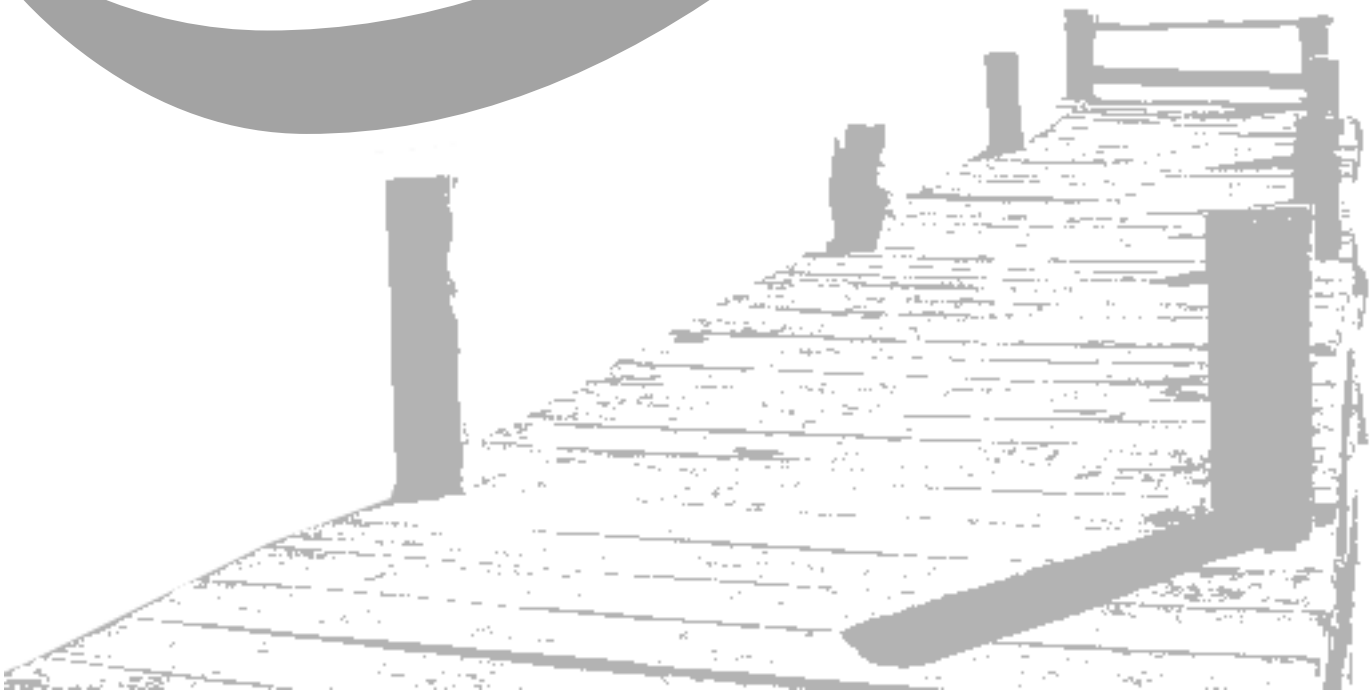
GCE
AS and A Level

Human Biology

AS exams 2009 onwards
A2 exams 2010 onwards

Unit 6T:
Specimen ISA and Task Sheet

Version 1.1



Version 1.1

Surname		Other Names	
Centre Number			Candidate Number				
Candidate Signature									

General Certificate of Education
Advanced Level Examination

AQA
ASSESSMENT and QUALIFICATIONS ALLIANCE

BIOLOGY **HBI6T**
Investigative Skills Assessment (ISA)
A2 Centre Assessed Unit

Draft Specimen Paper

In addition to this paper you will require
- results, table and charts or graphs from your own investigation
- a ruler with millimetre measurements

You may use a calculator

Time allowed: 1 hour 15 minutes

For Teacher's Use	
	Mark
Section 1 and 2 Skills	
Section A	
Section B	
TOTAL	

Instructions
- Use black ink or ball-point pen.
- Fill in the boxes at the top of this page.
- Answer **all** questions.
- Answer the questions in the spaces provided.
- Do all rough work in this book. Cross through any work you do not want marked

Information
- The maximum mark for the ISA is 44.
- The marks for questions are shown in brackets.
- You are reminded of the need for good English and clear presentation in your answers.
- Use accurate scientific terminology in all answers.

Signature of Teacher marking this ISA…… Date…….

SECTION A

The questions in this section of the paper are about the investigation you carried out.

That includes the data you obtained and and the statistical test you have used.

Answer **all** questions in the spaces provided.

1 Investigations that involve growth of bacteria should include the control of temperature. Explain why.

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(2 marks)

2 (a) Describe the control experiment you carried out in your investigation.

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(1 mark)

(b) Appropriate control experiments should be carried out when necessary. Explain why.

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(1 mark)

3 Apart from temperature**,** give **two** variables which you kept constant or attempted to keep constant in your investigation.

Variable 1 .....

Variable 2 .....

(2 marks)

4 Describe the trend or patterns in the data you obtained. You should refer to all four concentrations of disinfectant.

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(2 marks)

5 The following questions refer to your statistical analysis.

(a) What statistical test did you use to analyse your data? Explain why you used this test.

Statistical test used .....

Explanation .....

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(1 mark)

(b) State the null hypothesis for your investigation

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(1 mark)

(c) Give the statistical test value (the test statistic) you calculated.

Statistical test value = ...

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Explain how the statistical value can be used to interpret the data you collected.

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(2 marks)

(d) What conclusion can you make from the *interpretation of the statistical test*?

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(2 marks)

6 *Use evidence from your results table* to explain whether or not the data collected are reliable.

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(2 marks)

16

Turn over for the next question

SECTION B

This section of the paper is about the effect of antibiotics on growth of bacteria. Use the information given and your own knowledge to answer the questions.

Introduction

Staphylococcus is a common bacterium which is found in the throats of many people. *Staphylococcus aureus* is one species of this bacterium. MRSA stands for methicillin-resistant *Staphylococcus aureus*. This species is resistant to the antibiotic, methicillin, as well as other antibiotics. Many different strains of MRSA have been discovered, each with different degrees of resistance to various antibiotics. MRSA is a big problem in hospitals where sick and weaker people tend to be near each other. Antibiotics can still work against MRSA but high dosages are needed.

Resource A

Antibiotics do not all prevent bacterial growth to the same degree. Doctors investigated the effectiveness of different antibiotics in preventing growth of *Staphylococcus aureus.*
Paper discs were prepared containing antibiotics. Each disc contained **one** of three different antibiotics. Agar plates were prepared using aseptic techniques. 0.5 cm^3 of a liquid culture of *Staphylococcus aureus* was added to each plate and spread over the surface of the nutrient agar.

The discs were placed on the surface of the agar plates as follows:

- 15 plates had paper discs with antibiotic **X**,
- 15 plates had paper discs with antibiotic **Y**,
- 15 plates had paper discs with antibiotic **Z**.

The agar plates were placed in an incubator. After 36 hours, the diameter of any clear zones around the discs was measured. The results are shown in the table.

	Diameter of clear zone / mm		
Agar plate number	**Antibiotic X**	**Antibiotic Y**	**Antibiotic Z**
1	7	3	4
2	3	2	2
3	3	1	2
2	no growth	8	3
5	2	3	2
6	3	4	5
7	4	6	2
8	3	4	9
9	no growth	2	6
10	8	5	2
11	8	5	3
12	6	4	4
13	4	These plates had dried up	2
14	4		4
15	5		5
Mean diameter / mm		3.13	3.67
Standard deviation	2.48	1.78	2.19

Resource B

If a person had an MRSA infection at death, this is recorded on the death certificate. The table shows the number of reported deaths mentioning MRSA in 2003 and 2004.

Year	Number of mentions of MRSA on death certificates
2003	955
2004	1168

Resource C

To monitor the number of infections involving MRSA, all doctors keep a record of any patients seen with MRSA. The table shows the number of MRSA infections reported by doctors in the UK.

Year	Number of cases of MRSA infections reported by doctors
2003/4	7684
2004/5	7212
October 2005 to March 2006	3517

Resource D

Some patients contract a new infection while in hospital. Some of these are infections with MRSA. **Figures 1** and **Figure 2** show data on infections developed while in hospital and annual deaths from hospital-acquired infections. (Source: National Audit Office)

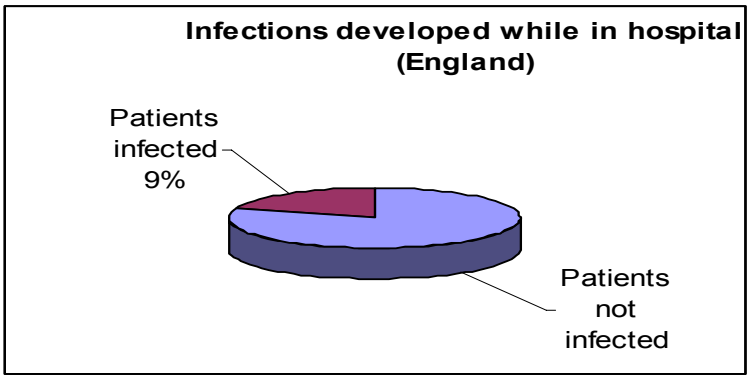

Figure 1

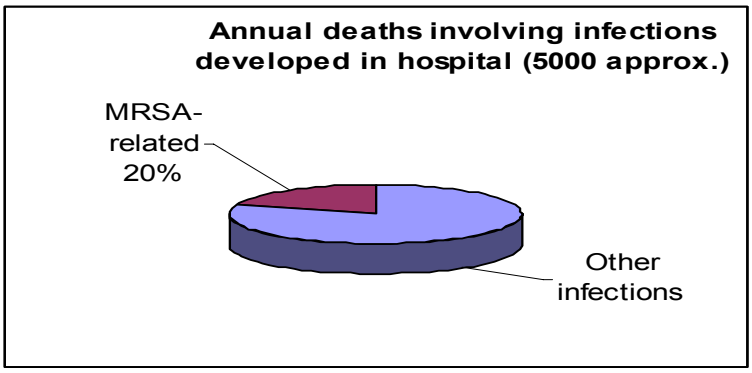

Figure 2

Resource E

An outline method for estimating the number of live bacteria in a culture (viable count).

- Produce known dilutions of the bacterial culture
- Use aseptic techniques
- Pour nutrient agar into Petri dishes (agar plates)
- Spread the bacterial culture across the surface of the agar
- Count the number of colonies

7 Select and use the resources to describe the risk of death from an MRSA-related infection developed while in hospital during 2004.

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(3 marks)

8 Use the information provided in the introduction and **Resource A** to answer the following questions.

(a) What is *mean diameter* obtained with **Antibiotic X**.

Mean diameter.....mm

(1 mark)

(b) Use the data for mean diameters to compare the effectiveness of antibiotic **Y** and antibiotic **Z** on growth of *Staphylococcus aureus*.

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(2 marks)

(c) Variation in a set of data can be measured using standard deviation of the mean, or the range of the data. Standard deviation is a more useful measure of variation.
Use the information in the table for antibiotics **X** and **Y** to explain why.

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(4 marks)

(d) Suggest why the growth of *Staphylococcus aureus* was affected in this investigation.

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(2 marks)

9 Compulsory reporting of MRSA infections was not introduced in the UK until 2001. A target of fewer than 4000 new cases was then set for 2007/8. Use the resources to consider the reliability of the following statements.

(a) There is an observable trend

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(2 marks)

(b) The target was likely to be met.

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(2 marks)

10 Your teacher gives you a 1cm^3 sample of *Staphylococcus aureus* in liquid culture medium. Using **Resource E** to help, describe a method you could use to estimate the size of the population in the sample.
Credit will be given for use of appropriate apparatus, techniques and control of relevant factors which will enable you to collect reliable data.

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(6 marks)

22

END OF QUESTIONS

GENERAL CERTIFICATE OF EDUCATION
JUNE 200X / JUNE 200X

DRAFT A2 HUMAN BIOLOGY ISA: HBI6T TASK SHEET

ASSESSMENT and QUALIFICATIONS ALLIANCE

ISA Specimen Material - The effect of substances on growth of bacteria

Introduction

The effect of different substances on the growth of bacteria can be shown using a culture of a suitable bacterium. For example, paper discs soaked in disinfectant can be placed on an agar plate culture of a bacterium. Disinfectants are bactericidal and a clear zone will form round a disc where bacterial growth has been prevented. The effectiveness of a disinfectant will be shown by the size of the clear zone.

In this investigation, you will investigate changes in bacterial growth when disinfectants with different concentrations are added to a culture of bacterium.

Outline method

A 1 Obtaining disinfectant solutions of different concentration. You will be provided with a stock solution of disinfectant (100%) from which you will produce three further concentrations (10%. 1% and 0.1%).

2 Identifying a suitable method for culturing bacteria on nutrient agar plates.

(You may ask for help from your teacher for this part.)

B Carrying out the investigation. (Your teacher is not allowed to give you help with this part.)

For each disinfectant solution:

1 Soak 3 discs of filter paper in the disinfectant solution.
2 Prepare a sterile agar plate containing nutrient agar inoculated with the bacterium provided.
3 Add three equally-spaced soaked discs of filter paper to the surface of the inoculated agar plate.
4 Incubate the plate for a period of between 24 and 72 hours.
5 Measure the size of the clear zone around each disc of filter paper.

You must decide:

- how many repeats to use with each concentration,
- how to control variables that might influence the data to be collected,
- what data to collect to determine the effect of concentration of disinfectant on the growth of the bacterium.