Organisms exchange substances with their environment

Lessons TBAT	Key Knowledge	Practical	Assessment
TBAT: Discuss the relationship between surface area to volume TBAT: Explain how single celled organisms exchange substances TBAT: Explain how insects exchange gasses TBAT: Explain how fish exchange gasses TBAT: Explain how plants exchange gasses TBAT: Explain how plants reduce water loss	The relationship between the size of an organism or structure and its surface area to volume ratio. Changes to body shape and the development of systems in larger organisms as adaptations that facilitate exchange as this ratio reduces. **Students should be able to** appreciate the relationship between surface area to volume ratio and metabolic rate Adaptations of gas exchange surfaces, shown by gas exchange: across the body surface of a single-celled organism in the tracheal system of an insect (tracheae, tracheoles and spiracles) across the gills of fish (gill lamellae and filaments including the counter-current principle) by the leaves of dicotyledonous plants (mesophyll and stomata). Structural and functional compromises between the opposing needs for efficient gas exchange and the limitation of water loss shown by terrestrial insects and xerophytic plants.	Students could use agar blocks containing indicator to determine the effect of surface area to volume ratio and concentration gradient on the diffusion of an acid or alkali Students could use an optical microscope to: examine prepared mounts of gas exchange surfaces of a mammal, fish and insect, or temporary mounts of gills examine vertical sections through a dicotyledonous leaf Students could dissect mammalian lungs, the gas exchange system of a bony fish or of an insect. Students could: design and carry out investigations into the effect of a pH or bile salts on the rate of reaction catalysed by a digestive enzyme	End of unit assessment Maths focus Students could be given the dimensions of cells with different shapes from which to calculate the surface area to volume ratios of these cells Students could use three-way taps, manometers and simple respirometers to measure volumes of air involved in gas exchange. Students could be given values of pulmonary ventilation rate (PVR) and one other measure, requiring them to change the subject of the equation Students could be given values of cardiac output

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TBAT: Explain the structure of the respiratory system TBAT: Describe the mechanism of breathing TBAT: Explain how humans exchange gasses TBAT: Describe the difference	The gross structure of the human gas exchange system limited to the alveoli, bronchioles, bronchi, trachea and lungs. The essential features of the alveolar epithelium as a surface over which gas exchange takes place. Ventilation and the exchange of gases in the lungs. The mechanism of breathing to include the role of the diaphragm and the antagonistic interaction between the external and internal intercostal muscles in bringing about pressure changes in the thoracic cavity .	use Visking tubing models to investigate the absorption of the products of digestion Students could design and carry out an investigation into the effect of a named variable on human pulse rate or on the heart rate of an invertebrate, such as *Daphnia* **Required practical 5:** Dissection of animal or plant gas exchange system or mass transport system or of organ within such a system Students could set up and use a potometer to investigate the effect of a named environmental variable on the rate of transpiration.	(CO) and one other measure, requiring them to change the subject of the equation:

enzymes used in digestion TBAT: Explain how different products of digestion are absorbed TBAT: Describe the structure of and function of haemoglobin TBAT: Discuss the circulatory system TBAT: Describe the structure of the heart TBAT: Describe the events of the cardiac cycle TBAT: Compare the different blood vessels	**Students should be able to:** interpret information relating to the effects of lung disease on gas exchange and/or ventilation interpret data relating to the effects of pollution and smoking on the incidence of lung disease analyse and interpret data associated with specific risk factors and the incidence of lung disease evaluate the way in which experimental data led to statutory restrictions on the sources of risk factors recognise correlations and causal relationships. During digestion, large biological molecules are hydrolysed to smaller molecules that can be absorbed across cell membranes. Digestion in mammals of: carbohydrates by amylases and membrane-bound disaccharidases lipids by lipase, including the action of bile salts proteins by endopeptidases, exopeptidases and membrane-bound dipeptidases. Mechanisms for the absorption of the products of digestion by cells lining the ileum of mammals, to include:	Key stage 4 4.2 Organisation In this section we will learn about the human digestive system which provides the body with nutrients and the respiratory system that provides it with oxygen and removes carbon dioxide. In 26 Visit aqa.org.uk/8464 for the most up-to-date specification, resources, support and administration each case they provide dissolved materials that need to be moved quickly around the body in the blood by the circulatory system. Damage to any of these systems can be debilitating if not fatal. Although there has been huge progress in surgical techniques, especially with regard to coronary heart disease, many interventions would not be necessary if individuals reduced their risks through improved diet and lifestyle. We will also learn how the plant's transport system is dependent on environmental conditions to ensure that leaf cells are provided with the water and carbon dioxide that they need for photosynthesis

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TBAT: Describe how water moves in the xylem TBAT: Describe how substances move in the phloem TBAT: Investigate transport in plants	co-transport mechanisms for the absorption of amino acids and of monosaccharides the role of micelles in the absorption of lipids The haemoglobins are a group of chemically similar molecules found in many different organisms. Haemoglobin is a protein with a quaternary structure. The role of haemoglobin and red blood cells in the transport of oxygen. The loading, transport and unloading of oxygen in relation to the oxyhaemoglobin dissociation curve. The cooperative nature of oxygen binding to show that the change in shape of haemoglobin caused by binding of the first oxygens makes the binding of further oxygens easier. The effects of carbon dioxide concentration on the dissociation of oxyhaemoglobin (the Bohr effect). Many animals are adapted to their environment by possessing different types of haemoglobin with different oxygen transport properties. The general pattern of blood circulation in a mammal. Names are required only of the coronary arteries and of the blood vessels entering and leaving the heart, lungs and kidneys.	

	The gross structure of the human heart. Pressure and volume changes and associated valve movements during the cardiac cycle that maintain a unidirectional flow of blood. The structure of arteries, arterioles and veins in relation to their function. The structure of capillaries and the importance of capillary beds as exchange surfaces. The formation of tissue fluid and its return to the circulatory system. Xylem as the tissue that transports water in the stem and leaves of plants. The cohesion-tension theory of water transport in the xylem. Phloem as the tissue that transports organic substances in plants. The mass flow hypothesis for the mechanism of translocation in plants. The use of tracers and ringing experiments to investigate transport in plants.	

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