

OUTBREAK: SUPER ANTIDOTE

These activities are designed for 60-minute lessons. You may need to adapt the materials for use in longer or shorter lessons.

INTRODUCTION

In this activity, pupils are asked to cure several patients. For each patient they must create a specific antidote from a selection of 6 ingredients. There are 4 'clues' giving information about the exact amounts of each ingredient that must be used.

This activity is mainly ICT based. It has been designed for use with pupils in an ICT suite although it could be adapted for use in a maths classroom equipped with a data projector and whiteboard. It is suggested that pupils work together in pairs or small groups to encourage appropriate levels of participation and discussion.

The activity contains 3 options offering varying degrees of challenge. Different pupil pairs or groups within a class can work at different options. Alternatively, you may prefer to ensure each group has a mix of pupils. This will help create appropriate conditions for peer support.

Completing an option unlocks a code which can be used in the map room to reflect the progress individuals or groups have made. **Please note that these codes are not automatically saved if the user logs out.** Remind users to make a note of any codes they receive as they progress.

Option 1: the use of simple fractions ($\frac{1}{2}$, $\frac{1}{3}$, $\frac{1}{4}$, $\frac{1}{5}$, $\frac{1}{10}$ etc), percentages that are multiples of 10 or 25 and simple ratios presented in words. This option is for pupils working at **level 4 of the National Curriculum**.

Option 2: the use of slightly more complex fractions, percentages that are multiples of 5, simple ratios expressed using notation and simple decimals such as 0.1. This option is for pupils working at **level 5 of the National Curriculum**.

Option 3: the use of a wider range of fractions and percentages, ratios of 3 ingredients and decimals such as 0.15. This option is for pupils working at **level 6 of the National Curriculum**.

LEARNING OBJECTIVES

Option 1

By the end of the lesson pupils will:

- use a fraction as an operator to find fractions of quantities;
- find simple percentages of small whole number quantities;
- calculate using simple ratios expressed in words;
- solve word problems.

Option 2

By the end of the lesson pupils will:

- recognise ratio notation and divide a quantity into two parts in a given ratio;
- calculate percentages, fractions and decimal amounts of a given quantity;
- identify the necessary information required to solve a problem.

Option 3

By the end of the lesson pupils will:

- divide a quantity into two or more parts in a given ratio;
- be able to solve more complicated problems using fractions, decimals, ratio and percentages;
- synthesise information in order to solve a problem.

LEARNING OUTCOMES**Option 1**

Most pupils will:

- Use given information to solve a problem. Use simple fractions including halves, quarters and tenths, percentages which are multiples of 10 or 25 and simple ratios expressed in words to identify how much of each of 6 ingredients are needed to create a specific antidote.

Option 2

Most pupils will:

- Use given information to solve a problem. Use fractions including halves, quarters, fifths, eighths and tenths, percentages which are multiples of 5, simple ratios and decimals to identify how much of each of 6 ingredients are needed to create a specific antidote.

Option 3

Most pupils will:

- Synthesise given information to solve a problem. Use fractions, percentages, ratios involving 2 or 3 values and decimals to identify how much of each of 6 ingredients are needed to create a specific antidote.

NATIONAL CURRICULUM OBJECTIVES**Ma2 Number and algebra****Using and applying number and algebra**

- 1) Pupils should be taught to:
 - a) explore connections in mathematics to develop flexible approaches to increasingly demanding problems; select appropriate strategies to use for numerical or algebraic problems
 - d) select efficient techniques for numerical calculation and algebraic manipulation.
 - j) show step-by-step deduction in solving a problem; explain and justify how they arrived at a conclusion.

Calculations

- 3) Pupils should be taught to:
 - c) calculate a given fraction of a given quantity, expressing the answer as a fraction; express a given number as a fraction of another; add and subtract fractions by writing them with a common denominator; perform short division to convert a simple fraction to a decimal.

Solving numerical problems

- 4) Pupils should be taught to:
 - a) draw on their knowledge of the operations and the relationships between them, to solve problems involving ratio and proportion, a range of measures and compound measures, metric units, and conversion between metric and common imperial units, set in a variety of contexts
 - b) select appropriate operations, methods and strategies to solve number problems, including trial and improvement where a more efficient method to find the solution is not obvious.

Links to the revised Programme of Study for introduction in 2008 include:

1 Key Concepts**Competence**

- c) Selecting appropriate mathematical tools and methods, including ICT.

Creativity

- b) Using existing mathematical knowledge to create solutions to unfamiliar problems.

2 Key Processes**Analysing**

Pupils should be able to:

- l) calculate accurately, selecting mental methods or calculating devices as appropriate
- m) manipulate numbers, algebraic expressions and equations and apply routine algorithms

3 Range and content**Number and algebra**

The study of mathematics should include:

- a) rational numbers, their properties and their different representations
- b) rules of arithmetic applied to calculations and manipulations with rational numbers
- c) applications of ratio and proportion.

4 Curriculum opportunities

The curriculum should provide opportunities for pupils to:

- b) work on sequences of tasks that involve using the same mathematics in increasingly difficult or unfamiliar contexts, or increasingly demanding mathematics in similar contexts
- e) work on tasks that bring together different aspects of concepts, processes and mathematical content
- f) work collaboratively as well as independently in a range of contexts
- g) become familiar with a range of resources, including ICT, so that they can select appropriately.

LESSON PREPARATION

- Familiarise yourself with the on-screen task in order to identify the key points that your pupils will need to address before they attempt the task.
- If required, print sufficient copies of the starter activity sheet (*Outbreak Starter*) and homework sheets (*Outbreak Homework*).
- Create sets of cards for the starter activity.
- Arrange for access to computers for the main part of the lesson.
- Create a wall display identifying key vocabulary and include pictorial representations of fractions, decimals and percentages.
- You may wish to create a certificate of achievement to award to pupils that perform well in the activity.

Vocabulary

Fraction, decimal, percentage, ratio, quantity, half, quarter, tenth.

Materials required

- Cards with fractions, percentages etc on for the starter activity. Either one set per pair or small group **OR** one large set to use with the whole class from the board **OR** sets of 'cards' prepared for use with a projector and/or interactive whiteboard.
- Copies of the Outbreak Starter sheet (if pupils have cards).
- Computer access: either one per pair or one per small group.
- To encourage pupils to practise mental methods of calculating, the use of calculators should be discouraged, however one or two calculators should be available for pupils who struggle with some of the more difficult mental calculations.

Classroom set-up

Pupils should be able to work with a partner for the starter activity and either with a partner of similar ability or individually once they begin the main activity on computers.

If the computers are in a separate room to the normal classroom, the starter and plenary activity can be carried out in the usual classroom and the pupils taken to the computer room for the main activity. You could also conduct the entire lesson in the computer room with pupils working away from the computers for the starter and plenary sessions.

Prior knowledge and skills**Option 1**

- Pupils should be able to calculate simple fractions of quantities.
- Pupils should know how to find 10%, 50% and 25% of a quantity.

Option 2

- Pupils should be able to find fractions of quantities.
- Pupils should know how to find 10%, 5%, 50% and 25% of a quantity and know how to combine these amounts to find others.
- Pupils should know how to find 0.1 of a quantity and be able to use this to ascertain other decimal quantities.
- Pupils should appreciate the connections between simple fractions, decimals and percentages.

Option 3

- Pupils should be able to find fractions of quantities.
- Pupils should know how to find any percentage of a given quantity.
- Pupils should know how to find 0.1 and 0.05 of a quantity and be able to use these to ascertain other decimal quantities.
- Pupils should appreciate the connections between simple fractions, decimals and percentages.
- Pupils should be familiar with ratio notation and be able to divide a quantity in a given ratio.

LESSON DETAILS**Starter**

Carry out the same task for each option, differentiated by the values given below.

Aims**Option 1**

- to remind pupils how to find basic fractions and percentages of quantities.

Option 2

- to remind pupils how to find fractions, simple decimals and percentages of quantities.

Option 3

- to remind pupils how to find fractions, decimals and percentages of quantities.

Either display the following three groups of numbers on the board or give them to pupils individually written on pieces of card; group A on one colour, group B on another and group C on a third colour.

Values for Option 1

Group A: 10% $\frac{1}{4}$ 50% $\frac{2}{5}$ $\frac{3}{10}$

Group B: 10 20 15 30 40
Group C: 4 5 7 8 9 10 11 15

Values for Option 2

Group A: 0.1 $\frac{1}{4}$ 30% 50% 0.4 $\frac{3}{5}$
Group B: 10 20 15 30 40
Group C: 4 5 7 8 9 10 11 15

Values for Option 3

Group A: 0.1 $\frac{1}{4}$ 15% 60% 0.4 $\frac{3}{5}$
Group B: 10 20 15 24 30 40
Group C: 4 5 6 7 8 9 10 11 12 18 24

Tasks

- Display on the board: \uparrow of $\uparrow = \uparrow$
- If pupils are given the cards then copies of the Outbreak Starter sheet can be given to pupils to place the cards on. This would be particularly useful for less able pupils.
- Ask pupils to complete the 'sentence' by selecting a card from group A for the first box, a card from group B for the second box and a card from group C for the third box.
- Ask pupils to work in pairs or groups to find 3 more 'sentences' using the values given.
- Ask a few pupils to share their responses and their methods of calculation.
- Ask the question "Are there any numbers in group C that cannot be used as answers for 'sentences' using the numbers in groups A and B?"

Main*Before moving to the computers:*

- It may be useful to show the pupils the screens they can expect to see and how to choose the option appropriate for them.
- Pupils could be told that they will be presented with a random selection of problems to solve so they need not worry if they have different answers to their neighbours.
- There are four clues for each problem presented simultaneously on screen and all of them will be needed to solve the problem. The on-screen order of the clues may not be the order in which they are needed, particularly with Option 3.
- Pupils will need to have pencil and paper (or exercise books) to hand in order to jot down notes and calculations. They need not write down their calculations formally.

Whilst pupils are working on the computer tasks:

- Pupils should be encouraged to use what they do know in order to work out other values, e.g. if they know how to find 10% of an amount, they should be prompted to realise that 5% is half of 10% and to build up other values accordingly.
- Pupils working on Option 2 may encounter ratio notation for the first time or may not know how to divide a quantity in a given ratio. The ratios presented in this option are mostly of the form 1: n and have integer answers that are multiples of 5. Teachers should be prepared to support pupils with these problems and may find it useful to stop the class after a few minutes to address this together.
- Pupils should be discouraged from using trial and error to complete the activity. You should remind them that they are penalised for having a high number of attempts. This penalty is specified in the code that is awarded to them at the end of the activity.

It is recommended that pupils begin on either Option 1 or Option 2 to familiarise themselves with the task and then move on to Option 2 or Option 3 to challenge their mathematics and problem-solving skills.

If time allows, invite your pupils to devise their own examples of similar problems. Pupils could then be asked to test out their own questions on other learners within their group, varying the number of ingredients to increase or decrease the overall level of challenge.

Plenary

Carry out the same task for each option, differentiated by the values given below.

The class is given a set of clues to work out the ingredients for an antidote, but the clues do not make the correct amount of antidote. This plenary will lead directly to the homework tasks.

Clues for Option 1

- a) 30% of the mixture is ingredient A
- b) Half of the mixture is ingredient C
- c) You need to make 100ml of antidote
- d) A quarter of the mixture is ingredient D

Clues for Option 2

- a) You need to make 100ml of antidote
- b) 25% of the mixture is ingredient B
- c) The ratio of ingredient C to ingredient D is 1:3
- d) Together, C and D make up 80ml of the antidote

Clues for Option 3

- a) You need to make 150ml of antidote using 4 ingredients
- b) 20% of the mixture is ingredient F
- c) The ratio of ingredients A: B: E is 2:3:4
- d) There is 30ml of ingredient A

Ask pupils to find 2 ways in which they could amend the clues in order to give a correct set of clues and answers.

Homework

The homework sheets provided are at the same levels as the main lesson work and are produced in a format reflecting the on-screen task.

For each option, question 1 is presented in the same manner as the on-screen task: pupils are given 4 clues to solve in order to create an antidote.

Question 2 is presented in reverse. Pupils are given the amount of each ingredient to be used in an antidote and are asked to create 4 clues that will give a unique solution.

For question 3, pupils have to decide on the amount of each ingredient to use in their own antidote and then create a set of clues with a unique solution.

As a follow-up, use pupils' clues as a starter activity for future lessons. Selected pupils can read out their set of clues for question 3 for the rest of the class to solve.

TECHNICAL SUPPORT

Throughout all the activities and support notes you will be asked to open various files in Flash or in Adobe PDF. To use these, you will need to have the minimum specification installed. This recommendations list can be found below.

The latest **Adobe Flash Player** (previously know as the Macromedia Flash Player) can be downloaded free from the Adobe website. Support and Help can also be found on this site.

http://www.adobe.com/shockwave/download/download.cgi?P1_Prod_Version=ShockwaveFlash

You will be using a version of **Adobe Reader** or Distiller to view these Teacher Notes. If you would like help or to download a newer version, you can find information at Adobe's website:

<http://www.adobe.com/products/reader/>

Minimum Machine and Software Specifications

PC

P3 800MHz; 128MB RAM; Windows 2000

Screen resolution 1024x768

Browser: Microsoft Internet Explorer 5.5; Firefox 1; Netscape 7; or Opera 7

Macromedia Flash Player 7

Adobe Reader 7

Mac

G3 500MHz; 128MB RAM; OS X 10.2

Browser: Safari 1; Firefox 1; Netscape 7; or Opera 6.2

Screen resolution 1024x768

Macromedia Flash Player 7

Adobe Reader 7