



Additional Assessment Materials
Summer 2021

Pearson Edexcel GCE (Biology A)

Resource Set Topic 6: Immunity, Infection and
Forensics

Question Paper

(Public release version)

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General guidance to Additional Assessment Materials for use in 2021

Context

- Additional Assessment Materials are being produced for GCSE, AS and A levels (with the exception of Art and Design).
- The Additional Assessment Materials presented in this booklet are an **optional** part of the range of evidence teachers may use when deciding on a candidate's grade.
- 2021 Additional Assessment Materials have been drawn from previous examination materials, namely past papers.
- Additional Assessment Materials have come from past papers both published (those materials available publicly) and unpublished (those currently under padlock to our centres) presented in a different format to allow teachers to adapt them for use with candidate.

Purpose

- The purpose of this resource to provide qualification-specific sets/groups of questions covering the knowledge, skills and understanding relevant to this Pearson qualification.
- This document should be used in conjunction with the mapping guidance which will map content and/or skills covered within each set of questions.
- These materials are only intended to support the summer 2021 series.

6 Tuberculosis (TB) is an infectious disease caused by mycobacteria.

(a) Most cases of TB are caused by infection with *Mycobacterium tuberculosis* (*M. tuberculosis*).

The ribosomes of bacteria are

(1)

- A larger than the ribosomes in eukaryotes
- B smaller than ribosomes in eukaryotes
- C the same size as ribosomes in animal cells
- D the same size as ribosomes in plant cells

*(c) Individuals infected with *M. tuberculosis* can be treated with antibiotics.

Four of the antibiotics used to treat TB are shown in the table.

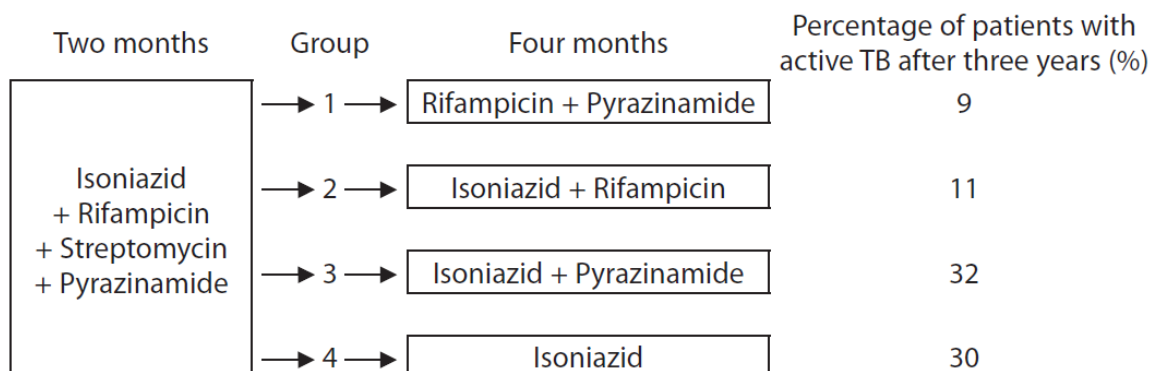
Antibiotic	Mechanism of action
Isoniazid	Inhibits the synthesis of a fatty acid needed to make bacterial cell walls
Rifampicin	Inhibits bacterial RNA polymerase
Streptomycin	Binds to bacterial ribosomes to prevent the binding of tRNA
Pyrazinamide	Not yet known, but not the same mechanisms as the other three antibiotics

In one clinical trial lasting six months, the effect of treating TB with these antibiotics was investigated.

All patients were treated with all four antibiotics for two months. Then they were treated with different pairs of antibiotics or isoniazid alone for a further four months.

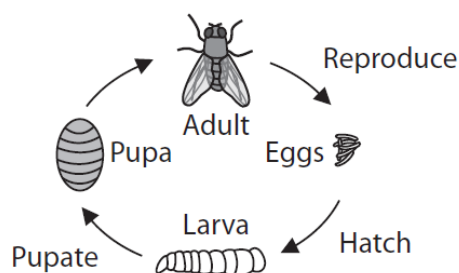
All patients were free of any signs of active TB at the end of the clinical trial.

The design of the trial and the percentage of these patients with TB three years after the trial ended are shown in the diagram.



3 Blowflies are found in many parts of the world, including Africa.

The diagram shows the life cycle of one species of blowfly (species A) found in Africa.



An investigation was carried out to find the temperature at which 50% of the larvae of this species survive. This investigation was repeated for a further six species of African blowfly larvae, B to G. All other variables were kept constant.

In another investigation, the temperature of sand that the larvae selected when ready to pupate was recorded.

(a) A student used the data from these investigations to find out if there is a statistically significant correlation between the two sets of temperatures.

To do so, a Spearman's rank correlation coefficient can be calculated.

(i) Complete the table to rank all the data and to calculate d and d^2 for species E to G.

(3)

Blowfly species	Mean temperature at which 50% of larvae survive / °C	Rank for mean temperature for 50% larvae survival	Mean temperature of sand selected / °C	Rank for mean temperature of sand selected	Difference in rank (d)	Difference in rank squared (d^2)
A	49.0	5	26.1	7	-2	4
B	47.5	2	23.2	3	-1	1
C	48.5	3	24.7	6	-3	9
D	42.9	1	16.6	1	0	0
E	48.8		23.6			
F	50.1		24.2			
G	49.2		23.1			

(ii) Calculate the Spearman's rank correlation coefficient (r_s) using the equation:

(3)

$$r_s = 1 - \frac{6\sum d^2}{n(n^2 - 1)}$$

where $\sum d^2 = 34$ and n is the number of blowfly species.

Answer.....

(iii) The table shows critical values for r_s .

n	Probability		
	0.10	0.05	0.01
5	0.900	1.000	1.000
6	0.829	0.886	1.000
7	0.714	0.786	0.929
8	0.643	0.738	0.881
9	0.600	0.683	0.833

Deduce whether the data showed a statistically significant correlation.

(2)

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(b) A number of observations were made about a dead rhinoceros:

- adults of all seven species of blowfly (A to G) were observed near the rhinoceros
- large numbers of living larvae of species F were present inside the rhinoceros
- mean temperature in this group of larvae was $49 \pm 1.1^\circ\text{C}$
- mean temperature of the air surrounding the rhinoceros was $33 \pm 3.0^\circ\text{C}$.

(i) Determine how the mean temperature of 49°C was found.

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(ii) It was observed that all the living larvae in the rhinoceros belonged to species F.

The metabolic activity of the larvae of species F increases the temperature within the dead rhinoceros.

Explain the advantages for this species of blowfly of increasing the temperature within the dead rhinoceros.

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(Total for Question 3 = 13 marks)

7

(c) A bacteriostatic antibiotic works by

(1)

- A** destroying bacteria
- B** destroying viruses
- C** preventing the multiplication of bacteria
- D** preventing the development of antibiotic resistance

(d) Hospitals have developed practices in response to the increase in hospital acquired infections.

Describe the infection control practices hospitals have introduced.

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(Total for Question 7 = 4 marks)

8 Human papilloma virus (HPV) is a DNA virus.

(a) Some strains of HPV are sexually transmitted and can cause cervical cancer or genital warts.

The table shows some information about the conditions associated with four strains of HPV.

HPV strain	Condition associated with the strain	Percentage of all cases caused by the strain (%)
6	cervical cancer	<1
	genital warts	67
11	cervical cancer	<1
	genital warts	22
16	cervical cancer	55
	genital warts	<1
18	cervical cancer	13
	genital warts	<1

(i) Comment on the relationship between HPV and these two conditions.

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(ii) The table shows two vaccines developed from different combinations of HPV.

Vaccine	Strains of HPV used in development of the vaccine
Cervarix	16 and 18
Guardasil	6, 11, 16 and 18

Analyse all the data to explain why the Guardasil vaccine is preferred to the Cervarix vaccine.

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(iii) Which of the following describes the type of immunity developed by these vaccines?

(1)

- A artificial active immunity
- B artificial passive immunity
- C natural active immunity
- D natural passive immunity

(b) Cervarix and Gardasil have been used in national vaccination programs.

A person who has been vaccinated becomes infected with HPV-16. Explain the role of the T cells in the body of this person.

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(Total for Question 8 = 11 marks)

