³
S:V ratio (reduced)	12:1
Cube B	
Surface Area	6 cm ²
Volume	1 cm ³
S:V ratio (reduced)	6:1
Cube C	
Surface Area	24 cm ²
Volume	8 cm ³
S:V ratio (reduced)	3:1
Cube D	
Surface Area	96 cm ²
Volume	64 cm ³
S:V ratio (reduced)	1.5:1

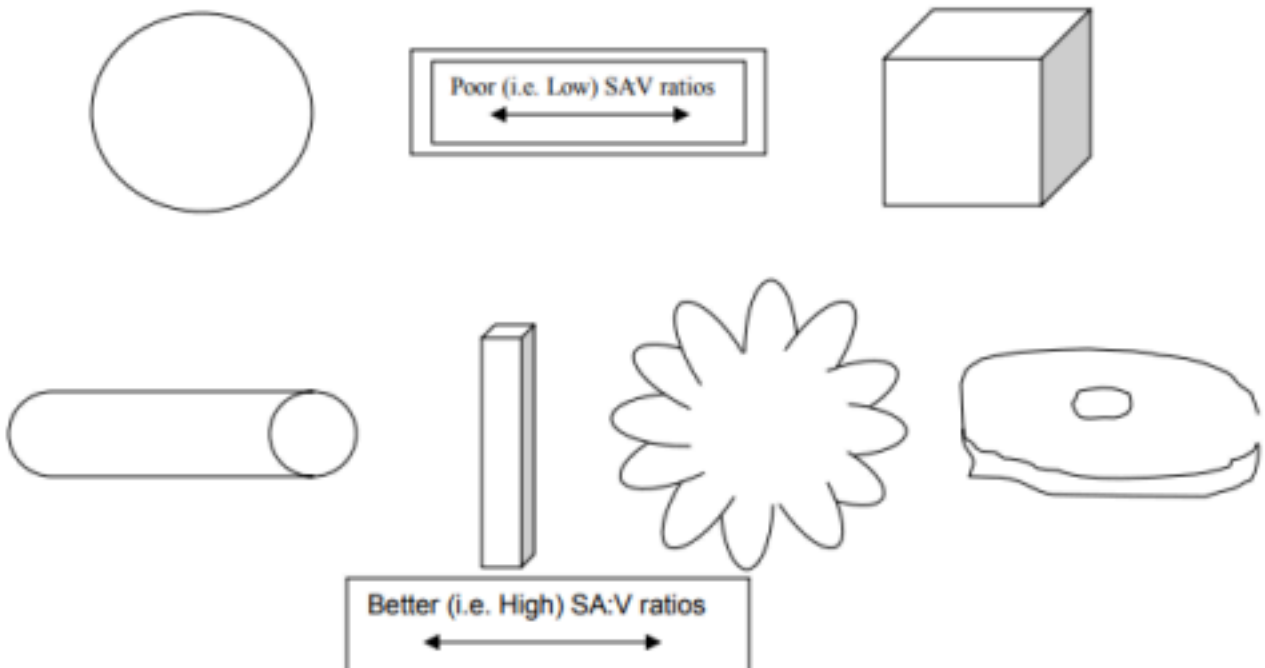
1. What trend do you notice as the size of the cells increases?
The surface area to volume ratio decreases as cell size increases (e.g. as cell size doubles, SA:V ratio is reduced 50%)

2. Why is this important to living cells?
Living cells can only get materials in (like glucose and oxygen) through the cell membrane, and can only get waste products out through the cell membrane. As SA:V ratio decreases, it means that every unit of volume of cytoplasm is "serviced" by less and less surface area. If the cell is actively metabolizing, it may not be able to get in enough nutrients or get rid of its wastes. Furthermore, as most things get around in cell via diffusion (a free albeit slow process), as a cell gets larger, it may not be able to get materials from one end of a cell to the next by diffusion quick enough to sustain its chemical reactions.

3. What can cells do about it?

Cells can:

- divide
- slow down metabolism
- change shape to increase the surface area (e.g. get long and thin or flat, or develop many folds in the cell membrane to increase SA and therefore SA:V ratio).



1. 3.35
2. 40.7
3. 0.839
4. 1.02
5. 60.0
6. 0.809
7. 237
8. 3.4
9. 0.00330
10. 3343