

LESSON PLAN

Modelling microbial growth

Overview

In this lesson students learn about the Kelvin scale of measurement and relate this to particle theory. By using on-line modelling software students discover how temperature affects the growth of bacteria. The different bacteria can then be researched using 'MicroTrumps' cards.

National Curriculum links

KS3/4 Working Scientifically:

Analysis and Evaluation

Apply mathematical concepts and calculate results

Measurement

Understand and use SI units and IUPAC (International Union of Pure and Applied Chemistry) chemical nomenclature

KS4 Biology:

Health and Disease

Reducing and preventing the spread of infectious diseases

Cell Biology

Factors affecting the rate of enzymatic reactions

Starters

How many? (5 minutes) – Explain to students that bacteria double in population size every 20 minutes under ideal conditions. Ask students to estimate the theoretical number of bacteria that would be present after 8 hours if doubling time was 20 mins.

The pH scale (10 minutes) – As the pH scale is logarithmic, students often find it difficult to understand that one unit is in fact 10x in difference. Practically demonstrate the pH scale dilutions to help students understand exponentials and dilutions see:

<http://www.nuffieldfoundation.org/practical-chemistry/ph-scale>

Main

Use question and answer to generate the particle model of solids, liquids and gases. Ask students to act out the particle movement in each state of matter. Then relate the movement to temperature, explaining that temperature is a measurement of the kinetic energy of the particles. Ask students to suggest when a substance would have no kinetic energy i.e. when all particles are not moving and describe this as absolute zero. This is therefore the beginning of the Kelvin temperature scale.

Ensure that students realise that a 1°C difference is the same as a 1 K difference, but 0 K is -273°C. Hence ask them to predict the kelvin value for 0°C. Now ask students to complete the temperature conversions. You may want to watch a video such as:

<https://www.youtube.com/watch?v=CAYp79W3nSY>

Show students how to log on to the 'ComBase' website <http://www.combase.cc/>. They will need to register to make an account in advance. This is a database used by research scientists and can initially appear complex. However, using the lab sheet students will model temperature effects on bacterial growth focusing on the Working Scientifically curriculum and especially on presenting data.

Plenary

MicroTrumps (10 minutes) – 'MicroTrumps' cards are a resource available from <http://www.chilledfood.org/education>. In small groups, give a pack of cards which the students share between them. They then take a card from the top, state the microbe and the temperature. The highest temperature is the winning card and that student gains all the cards from that round. The winner is the person who has the most cards in the playing time. For stretch and challenge students may use the Kelvin scale, converting from what is on the card.

What if...? (5 minutes) – Ask students to make a "safety post-it note" to explain why the fridge door must be kept fully closed.