Antibiotics

Question Paper 4

Level	International A Level
Subject	Biology
Exam Board	CIE
Topic	Infectious disease
Sub Topic	Antibiotics
Booklet	Theory
Paper Type	Question Paper 4

Time Allowed: 68 minutes

Score : /56

Percentage: /100

Grade Boundaries:

A*	А	В	С	D	E	U
>85%	'77.5%	70%	62.5%	57.5%	45%	<45%

1 (a)	Outline the symptoms of cystic	fibrosis (CF).		
				[4]
(b) CF is caused by a recessive mutation, b, on an auto-				e .
	Draw a genetic diagram to sh probability of having a daught			otypes BbXX and BbXY , the
	In your genetic diagram, show phenotypes of the offspring.	the genotypes of	of the gai	metes and the genotypes and
	genetic diagram			
parental	genotypes	BbXX	x	BbXY
genotyp of game				
genotyp phenoty of offspr	pes			

(0)	One	of the me	nov mutation	oo for CE r	ooulto	in the emi	oo ooid c	rainina ha	ing roplos	od by
(c)			any mutatior polypeptid				io aciu a	argiriirie be	ing replace	eu by
		ain how a peptide.	a mutation i	may cause	such	a change	in the a	imino acid	sequence	of a
	•••••									
<i>,</i>										
(d)	a sm	all part of	was perforn the CF ger dual E has 0	ne. The diff						
		ba	ases				ba	ses		
	G	Α	Т	С		G	Α	Т	С	
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L	_		1							
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									_	
		indiv	idual D				indiv	idual E		_
				F	Fig. 3.	1				
	With	reference	e to Fig. 3.1,							
			ase sequer		ffare fi	om that of	n			
	(1)	IIOW UIC D	ase sequel	ice of L all	iicis II	om mat U				

......[1]

the effect of this difference in the polypeptide produced by the two individuals.	(ii)
[2]	
[Total: 15]	

2 (a) Describe the advantages of using batch culture for penicillin production and culture for mycoprotein production.	continuous [8]
(b) Outline the hybridoma method for the production of a monoclonal antibody.	[7]
	[Total: 15]

3 Fig. 4.1 shows the two base pairs in a DNA molecule.

Fig. 4.1

(a) Name the bases labelled J and K and the bond labelled L.

J	
_	
K	
	cı
_	[3

HIV enters T-lymphocytes by a form of endocytosis. Two of the enzymes in HIV are:

- reverse transcriptase, which uses viral RNA as a template to make DNA to incorporate into the chromosomes of the host's cells
- protease, which is used to break a polypeptide into smaller molecules. These molecules are used to make the protein coat of new viral particles, which will infect other cells.

Various drugs have been developed to treat HIV infections. Table 4.1 gives information about some of these drugs.

Table 4.1

drug	enzyme inhibited	mode of action
zidovudine	reverse transcriptase	occupies active site
tenofovir	reverse transcriptase	occupies active site
efavirenz	reverse transcriptase	occupies sites other than the active site
atazanavir	protease	occupies active site

(b)	Explain the difference between the mode of action of zidovudine and efavirenz.
	[4]
(c)	People who receive drug treatment for HIV take a mixture of drugs that act in different ways.
	Suggest the advantage of taking a mix of the drugs shown in Table 4.1.
	[2]
(d)	Antibiotics are prescribed to people who have HIV/AIDS for the treatment of secondary infections, but not to treat the HIV infection.
	Explain why this is so.
	[2]

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4 The artificial plasmid, pBR322, was constructed to act as a vector. It has often been used to insert human genes, such as the human insulin gene, into the bacterium, *Escherichia coli*.

The plasmid was constructed to include two genes, each giving resistance to a different antibiotic: an ampicillin resistance gene and a tetracycline resistance gene. The plasmid also has a target site for the restriction enzyme, *BamHI*, in the middle of the tetracycline resistance gene.

A pBR322 plasmid was cut using BamHI and the cDNA gene for human insulin inserted into it

Fig. 2.1 shows pBR322 and the recombinant plasmid.

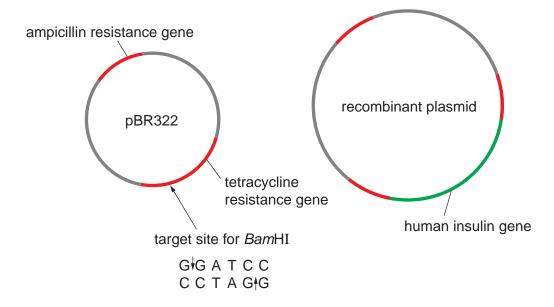


Fig. 2.1

(a)	With reference to Fig. 2.1, describe how a cDNA human insulin gene can be inserted into pBR322 that has been cut by <i>Bam</i> HI.
	[4]

- **(b)** Bacteria were then mixed with the recombinant plasmids. Those bacteria which had successfully taken up recombinant plasmids were identified using the following steps:
 - **step 1** the bacteria were spread onto culture plates containing nutrient agar and ampicillin and incubated to allow colonies to form
 - **step 2** some bacteria from each of the colonies growing on these plates were transferred to plates containing nutrient agar and tetracycline, as shown in Fig. 2.2.

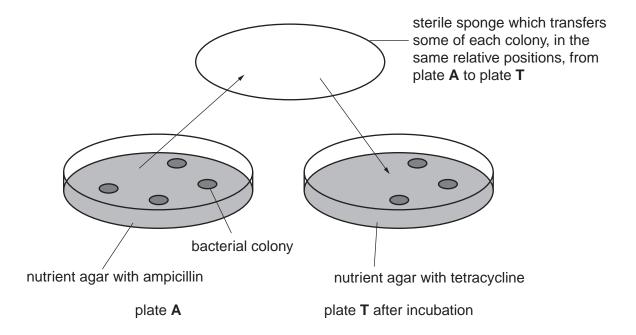


Fig. 2.2

Explain why the bacteria were first spread onto plates containing ampicillin.

 	 [3]

	(ii)	Explain why it is important, for identifying bacteria that have successfully taken up the recombinant plasmid, that on pBR322 the target site for $\it Bam HI$ is in the middle of the tetracycline resistance gene.
		[3]
(iii)	Use a label line and the letter ${\bf C}$ to identify, on Fig. 2.2, a colony of bacteria that contain the recombinant plasmid.
		Put your answer onto Fig. 2.2 on page 5. [1]
-		smid vectors carrying antibiotic resistance genes are now rarely used in gene noology.
	(i)	Explain why antibiotic resistance genes are now rarely used.
		[2]
	(ii)	State one type of gene that has replaced antibiotic resistance genes in plasmid vectors and indicate how its presence can be detected.
		type of gene
		detection
		[2]