Name: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

1. **Characteristics of Life**

All living things share life processes such as growth and reproduction. Most scientists use seven life processes or characteristics to determine whether something is living or non-living.

The table below describes seven characteristics of most living things and contains references to earthworms to help you decide if they are living or non-living.

|  |  |  |
| --- | --- | --- |
| **Characteristic** | **Definition** | **Explanation** |
| **Movement** | an action by an organism or part of an organism causing a change of position or place. | All living things move in some way. This may be obvious, such as animals that are able to walk, or less obvious, such as plants that have parts that move to track the movement of the sun. |
| **Respiration** | the chemical reactions that break down nutrient molecules in living cells to release energy, | Glucose molecules are broken down in a series of steps to release energy to be used by the body, producing carbon dioxide and water as waste products. |
| **Sensitivity** | the ability to detect or sense changes in the environment (stimuli) and to make responses | Think of the five senses that humans have. |
| **Growth** | a permanent increase in size and dry mass by an increase in cell number or cell size or both | All living things grow. In many organisms, this happens through mitosis. |
| **Reproduction** | the processes that make more of the same kind of organism | This is the ability to reproduce and pass genetic information onto their offspring. Recall both sexual and asexual reproduction. |
| **Excretion** | removal from organisms of toxic materials, the waste products of metabolism (chemical reactions in cells including respiration), and substances in excess of requirements, | Getting rid of waste. In humans, excretion happens through the anus and through urine formation in the kidney. |
| **Nutrition** | taking in of nutrients which are organic substances and mineral ions, containing raw materials or energy for growth and tissue repair, absorbing and assimilating them | This occurs in very different ways in different kinds of living things. The most basic example is eating. |

1. **Cell Structure**

In addition to the seven characteristics described above, **all living things are made up of cells.** The structures of different types of cells are related to their functions.

1. **Animal and plant cells**

Animal cells and plant cells have features in common, such as a nucleus, cytoplasm, cell membrane, mitochondria and ribosomes. Plant cells also have a cell wall, and often have chloroplasts and a permanent vacuole.

**Function of cells which animal and plant cells have in common**

| **Part** | **Function** |
| --- | --- |
| Nucleus | Contains genetic material, which controls the activities of the cell |
| Cytoplasm | Most chemical processes take place here, controlled by enzymes |
| Cell membrane | Controls the movement of substances into and out of the cell |
| Mitochondria | Most energy is released by respiration here |
| Ribosomes | Protein synthesis happens here |

Plant cells also have extra parts:

**Extra parts of plant cells**

| **Part** | **Function** |
| --- | --- |
| Cell wall | Strengthens the cell |
| Chloroplasts | Contain chlorophyll, which absorbs light energy for photosynthesis |
| Large vacuole | Filled with cell sap to help keep the cell *turgid (stiff)* |

Make sure you can label diagrams of animal and plant cells, like these:



1. **Specialized cells [E]**

Cells may be specialized for a particular function. Their structure will allow them to carry this function out. Here are some examples:

**Examples of the functions of cells**

| **Cell** | **Function** | **Adaption** |
| --- | --- | --- |
| ross section through a leaf cellLeaf cell | Absorbs light energy for photosynthesis | Packed with chloroplasts. Regular shaped, closely packed cells form a continuous layer for efficient absorption of sunlight. |
| oot hair cell - has a head and tailPlant Root hair cell | Absorbs water and mineral ions from the soil | Long 'finger-like' process with very thin wall, which gives a large surface area. |
| ed blood cellsRed blood cells | Contains haemoglobin to carry oxygen to the cells. | Thin outer membrane to let oxygen diffuse through easily. Shape increases the surface area to allow more oxygen to be absorbed efficiently. No nucleus, so the whole cell is full of haemoglobin. |

You are likely to be given information, perhaps in a diagram, to help you to explain the adaptations of a particular cell type to its function.

1. **Magnification and Size**

You may be asked to calculate magnification and/or size. In doing so, you should use **millimeters (mm)** as units. Recall that there are 1000mm in a meter, and 10 mm in a centimeter. That means that the width of your pinky is about 10 millimeters!

**Magnification calculations**

We can calculate the length of a magnified object by using the magnification of the lens.

**Length of object = length of magnified object ÷ magnification**

For example, if a specimen appeared 10mm in length under a microscope with a magnification of 1,000 times, the calculation of the actual length would be:

Length of object = 10 ÷ 1000 = 0.01 mm

1. **Movement In and Out of Cells**
2. **Diffusion**

Dissolved substances have to pass through the cell membrane to get into or out of a cell. Diffusion is one of the processes that allows this to happen.

**Diffusion** occurs when particles spread. They move from a region where they are in high concentration to a region where they are in low concentration. Diffusion happens when the particles are free to move. This is true in gases and for particles dissolved in solutions. **Particles diffuse down a concentration gradient**, from an area of high concentration to an area of low concentration. This is how the smell of cooking travels around the house from the kitchen, for example.

Diffusion allows substances to pass into or out of cells across the cell membrane - but they must be dissolved and there must be a concentration gradient present between the solutions on either side of the cell membrane.

**Two examples of diffusion down concentration gradients:**

| **Location** | **Particles move** | **From** | **To** |
| --- | --- | --- | --- |
| Gut | Digested food products | Gut cavity | Blood in capillary of villus |
| Lungs | Oxygen | Alveolar air space | Blood circulating around the lungs |

Remember, particles continue to move from a high to a low concentration while there is a *concentration gradient*.

In the lungs, the blood will continue to take in oxygen from the alveolar air spaces provided the concentration of oxygen there is greater than in the blood. Oxygen diffuses across the alveolar walls into the blood, and the circulation takes the oxygen-rich blood away.



1. **Osmosis [E]**

Osmosis only applies to the movement of **water** into or out of a cell. The definition of osmosis is the movement of water molecules from a dilute solution (with a high proportion of water molecules) to a more concentrated solution (with a low proportion of water molecules) across a ***partially permeable membrane.***

A partially permeable membrane allows small, soluble molecules like water to pass through it freely - but prevents larger molecules from doing so. In a cell, the cell membrane acts as a partially permeable membrane.

**The effect of osmosis on cells**

If a cell has a more dilute solution inside it than outside it, then the overall movement of water is out of the cell. In animal cells this would cause the cell to shrivel up, whilst in plant cells this would cause the membrane and cytoplasm to shrink away from the cell wall, causing the plant cell to become **flaccid** (limp).



 Animal Cells Plant Cells

If a cell has a more concentrated solution inside it than outside it, then the overall movement of water is **into** the cell. In plant cells this causes the cell to begin to swell, and the cytoplasm and membrane push against the cell wall. The strong cell wall then resists further expansion, supporting the cell which becomes **turgid** (fully inflated).

However, animal cells do not have a cell wall so any large movement of water into the cell causes it to burst. For this reason, it is important that the concentration of water outside cells is constant.

Osmosis is important to plants. Plants absorb water by osmosis through their roots. Water moves into plant cells by osmosis, making them *turgid* or stiff so that they are able to hold the plant upright.

1. **Water Potential [E]**

Biologists use this term to describe the tendency of water to leave one place in favor of another. Water always moves from an area of higher water potential to an area of lower water potential. Thus, **water moves down the water potential gradient.** Due to evaporation at a plant’s leaves, the water potential gradient pulls water from the soil, into the roots, then up through the stem of a plant to the leaves.

Sources:

<http://www.phschool.com/science/biology_place/labbench/lab1/watpot.html>

<http://www.bbc.co.uk/schools/gcsebitesize/science/add_aqa/cells/cellsrev1.shtml>

<http://www.bbc.co.uk/schools/gcsebitesize/science/triple_aqa/movement_of_molecules/dissolved_substances/revision/3/>

<http://www.sciencelearn.org.nz/Science-Stories/Earthworms/Characteristics-of-living-things>

To learn more, visit <http://www.phschool.com/science/biology_place/labbench/lab1/concepts.html>

Practice Questions:

1. As you grow up, the cells in your body divide to create more cells. What characteristic of life does this BEST represent?
2. Movement
3. Respiration
4. Division
5. Growth
6. The act of eating is most closely associated with the characteristic of \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ whereas the break down in cells of those consumed substances to produce a usable form of energy is \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_.
7. Nutrition, excretion
8. Respiration, nutrition
9. Nutrition, respiration
10. Excretion, respiration
11. Which parts are found in both plant and animal cells?
12. Cell membrane, large vacuole
13. Cell membrane, cytoplasm
14. Cell wall, large vacuole
15. Cell wall, cytoplasm
16. Which of the following are found in plant cells but not animal cells?
17. Large vacuole
18. Cytoplasm
19. Nucleus
20. Which of these is a part found in plant cells but not in animal cells?
21. Cell wall
22. Mitochondria
23. Cell membrane
24. Which is a function of a plant cell wall?
25. To control what goes in and out of the cell
26. To provide structure and prevent the cell from bursting when it absorbs water
27. To stop the cell growing too large
28. To store nutrients and catalyze reactions
29. What is the role of the cytoplasm?
30. Controls the movement of substances into the cell
31. Contains genetic material
32. Is where the cell's chemical reactions take place
33. What is the function of a cell's nucleus?
34. To act as a brain
35. To control the movement of substances into and out of the cell
36. To control the activities of the cell
37. Which structure controls the movement of substances in and out of the cell?
38. Cell membrane
39. Cell wall
40. Cytoplasm
41. Nucleus
42. What is the actual length of an object that appeared 5mm under a x1500 magnification lens?
43. 0.003mm
44. 0.03mm
45. 0.3mm
46. A drawing of an ant is 75 mm long. The magnification of the drawing is × 15. What is the real length of the ant?
47. 0.2 mm
48. 0.5 mm
49. 5 mm
50. 1125 mm
51. Which part is missing from human red blood cells? [E]
52. Nucleus
53. Cell membrane
54. Cytoplasm
55. What is diffusion?
56. The movement of particles from low concentration to high concentration
57. The movement of particles from high concentration to low concentration
58. Active movement of particles, requiring energy from respiration
59. Osmosis is the movement of \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ molecules from an area of high concentration to an area of low concentration without the input of energy. [E]
60. Oxygen
61. Carbon
62. Water
63. Any type of molecule
64. Which substance diffuses out of respiring cells?
65. Oxygen
66. Carbon dioxide
67. Glucose
68. In an investigation, four sucrose solutions were separated from each other by partially permeable membranes. [E]

**1 1.1 M**

**2 0.8 M**

**3 0.5 M**

**4 0.1 M**

Which shows the direction in which **water** will move between the solutions?

1. From 1 and 2 to 3 and 4
2. From 2 and 3 to 1
3. From 1 to 3
4. From 2 to 4
5. Three characteristics of living organisms and four possible descriptions are shown below. Draw a straight line to match each characteristic to its description.





1. On this diagram of a liver cell, identify
2. which structure carries out aerobic respiration \_\_\_\_\_\_\_\_\_\_\_\_\_
3. which structure controls the movement of salts into the cell \_\_\_\_\_\_\_\_\_\_\_\_\_
4. which structure would carry the genes \_\_\_\_\_\_\_\_\_\_\_\_\_
5. which feature increases the surface area of the cell \_\_\_\_\_\_\_\_\_\_\_\_\_
6. which structure is a food store \_\_\_\_\_\_\_\_\_\_\_\_\_
7. Fig. 4.1 shows a typical animal cell and a typical plant cell.



1. (i) Name the parts of the cells labeled A and B.

**A- B-**

1. [ii] Label on the diagram, with a letter **C**, another structure that occurs in both cells.
2. Materials can enter the cells shown in Fig. 4.1 by diffusion and osmosis.
	1. Define diffusion.
	2. Describe how osmosis differs from diffusion. [E]
3. Fig 6.1 shows a plant cell from a leaf.



1. State the letters for the three parts that occur **only** in plant cells. \_\_\_\_\_\_\_ \_\_\_\_\_\_\_ \_\_\_\_\_\_\_
2. State two differences in structure between this leaf cell and a root hair cell. [E]
3. Explain the reason for each difference. [E]
4. Describe one difference that exists between a red blood cell and a typical animal cell. [E]
5. State an advantage of this feature in a red blood cell. [E]