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SEMESTER 3

2019

BIOLOGY TRIAL 3 (964/3)

Duration: 1 ½

Hour

NAME :	Class:
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*Instruction: This paper consists of three sections. Answer **ALL** questions in Section A and Section B. In Section C, answer only **TWO** questions out of three.*

Section A: Multiple Choices Question. Please indicate your answer in the table below.

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

1. Haemophilia is a sex-linked recessive trait that slows blood clotting.

Diagram 1 shows information about the inheritance of haemophilia in Ali's family.

Ali is suffering from haemophilia.

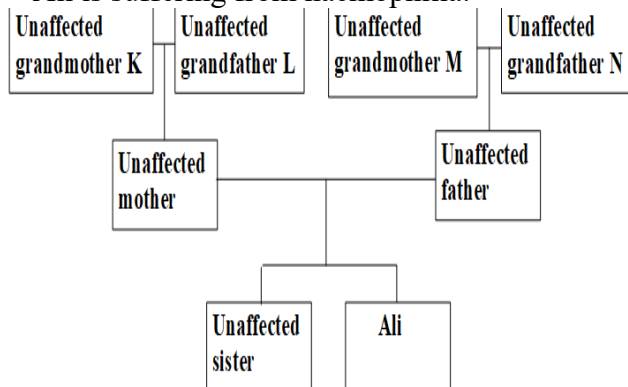


Diagram 1

From the information given, which of the statements is **TRUE**?

- A) Both Ali's mother and sister must be a carrier
- B) Grandmother K must be homozygous dominant
- C) The genotype of neither grandmother M nor Ali's sister can be determined
- D) The genotype of neither grandmother nor grandfather can be determined

2. Diagram 2 shows a bacterial sample viewed under a microscope.

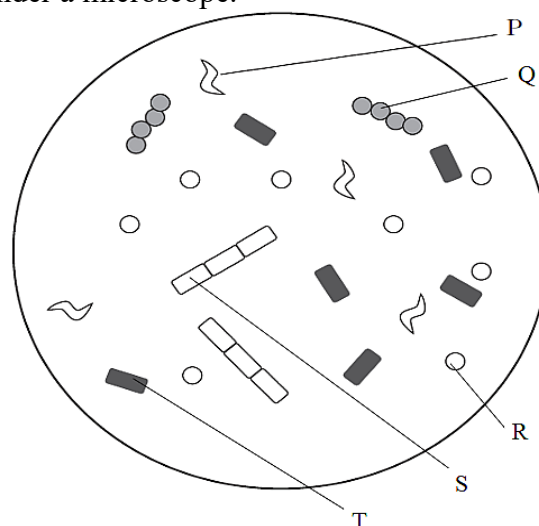


Diagram 2

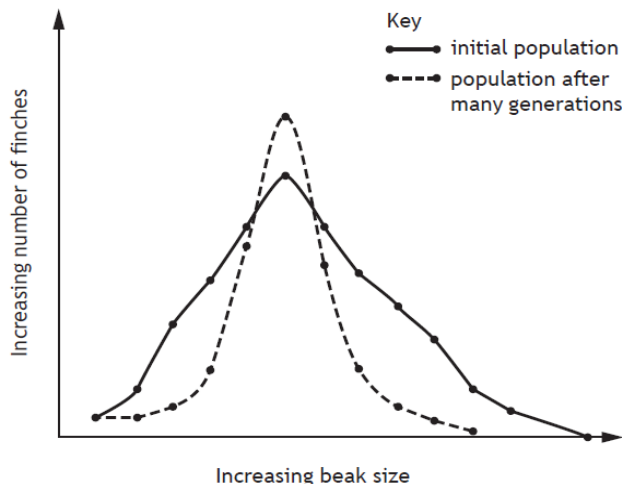
Which of the following is **CORRECTLY** label the types of bacteria found?

	Coccus	Vibrio	Streptococci	Bacillus
A)	Q	P	S	T
B)	P	T	Q	S
C)	R	P	Q	T
D)	T	P	S	R

3. In a food chain, which link involves the least efficient energy transfer?

- A) Fishes feed on small crustacea.
- B) Herons feed on fishes.
- C) Small crustacea feed on dead mangrove leaves.
- D) Mangrove plants trap sunlight during photosynthesis.

4. A population of finches became isolated on an island. The graph shows the range of beak sizes within the initial population at the time of isolation and in the population after many generations.



Which row in the table shows the type of selection pressure and the type of speciation which might be expected to occur in this example?

Selection pressure	Speciation
A) directional	allopatric
B) stabilising	allopatric
C) directional	sympatric
D) stabilising	sympatric

5. In *Drosophila*, the genes for wing length (W), eye colour (E), body colour (B) and presence of bristles (P) are linked.

The table below gives the frequency of recombination obtained in crosses involving different pairs of linked genes.

Gene pair in cross	Freq of recombination
Wing length × Eye colour	12 %
Wing length × Body colour	18 %
Wing length × Presence of bristles	15 %
Eye colour × Body colour	6 %
Body colour × Presence of bristles	3 %

Use the information to show the position of these genes in relation to each other on the chromosome

- A) WEPB C. EPBW
B) PEWB D. BWEP

6. What is the role of *Agrobacterium tumefaciens* in the production of transgenic plants?
A) Transgenic plants have been given resistance to the pest *A. tumefaciens*.
B) Genes from *A. tumefaciens* are inserted into plant DNA to give the plant different traits.

- C) Plant genes are incorporated into the genome of *Agrobacterium tumefaciens*.
D) It is used as a vector to move genes into plant cells.

7. A scientist is studying a DNA sequence that is made up of 3815 nucleotide pairs. Exons account for 684 of the nucleotide pairs. Introns account for 3131 of the nucleotide pairs. The sequence codes for a section of a polypeptide. How many amino acids will make up this section of the polypeptide?

- A) 1272 C. 456
B) 1044 D. 228

8. Cells were obtained from a patient with a viral infection. The DNA extracted from these cells consisted of two forms: double-stranded human DNA and single-stranded viral DNA. The base compositions of these two forms of DNA were as follows:

	Purine		Pyrimidine	
	I	II	I	II
Form 1(%)	22.1	27.9	27.9	22.1
Form 2 (%)	31.3	31.3	18.7	18.7

Which of the following statements are correct?

- P. Form 2 is the viral DNA
Q. Form 2 is human DNA
R. Purine are Adenine and Thymine
A) P only C) Q and R only
B) P and R only D) P, Q and R

9. Ellis-van Creveld syndrome is a rare genetic disorder characterized by short limb dwarfism and polydactyl. It is much more common in an isolated population in North America, which was founded by a small number of individuals (Amish) than in the general population.

The most likely explanation for this is

- A) random mutation
B) Founder effect
C) Bottleneck effect
D) natural selection

10. Which of the following species shows K-reproductive strategy?

- A) Leatherback turtle
B) Barn owl
C) Common dandelion
D) Phytoplankton

11. A mutation which involves part of a chromosome becoming dislocated and attached to another whole chromosome is known as
- Translocation
 - Deletion
 - Inversion
 - Duplication

12. Which is the correct order of events in the process of speciation?
- Isolation, Mutation, Selection
 - Isolation, Selection, Mutation
 - Selection, Isolation, Mutation
 - Mutation, Selection, Isolation

13. Phenylketonuria (PKU) is an autosomal recessive disorder caused by the mutation of an enzyme phenylalanine hydroxylase, that breaks down phenylalanine in the cell. If identified at birth, dietary restrictions can control the disease. If not identified, buildup of phenylalanine interferes with brain development. The frequency of PKU in the population is 1 in 15,000 births. How many people with PKU would you expect to find in a population of 30,000,000?
- | | |
|------------|---------|
| A) 485 900 | C) 2000 |
| B) 29 512 | D) 200 |

14. Diagram 3 shows some features of a plasmid which has been cut open by a restriction endonuclease.

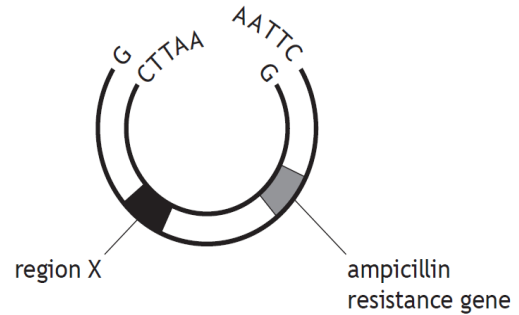


Diagram 3

Which of the following statements are **TRUE**?

P: *Sma*I is the endonuclease used

Q: Blunt end is produced

R: Region X is important to ensure that the rplasmid would be passed on to daughter cells.

S: DNA ligase is used to seal the gene into the plasmid.

A) P and Q only

C) R and S only

B) P and S only

D) P, R and S only

15. In which of the following applications would DNA fingerprinting **NOT** be used?
- Paternity testing
 - Tissue typing of organs for transplant
 - Detection of genetic disorders
 - Detection of genetic modification of foods

Section B:

16. Diagram 4 shows a cladogram of chordates with their common ancestor, X.

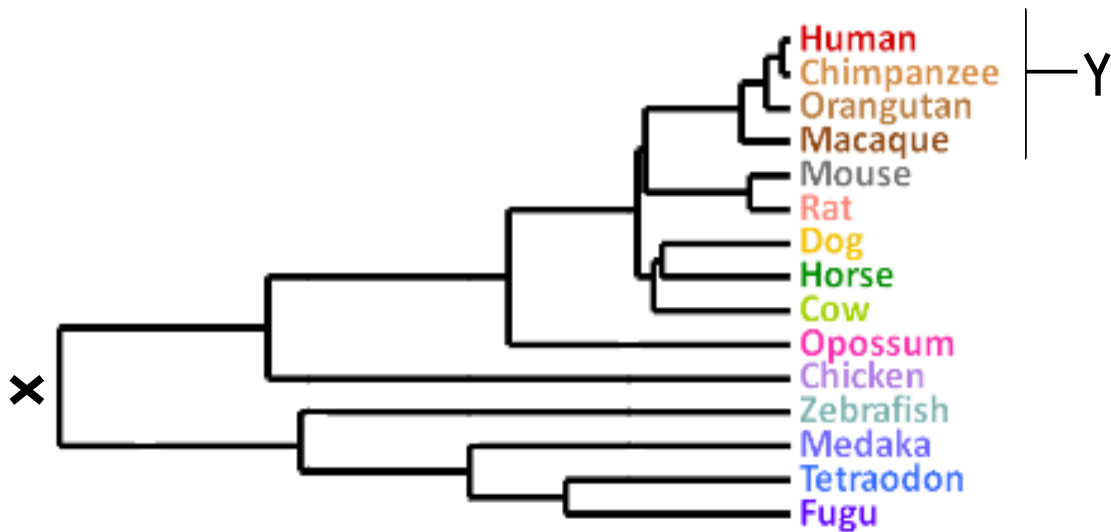


Diagram 4

- a) i. State one advantage of classify organisms using cladistic system. [1M]
-
- ii. Box Y indicates a single branch of the cladogram. Name box Y. [1M]
-
- iii. State one reason why the organisms listed on Diagram 4 are grouped under chordata. [1M]

b) Bornean Orangutan (*Pongo pygmaeus*) is an endangered species found in Indonesia and Malaysia. The



population is estimated to be fallen by 5000 animals each year due to human activities .

The map below shows some areas of Borneo where orangutan were found in 1999 and in 2004. It also shows the oil palm plantations in Borneo.



- i. Explain how the oil palm plantations labelled X might affect the genetic diversity of the overall orangutan population. [2M]

ii. State the ecological role of orangutan in rainforest. [1M]

iii. Suggest one effort that Malaysia-Indonesia can work bilaterally to save the orangutan. [1M]

17. Diagram 5 shows the main stages involved in cheese making. The starting material is milk, which contains casein.

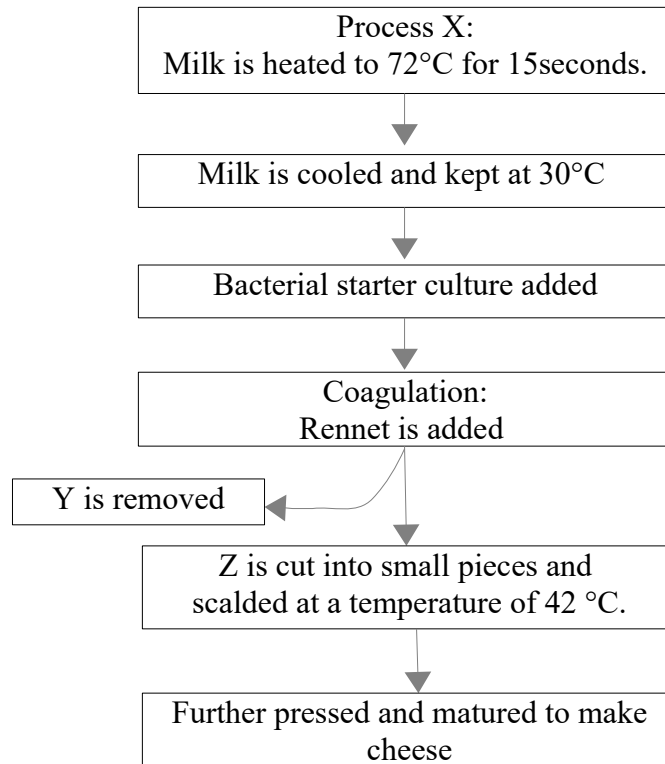


Diagram 5

a) Explain why making cheese can be described as a biotechnological process. [2M]

b) Suggest TWO benefits of Process X. [2M]

c) Bacteria such as *Lactobacillus casei* and *Streptococcus lactis* added as started culture. Explain the role of bacteria as starter culture. [1M]

d) Name Product Y and Z [2M]

Y: _____

Z: _____

e) Give ONE example of application of biotechnology in agriculture. [1M]

Section C: Answer any TWO questions only.

18. a. Explain briefly the characteristics of the genetic code. [5M]
b. Explain the experiment conducted by Meselson and Stahl to prove the DNA replication method. [10M]
19. a. Define complementary DNA (cDNA) and describe how cDNA library is prepared from liver cells. [10M]
b. By using examples, describe what is palindromic sequence? [5M]
20. a. Define aneuploidy and euploidy. [2M]
b. Explain the importance of polyploidy in human food crops such as fruits and grains. [13M]

Set by:
Mdm. Khoo WT

Checked and Approved by:
Mdm.

Answer:

MCQ

1. C	2. C	3. D	4. B	5. A
6. D	7. D	8. A	9. B	10. B
11. A	12. A	13. C	14. C	15. B

16a.	i. Cladistics emphasizes evolutionary relationships	1
	ii. Clade	1
	iii. Presence of notochord at embryonic stage/ Presence of pharyngeal gill-slits at embryonic stage /Dorsal nerve cord/ Myotomes /Post-anal tail	1
b.	i. X isolates the orangutan population into two smaller populations.	1
	The population will eventually decline as they became inbred and lost their genetic diversity	1
	ii. Seed dispersal	1
	iii. set up TBCA orangutan sanctuary/ national park // Enforce illegal international trade/trafficking orangutan/ CITES	1
		(7M)
17.a.	It involves/applies/uses microbes / (living) organisms / cells / enzymes to make/manufacture product for human benefit / (carry out) conversion / reaction / industrial process producing useful/beneficial product/cheese	1
	b. kill pathogenic microorganisms (to reduce human risk)	1
	enzyme denatured (to remove unwanted reaction)	1
	c. increase fermentation process to produce more lactate and turns the milk sour	1
	d. Y: whey	1
	Z: Curd	1
	e. Produce transgenic plant/animal which is resistant to disease/ environmental stress/herbicides/pesticides// has improved yield/quality/nutritional value/increased growth rate of crops	1
		(8M)
18a	Characteristics of genetic code	
	The genetic code is degenerate/ redundant as each amino acid is represented by one or more triplet codes.	1
	DNA contains triplet codes , 61 of the 64 different three bases sequences in DNA codes for one amino acid each.	1
	The genetic code is universal as the same codes are used for the same type of amino acids in almost all organisms.	1
	Codon AUG (triplet code TAC) is a start signal while codons UGA, UAA and UAG (triplet codes ACT, ATT and ATC) are stop codes.	1
	The genetic code is non-overlapping as the codes are read in sequence with every three nucleotides and do not overlap each other.	1
	It is punctuated .	1
		(Any 5 5M)
18b.		
	1. <i>Escherichia coli</i> were cultured for many generations in medium containing heavy nitrogen isotope 15N in order to label all DNA in E. coli with the heavy (15N) nitrogen isotope.	
	2. Bacteria with 15N-DNA were then transferred to medium containing normal nitrogen isotope 14N .	
	3. Samples were removed at fixed intervals corresponding to the generation time of E. coli at a specific temperature.	
	4. DNA from different generations were extracted and centrifuged in a solution containing caesium chloride (CsCl) to separate denser DNA containing 15N from the ordinary DNA containing 14N.	
	5. The position of DNA with 15N and DNA with 14N was measured in ultraviolet light .	

<p>The results of the Meselson and Stahl experiment are as follows:</p> <ol style="list-style-type: none"> 6. Generation 0: All the DNA molecules contain 15N on both strands of the double helix, forming a dark band near the base of the centrifuge tube. 7. Generation 1: All the DNA were hybrids containing 15N in one strand and 14N in another strand, forming a band between the heavy and light DNA band. 8. Generation 2: Half of the DNA were hybrids and another half were light DNA with 14N. 9. Generation 3: Third generation onwards, DNA with 14N increases but the number of hybrid DNA remain unchanged. 10. The result of the first generation eliminated the conservative hypotheses as it does not explain the presence of hybrid DNA. 11. The result of the second generation eliminated the dispersive hypothesis as it does not explain the presence of light DNA in the second generation. 12. Meselson and Stahl proved that DNA replicates semi-conservatively. 	<p>(Any 10 10M)</p>
<p>19a. cDNA and cDNA library</p> <p>Definition: cDNA is DNA synthesised from mRNA with the help of reverse transcriptase. cDNA contains only genes that are expressed in transcription which do not have introns.</p> <ol style="list-style-type: none"> 1. Pre-mRNA (which is transcribed from DNA) in liver cells undergoes splicing 2. splicesomes split off the introns and the exons are joined together 3. to produce a mature mRNA which contains only exons. 4. Mature mRNAs are extracted and purified from the cells 5. The mRNAs are treated with reverse transcriptase 6. to produce single stranded cDNA. 7. The mRNA are digested with RNase to leave behind the cDNA. 8. The single stranded cDNA is converted into double stranded cDNA by treating DNA polymerase. 9. cDNA is inserted into plasmid and inoculated into bacteria to form clones. 10. Each clone is screened/tested, labelled and stored for future use. <p>b. examples + describe palindromic sequence</p> <p>Palindromic sequence is a sequence found mostly on the restriction site of a DNA molecule that consists of the same four to eight nucleotides on both strands but arranged in opposite direction. the base sequence is the same when read from 5' to 3' in both strands of DNA.</p> <p>The palindromic sequence is the site where restriction enzymes cut to produce DNA fragments with the sticky ends or blunt ends.</p> <p>These DNA fragments are needed to produce rDNA.</p> <p>Examples: 5' -GAATTC- 3' 3' -CTTAAG- 5'</p> <p>In EcoR1 (<i>Esherichia coli</i>), sticky end produced TTAA or AATT</p> <p>5' -CCCGGG- 3' 3' -GGGCCC- 5'</p> <p>In Sma I (<i>Serraba marcesceris</i>), blunt end produced CCC or GGG.</p>	<p>1 1</p> <p>Any 8 8M</p> <p>1 1 1</p> <p>1</p> <p>1 5M</p>
<p>20a Define aneuploidy and euploidy</p> <p>Aneuploidy occurs when a diploid organism gains or losses one or more chromosomes in its genome as the result of non-disjunction</p> <p>Euploidy or polyploidy is the condition of an organism having three or more complete haploid sets of chromosomes.</p>	<p>1 1</p>
<p>20b. Explain the importance of polyploidy in human food crops</p> <ol style="list-style-type: none"> 1. Euploidy is categorised into autopolyploidy and allopolyploidy 	

2. more common in plants.
3. **Autopolyploidy** is a condition in which there is an multiple/increase in the number of sets chromosomes from the same genome or **same/single species**.
4. It produces **bigger** leaves, stems, roots, flowers and fruits. Thus, increase the yield of production
5. The crops **grow faster** and more luxuriant growth, with more leaves, stems and roots. Crops can be harvested in faster and increases the profit of farmers.
6. The colour of their **leaves is greener** and their **flowers are darker** in colour which is important in horti culture.
7. **Allopolyploidy** involves the increase in number of chromosome sets of hybrids from **two or more different species**.
8. Hybridisation is followed by **doubling of the chromosome number** in polyploidy
9. Usually, the hybrids produced from different species are **sterile** since there are no homologous chromosomes and pairing cannot occur during prophase I of meiosis.
10. Sterile polyploids are **seedless** like that of water-melons, guavas. bananas, citrus and grapes.
11. New hybrid species with desired qualities/enhanced characteristic are produced, such as a hybrid that combines the high yield of wheat with the hardiness of rye.
12. This is known as **hybrid vigour**.
13. Propagation of sterile polyploid is by **vegetative** means of grafting.
14. Asexual reproduction enables polyploids to reproduce in the absence of sexual mates

Any
13
13M