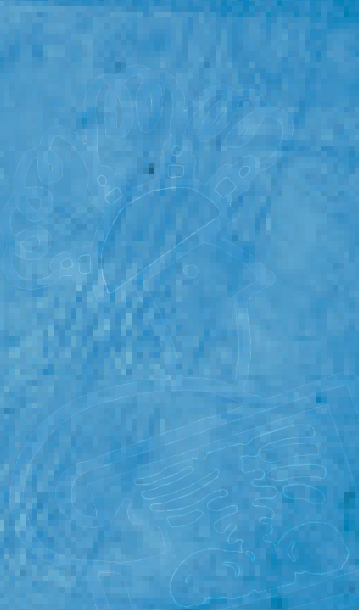# SCIENCE
LEVEL 1/2

UNIT R073 - HOW SCIENTISTS TEST THEIR IDEAS: ANTIMICROBIALS

LEARNER STYLE WORK

LEVEL 1 PASS

VERSION 1 JUNE 2013

CONTENTS

INTRODUCTION

This work has been developed to provide examples of the content and standard of work required to evidence the identified assessment criteria (Level 1, R073 Model Assignment). This is one approach that could be used but it must not be directly replicated or any part plagiarised by learners.

Teachers may choose to identify their own approach for learners to follow but evidence submitted must clearly meet the assessment criteria.

This is not real learner work; its purpose is to provide ideas and approaches.

The text in the blue boxes are examples of annotations teachers may add to work. The annotations are of good practice and are not a compulsory element of teacher marking.

All centres should complete a unit record sheet for each candidate. The unit record sheet should include comments related to the marking of candidates work. The unit record sheet should not be returned to candidates once work has been marked.

LEVEL 1 PASS
EXPERIMENT ON ANTIMICROBIALS

The terms antiseptic and disinfectant are used almost interchangeably nowadays. Yet they do have different meanings.

An antiseptic is a chemical or technique that is used on people.

A disinfectant is a chemical that is applied to an inanimate object or surface to get rid of microorganisms.

An antiseptic generally does not have the same potency as a disinfectant. Otherwise, the chemical would harm the tissues it is in contact with. For this reason, an antiseptic should not be used on work surfaces. Likewise, the generally more toxic disinfectant should not be used to treat skin or areas such as the mucous membranes of the nose and mouth.

http://www.modernmedicalguide.com/antiseptics/

Some types of harmful germs (such as those that cause colds and flu) can live on surfaces for several days. A few simple cleaning and disinfecting tips can help protect your family by reducing the spread of these germs.

Types of germs:

Bacteria: Salmonella and E. coli bacteria can cause food poisoning.
*   Viruses: Rhinoviruses can cause colds. Herpes simplex virus causes cold sores. Influenza viruses cause flu.
*   Fungi: Trichophyton can cause athlete's foot.
*   Parasites: Giardia can cause diarrhoea.

I found this information on the Dettol web site http://www.dettol.co.uk/.

You can get disinfectants and antiseptics as liquids, cleaning wipes and sprays.

LO1 - MB1 Sources of secondary info

Plan

The equipment I used for my experiment:

**LO1 - MB1 Equipment and method**

- Filter paper
- Agar
- Petri dish
- Measuring cyllinder
- Pen
- Tweezers
- Ruler
- Incubater
- Stopwatch
- the bacteria we used for our experiment
- Hydrogen peroxide
- Rubber gloves
- Tape
- Paper

Method:
- Firstly we grew the bacteria with nutrients in a conical flask for 24 hours in an incubater.
- We made the agar and poured it into the five Petri dishs.
- We cut out 20 small circles of filter paper. They were the same size.
- Then we soaked 3 circles of filter paper in one of the beakers of antimicrobial. And the 4th filter paper will be soaked in water.
- Then I will devide our 5 Petri dishes into 4 sections for the 5 different concentrations.
- We picked out our filter paper from the beaker of antimicrobial and placed it onto our agar. We also added our control to every one of the Petri dishs.
- The after we'd done all 5 petri dishes with our different concentrations and controls, we put them in the incubater for 24 hours.

100%   50%   25%   12.5%   6.25%

● = **control**

● = **filter paper soaked in antimicrobial**
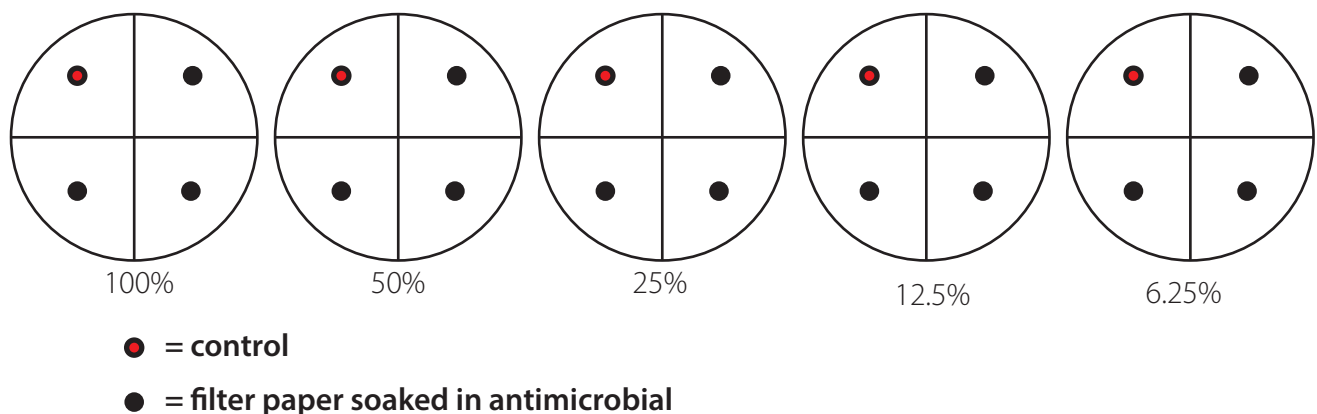
This diagram shows my 5 petri dishes and the different concentrations.

Making it a fair test -

The extra piece of filter paper with water made it a fair test. We could tell if our experiment was accurate or not.

We tried to get the same amount on each to make it a fair test.

Risk Assessment:
- Hang bags up as people may trip up on them while doing the experiment.
- Tie your hair back and wear goggles.

**LO1 - MB1 Same amount of H$_2$O$_2$ = fair testing**

LO2 MB1 Basic risk assessment: Intervention needed to prevent candidate putting face too close to the bacteria/agar plate

Results and data analysis:

Concentration	Average diameter
100%	22
50%	16
25%	12
12.5%	7
6.25%	6
Control	0

LO1 - MB1 No units

LO2 MB1 No raw data: Calculations of averages carried out correctly

LO5 - MB1 Bar chart drawn instead of line graph

LO1 - MB1 Scale inappropriate
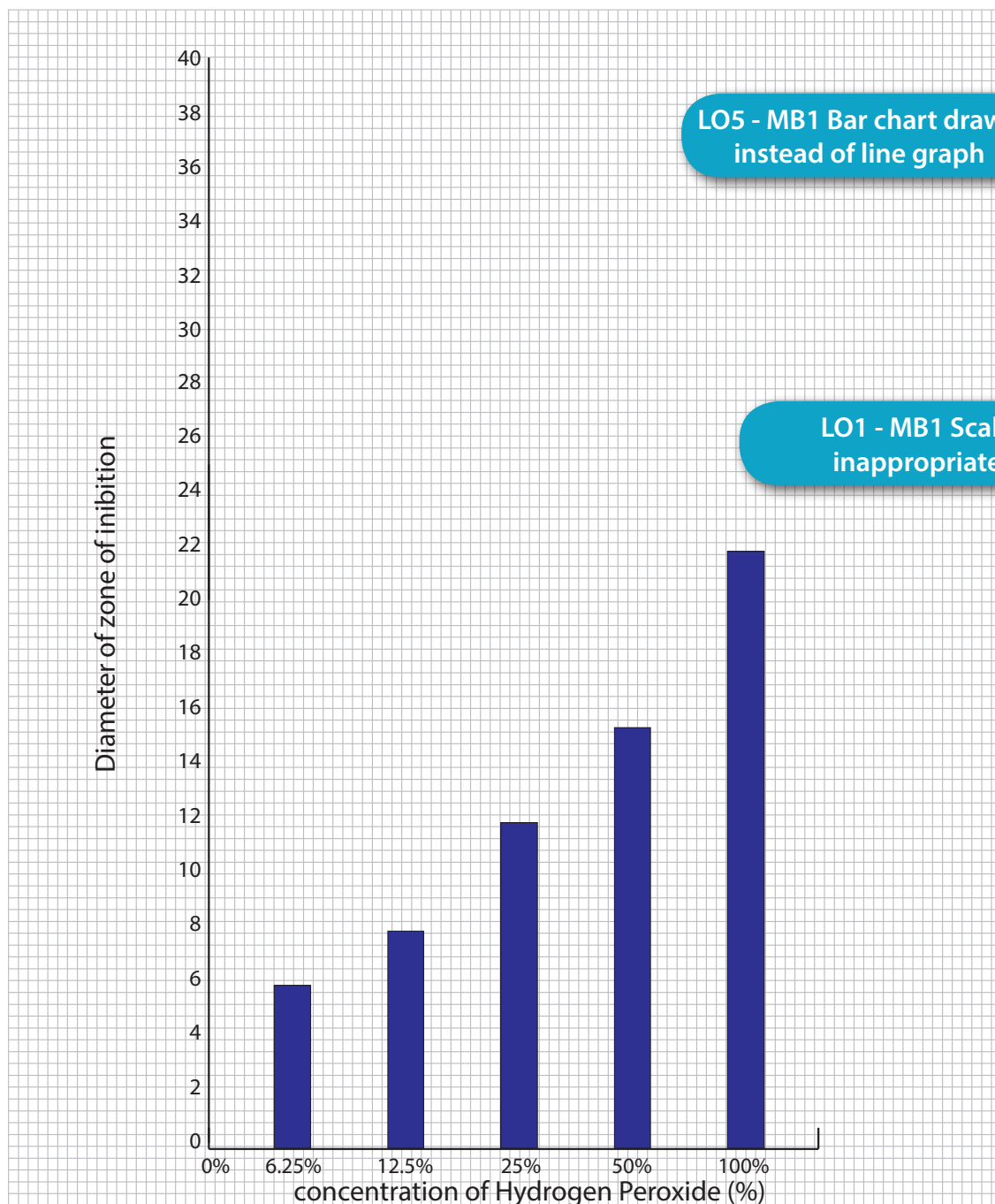
Graph of diametre and concentration

By looking at my table and graph, I can see that there are no outliers, as the results show a pattern, meaning my results are accurate and reliable as I use all my data to work out the mean.

The bacteria we used was called *Bacillus subtilis* and the antimicrobial called hydrogen peroxide. I have found that the higher the concentration of the antimicrobial, the faster it can kill germs.

LO3/LO4 - MB1 Trend

UNIT RECORDING SHEET

Science

OCR J815 Unit R073 Level 1/Level 2

Cambridge National Certificate in Science

Unit Recording Sheet

Please read the instructions printed at the end of this form. **One** of these sheets, suitably completed, should be attached to the assessed work of **each** candidate.

Unit Title	How scientists test their ideas		Unit Code	R073	Session	January	Year	
Centre Name						**Centre Number**		
Candidate Name	Antimicrobials L1 Pass					**Candidate Number**		

Criteria			Teacher Comments	Mark	Page No
LO1: Be able to plan a scientific investigation			Plan includes equipment and techniques. Comment on fair testing (ensuring discs loaded with same amount of hydrogen peroxide). Two sources of information cited (but some, e.g. of images, not).	5	
MB1: 1 – 6 marks	**MB2: 7 – 11 marks**	**MB3: 12 – 15 marks**			

• **Limited** plan includes equipment and techniques to be used
• Plan provides a 'fair test'
• Identifies how **some** errors will be minimised
• **Some** sources of secondary data/information identified
	• Plan gives **sufficient detail** for investigation to be repeated, including choices of:
	  o equipment, including instrumentation
	  o range and number of data points
	  o number of replicates
	  o control of variables
	to result in the collection of data of an appropriate quality
	• **Some** explanation of how errors will be minimised
	• **Range** of **relevant** sources of secondary data/information identified
		• **Comprehensive** plan shows scientific understanding in making appropriate choices of:
		  o equipment, including instrumentation
		  o range and number of data points
		  o number of replicates
		  o control of variables
		to result in the collection of accurate data to address the scientific problem
		• **Detailed** explanation of:
		  o how errors will be minimised
		  o variables which cannot be controlled
		• **Wide range** of **relevant** sources of secondary data/information identified and selection of **appropriate** sources justified			

[1 2 3 4 ⑤ 6]	[7 8 9 10 11]	[12 13 14 15]			

Criteria			Teacher Comments	Mark	Page No
LO2: Be able to collect scientific data			A basic risk assessment has been provided; no reference to specific hazards and reducing risks. The quality of response is limited, however. Teacher intervention required to ensure that molten agar containing bacteria handled safely and aseptic technique used. Results recorded. No units provided for diameter and column heading lacks appropriate information.	3	
MB1: 1 – 4 marks	**MB2: 5 – 7 marks**	**MB3: 8 – 10 marks**			
• **Basic** understanding of risks in procedures with only standard laboratory safety precautions identified • **Significant** teacher intervention required to ensure safety **or** help set up equipment • Results recorded **clearly** [1 2③4]	• **Some** risks in procedures identified and **some** specific responses suggested to reduce risks • **Most** risks managed successfully with no significant incidents or accidents and no requirement for teacher intervention • **Little support** required to set up equipment • Results tabulated to include all data collected, including use of correct headings [5 6 7]	• All significant risks in the plan **evaluated** and **reasoned** judgements made to reduce risks by use of **appropriate** specific responses • All risks managed successfully with no incidents or accidents and no requirement for teacher intervention • Measurements taken and recorded to appropriate accuracy and precision using an appropriate format, including use of correct units [8 9 10]			
LO3: Be able to analyse scientific information			Means calculated but calculations not shown. Bar chart used to display data. Scale on x-axis inappropriate. Simple trend in data indicated.	4	
MB1: 1 – 5 marks	**MB2: 6 – 9 marks**	**MB3: 10 – 13 marks**			

• **Some** evidence of processing of quantitative data:
  o data presented as **simple** charts or graphs
  o use of a **simple** mathematical technique where appropriate
• **Some** trends/patterns in the data identified
 	
[1 2 3④5]
	• Graphical and mathematical techniques used to reveal patterns in data:
	  o charts or graphs used to display data in an **appropriate** way
	  o correct use of simple mathematical techniques where appropriate
	  o **appropriate qualitative** treatment of the levels of uncertainty in the data, including identification of any anomalous results
	• Main trends/patterns in the data **described** with reference to quantitative data
	[6 7 8 9]
		• **Appropriate** graphical and mathematical techniques used to reveal patterns in data:
		  o **appropriate** scales and axes used in graphs and data plotted **accurately**, including where **appropriate**, use of lines of best fit
		  o correct use of complex mathematical techniques where **appropriate**
		  o **appropriate** quantitative treatment of levels of uncertainty in the data
		• Main trends/patterns in the data described in detail and interpreted correctly with reference to quantitative data and **relevant** scientific understanding
		[10 11 12 13]			

Criteria			Teacher Comments	Mark	Page No.
LO4: Be able to evaluate scientific information			Candidate indicates there are no outliers because the results show a trend. Simple conclusion given. Draws on limited information from Unit 1.	**4**	
MB1: 1 – 5 marks	**MB2: 6 – 9 marks**	**MB3: 10 – 13 marks**			
• **Limited** comments made about the quality of the data and the methods used • **Simple** conclusion given which is consistent with the data collected and shows **limited** scientific understanding • There is **limited** application of skills/knowledge/understanding from other units in the specification [1 2 3④5]	• **Some relevant** comments made about the quality of the data including accuracy and sources of error, linked to the methods of collection: o limitations in the methods of data collection identified and suggestions for improvements given • Conclusion given and **justified** based on an analysis of the data, showing **sound** understanding of the underlying science • Applies skills / knowledge / understanding from other units in the specification in a way which is **mostly relevant** [6 7 8 9]	• **Detailed** and **critical** consideration given to the data and methods used to obtain them: o sources of error and quality of data **discussed** and **explained**, including accuracy, repeatability and uncertainty o limitations of the method identified and suggestions for improvements **justified** • Conclusion given and **justified** based on **critical** analysis of primary and secondary data, clearly linked to **relevant** scientific understanding o identification of conflicting evidence o what further evidence is needed to make the conclusion more secure • Applies skills / knowledge / understanding from other units in the specification in an **effective** relevant way [10 11 12 13]			
LO5: Be able to communicate scientific information			Some errors in SPG. Some relevant images used in introduction, but lack appropriate captions. Bar chart drawn instead of line graph.	**3**	
MB1: 1 – 4 marks	**MB2: 5 – 7 marks**	**MB3: 8 – 9 marks**			
• **Limited** use of scientific, technical and mathematical language, conventions and symbols • **Some** errors in grammar, punctuation and spelling • **Limited** use of diagrams, graphs, flow charts and pictures [1 2③4]	• Information is presented in a **structured** format • **Sound** use of scientific, technical and mathematical language, conventions and symbols • **Occasional** errors in grammar, punctuation and spelling • **Some appropriate** use of diagrams, graphs, flow charts and pictures [5 6 7]	• Information presented is **clear**, well organised and structured, and in a **coherent** format • Scientific, technical and mathematical language, conventions and symbols are used **effectively** • **Few**, if any, errors in grammar, punctuation and spelling • Diagrams, graphs, flow charts and pictures are used **appropriately** and accurately [8 9]			
			Total/60	**19**	

URS143 Devised July 2012   **R073/URS**

Oxford Cambridge and RSA Examinations

MODERATORS COMMENTS

R073 How Scientists test their ideas: Antimicrobials L1 Pass		
LO1: Be able to plan a scientific investigation		
MB1: 1 – 7 marks	**MB2: 8 – 13 marks**	**MB3: 14 – 18 marks**

• **Limited** plan includes equipment and techniques to be used
• Plan provides a 'fair test'
• Identifies how **some** errors will be minimised
• **Some** sources of secondary data/information identified
	• Plan gives **sufficient detail** for investigation to be repeated, including choices of:
	  - equipment, including instrumentation
	  - range and number of data points
	  - number of replicates
	  - control of variables to result in the collection of data of an appropriate quality
	• **Some** explanation of how errors will be minimised
	• **Range** of **relevant** sources of secondary data/information identified
		• **Comprehensive** plan shows scientific understanding in making appropriate choices of:
		  - equipment, including instrumentation
		  - range and number of data points
		  - number of replicates
		  - control of variables
		  - to result in the collection of accurate data to address the scientific problem
		• **Detailed** explanation of:
		  - how errors will be minimised
		  - variables which cannot be controlled
		• **Wide range** of **releva**nt sources of secondary data/information identified and selection of **appropriate** sources justified

The report includes a list of equipment a method, but the material is not written as or designated as a 'plan'. An aspect of 'fair testing' is mentioned. Two sources of information are cited in-text, but the second limited to a homepage. The first provides useful information, but not reworked to any extent by the candidate; the selection of information by the candidate from the second website could have been improved. The sources of the images have not been cited. [5]		

LO2: Understand the risks and benefits related to the applications of nuclear radiation		
MB1: 1 – 4 marks	**MB2: 5 – 7 marks**	**MB3: 8 – 10 marks**
• **Basic** understanding of risks in procedures with only standard laboratory safety precautions identified • **Significant** teacher intervention required to ensure safety or help set up equipment • **Results** recorded clearly	• **Some** risks in procedures identified and **some** specific responses suggested to reduce risks • **Most** risks managed successfully with no significant incidents or accidents and no requirement for teacher intervention • **Little support** required to set up equipment • Results tabulated to include all data collected, including use of correct headings	• All significant risks in the plan **evaluated** and **reasoned** judgements made to reduce risks by use of **appropriate** specific responses • All risks managed successfully with no incidents or accidents and no requirement for teacher intervention • Measurements taken and recorded to appropriate accuracy and precision using an appropriate format, including use of correct units
A basic risk assessment that includes generic precautions only. Centre annotation says intervention during practical work required. Means recorded, but no raw data. The column heading for zone of inhibition does not define this, and units are lacking. [3]		

LO3: Be able to analyse scientific information		
MB1: 1 – 5 marks	**MB2: 6 – 9 marks**	**MB3: 10 – 12 marks**

• **Some** evidence of processing of quantitative data:
• data presented as **simple** charts or graphs
• use of a **simple** mathematical technique where appropriate
• **Some** trends/patterns in the data identified
	• Graphical and mathematical techniques used to reveal patterns in data:
	  - charts or graphs used to display data in an **appropriat**e way
	  - correct use of simple mathematical techniques where appropriate
	  - **appropriate qualitative** treatment of the levels of uncertainty in the data, including identification of any anomalous results
	• Main trends/patterns in the data **described** with reference to quantitative data
		• **Appropriate** graphical and mathematical techniques used to reveal patterns in data:
		  - **appropriate** scales and axes used in graphs and data plotted **accurately**, including where **appropriate**, use of lines of best fit
		  - correct use of complex mathematical techniques where **appropriate**
		  - **appropriate** quantitative treatment of levels of uncertainty in the data
		• Main trends/patterns in the data described in detail and interpreted correctly with reference to quantitative data and **relevant** scientific understanding

Means have been presented in the table, but no raw data so that calculations could be checked (though centre annotation indicates that these have been calculated satisfactorily). Bar chart drawn, but with inappropriate scale and some errors in plotting. Simple trend in data described. [4]		

LO4: Be able to evaluate scientific information		
MB1: 1 – 5 marks	**MB2: 6 – 9 marks**	**MB3: 10 – 13 marks**

• **Limited** comments made about the quality of the data and the methods used
• **Simple** conclusion given which is consistent with the data collected and shows **limited** scientific understanding
• There is **limited** application of skills/ knowledge/ understanding from other units in the specification
	• **Some relevant** comments made about the quality of the data including accuracy and sources of error, linked to the methods of collection:
	• limitations in the methods of data collection identified and suggestions for improvements given
	• Conclusion given and **justified** based on an analysis of the data, showing **sound** understanding of the underlying science
	• Applies skills/knowledge/understanding from other units in the specification in a way which is **mostly relevant**
		• **Detailed** and **critical** consideration given to the data and methods used to obtain them:
		  - sources of error and quality of data **discussed** and **explained**, including accuracy, repeatability and uncertainty
		  - limitations of the method identified and suggestions for improvements **justified**
		• Conclusion given and **justified** based on **critical** analysis of primary and secondary data, clearly linked to **relevant** scientific understanding
		  - identification of conflicting evidence
		  - what further evidence is needed to make the conclusion more secure
		• Applies skills/knowledge/understanding from other units in the specification in an **effective** relevant way

Claim for 'no outliers' made, and suggestion that this is because the data show a trend. A simple conclusion has been provided. There is some (limited) application of knowledge and understanding from Unit 1 on the introductory page. [4]		

LO5: Be able to communicate scientific information		
MB1: 1 – 4 marks	**MB2: 5 – 7 marks**	**MB3: 8 – 9 marks**
• **Limited** use of scientific, technical and mathematical language, conventions and symbols • **Some** errors in grammar, punctuation and spelling • **Limited** use of diagrams, graphs, flow charts and pictures	• Information is presented in a **structured** format • **Sound** use of scientific, technical and mathematical language, conventions and symbols • **Occasional** errors in grammar, punctuation and spelling • **Some appropriate** use of diagrams, graphs, flow charts and pictures	• Information presented is **clear**, well organised and structured, and in a **coherent** format • Scientific, technical and mathematical language, conventions and symbols are used **effectively** • **Few**, if any, errors in grammar, punctuation and spelling • Diagrams, graphs, flow charts and pictures are used **appropriately** and accurately
There is some limited use of scientific, technical and mathematical language. There are some errors in grammar, punctuation and spelling. Two pertinent images have been used related to application of antimicrobials; another image that is simply decorative. [3]		

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