

Additional Assessment Materials Summer 2021

Pearson Edexcel GCE in A Level Biology

Topic 6: Microbiology and Pathogens

(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- Additional Assessment Materials have come from past papers both published (those materials available publicly) and unpublished (those currently under padlock to our centres) presented in a different format to allow teachers to adapt them for use with candidate.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.

During the development of active immunity, macrophages present antigens to T helper cells	
(a) Describe how macrophages present antigens to T helper cells.	(2)

(b) In an investigation into clonal selection, macrophages and T cells were isolated from two strains of guinea pig, strain 2 and strain 13.

The macrophages from each strain of guinea pig were exposed to an antigen and treated with mitomycin.

Mitomycin forms cross links between complementary strands of DNA.

These macrophages were then cultured with T cells from each of the strains of guinea pig for 72 hours.

Radioactive thymidine was included in the culture. This molecule will become incorporated into DNA during DNA replication instead of thymine.

The table shows the results of this investigation.

Source of	Level of radioactive thymidine	adioactive thymidine incorporated into T cells / a.u.	
macrophages	T cells from strain 2 guinea pigs	T cells from strain 13 guinea pigs	
strain 2	180	13	
strain 13	17	59	

(i) Explain why the macrophages were treated with mitomycin.

(ii) Explain how radioactive thymidine becomes incorporated into the DNA.	(2)

(iii) Analyse the data to explain the results of this investigation.	(4)

	Sal	moi	nella are Gram negative bacteria found in the large intestine of humans.	
	(a)	wh	nich is the correct statement about Salmonella?	
				(1)
		A	Salmonella has a thick peptidoglycan cell wall and produces endotoxins	
		В	Salmonella has a thick peptidoglycan cell wall and produces exotoxins	
		C	Salmonella has a thin peptidoglycan cell wall and produces endotoxins	
		D	Salmonella has a thin peptidoglycan cell wall and produces exotoxins	
	(b)	A s	cientist studied the growth of Salmonella.	
		(i)	Salmonella was isolated from a mixed culture of bacteria, using streak plating onto selective media.	
			Explain why this is a suitable method for isolating the Salmonella.	
				(4)
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cells per cm ³ .	
Ten hours later the concentration of Salmonella was 4×10^6 per cm ³ .	
Calculate the exponential growth rate constant (k) for this culture of Salmonelli using the formula	а
	(3)
$k = \frac{\log_{10}N_{t} - \log_{10}N_{0}}{0.301 \times t}$	
Answer	
(iii) In this calculation, the scientist did not allow for the time that the Salmonella spent in the lag phase.	
Explain the effect that this will have on the calculated value for the growth rate constant.	
Tate Constant.	(3)

(ii) The scientist made a broth culture of Salmonella at a concentration of 5×10^3

Malaria is caused by *Plasmodium*, a pathogenic microorganism.

Vaccination is one of many methods being used to control malaria.

In a study, the effectiveness of a vaccine for malaria was tested.

The following method was used:

- samples of *Plasmodium* were exposed to radiation and used to make a vaccine
- two groups of people, A and B, were given different doses of the vaccine
- a third group of people, C, was used as a control
- one month after vaccination, all three groups of people were exposed to mosquitoes known to contain live *Plasmodium*
- the number of people in each group with malaria was recorded.

The results are shown in the table.

Group	Treatment with the vaccine	Number of people in each group	Number of people with malaria
Α	low dose	17	16
В	high dose	6	0
С	control	12	11

	(a) (i)	Explain why the samples of <i>Plasmodium</i> were exposed to radiation.	(2)
	(ii	State the control treatment that was given to people in group C.	(1)
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(iii) It was claimed that this vaccine was 100% effective.	
Analyse the data to criticise the validity of this claim.	
	(3)
(iv) Describe how vaccination enabled the people in group B to have active artificial immunity against malaria.	
	(5)

(b) Anti-malarial drugs can be used to protect people from malaria.	
These drugs are not always effective because Plasmodium develop resistance.	
Explain how drug-resistant <i>Plasmodium</i> may evolve.	(3)

4

Glucose and fructose are monosaccharides.

(a) Complete the diagram to show the structure of alpha glucose.

(1)

(b) The makers of sweet tasting drinks use the enzyme glucose isomerase to convert glucose into fructose.

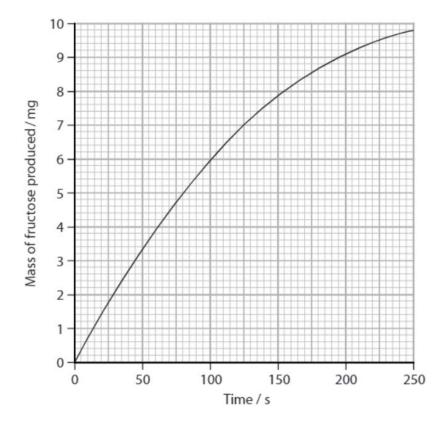
Fructose is a monosaccharide that tastes much sweeter than glucose.

(i) Explain a possible health benefit of converting glucose into fructose for use in sweet tasting drinks.

(2)

(ii) A student investigated the activity of glucose isomerase.

The graph shows the results of this investigation.



Determine the initial rate of the reaction.

(1)

Answer

	Magnesium ions act as cofactors for some enzymes.	
	Devise an experiment to investigate the effect of magnesium ions on the initial rate of this reaction.	
		(5)

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(iii) Cofactors are non-protein molecules that help enzymes to function.

TOTAL FOR TEST = 45 marks