

Name:
Class :

***CONFIDENTIAL**
STPM2020



SEKOLAH TINGGI KLUANG

PENTAKSIRAN PRESTASI KURIKULUM PENGGAL 3
STPM 2020

BIOLOGY 964/3
One and a half hours

Instructions to candidates:

DO NOT OPEN THIS QUESTION PAPER UNTIL YOU ARE TOLD TO DO SO.

*There are **fifteen** questions in Section A. For each question, four choices of answers are given. Choose **one** correct answer and indicate it on the Multiple-choice Answer Sheet provided. Read the instructions on the Multiple-choice Answer Sheet very carefully. Answer **all** questions. Marks will not be deducted for wrong answers.*

*Answer **all** questions in Section B. Write your answers in the spaces provided.*

*Answer any **two** questions in Section C. All essential working should be shown. For numerical answers, unit should be quoted wherever appropriate. Begin each answer on a fresh sheet of paper and arrange your answers in numerical order.*

Tear off the front page of this question paper and your answer sheets of Section B, and tie both of them together with your answer sheets of Section C.

For examiner's use						
Part A	Part B		Part C			Total
1-15	16	17	18	19	20	

This question paper consists of 8 printed pages and 0 blank page.

* This question paper is CONFIDENTIAL until the examination is over. **CONFIDENTIAL***

[Turn over]

SECTION A [15 marks]
Answer all questions in this section.

1. Which of the following is not true about the taxon of the housefly?

- A Class : Insecta
- B Genus : *Musca*
- C Order : Lepidoptera
- D Phylum : Arthropoda

2. The following identification key is prepared for five types of animals.

- 1. Animal with back boneGo to number 2
 Animal without back bone.....Go to number 3
- 2. Body with dry scales.....P
 Body without scales.....Q
- 3. A pair of antennae.....Go to number 4
 More than 2 pairs of antennae.....R
- 4. 3 pairs of mouthparts.....S
 A pair of jaws.....T

What is animal P, Q, R, S and T?

	P	Q	R	S	T
A	Snake	Frog	Cockroach	Prawn	Centipede
B	Frog	Snake	Cockroach	Centipede	Prawn
C	Snake	Frog	Centipede	Prawn	Cockroach
D	Snake	Frog	Prawn	Cockroach	Centipede

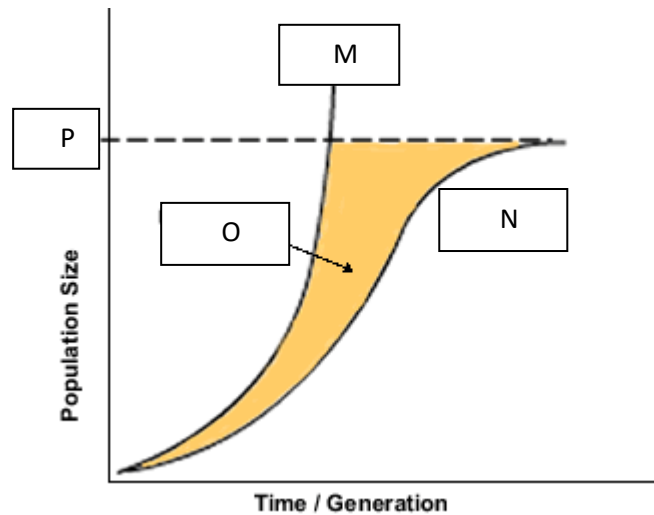
3. Which of the following are **true** of an ecosystem?

- I phytoplankton are producers.
 - II the last consumer obtains the highest energy.
 - III Ecosystem is an open system with input and output of energies .
 - IV Heterotrophs include herbivores, carnivores, omnivores, decomposers and detritivors.
- A I , II
 - B III, IV
 - C I, III, IV
 - D II, III, IV

4. In a research, a total of 50 snails and 159 grasshoppers were caught in a farm. All were marked and released. A few days later, 40 snails and 141 grasshoppers were caught in the same farm. There were 4 snails and 77 grasshoppers had marks. Estimate the population size of the snails in that farm.

- A 160
- B 200
- C 500
- D 2000

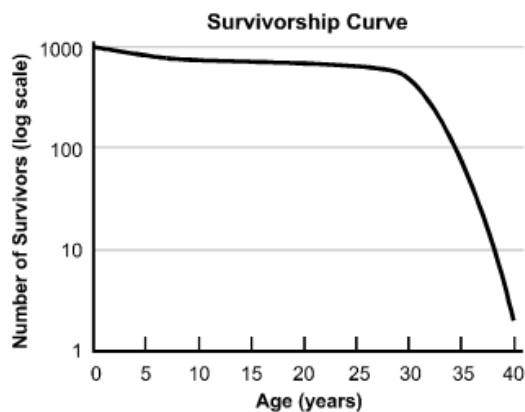
5. The diagram below shows two types of growth curves for a population under optimum conditions and growth with environmental resistance.



What is represented by M, N, O and P?

	M	N	O	P
A	Carrying capacity	Exponential curve	Sigmoid curve	Environment resistance
B	Exponential curve	Sigmoid curve	Carrying capacity	Environment resistance
C	Exponential curve	Sigmoid curve	Environment resistance	Carrying capacity
D	Sigmoid curve	Exponential curve	Environment resistance	Carrying capacity

6. A type of survivorship curve below would be expected in a species in which



- A parental care is minimal
- B mortality is constant over the lifespan
- C the body size is small
- D number of offspring produced is small

7. Which of the following statements are **true** about r-strategist ?

- I They have poor competitive ability.
 - II They reproduce at late stage of life.
 - III They are opportunistic and can adapt easily in a new environment.
 - IV They thrive in stable and relatively undisturbed habitat.
- A I and III
 - B II and III
 - C II and IV
 - D I and IV

8. Which of the following demonstrates stabilising selection?

- A Giraffes with long neck tend to survive during long drought seasons.
- B Babies born with the average weight tend to show a higher survival rate.
- C Female guppy fish tends to select the male fish with bright and colourful tail.
- D Small-sized and big-sized birds are easier to survive as they have different food resources.

9. In the human ABO blood system, there are six possible genotypes but they have only four phenotypes. This can be explained because ABO blood groups are controlled by

- A one gene locus with three codominant alleles
- B one gene locus with two codominant alleles and two recessive alleles
- C one gene locus with two codominant alleles and one recessive alleles
- D two unlinked gene loci where crossing over has taken place

10. In the inheritance of sex-linked eye colour in *Drosophilla melanogaster*, red eye is dominant allele. What is the likely results of a cross between a red-eyed male and a white-eyed female fly?

- A 50% male flies are white-eyed, all female flies are red-eyed
- B all male flies are red-eyed, all female flies are white-eyed
- C all male flies are white-eyed, all female flies are red-eyed
- D all flies are red-eyed

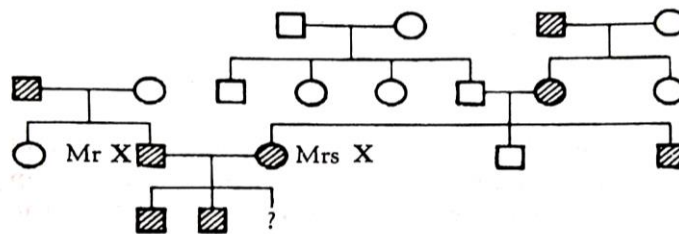
11. The diagram below shows three out of 23 pairs of chromosomes found in human cell.



Which diagram shows an example of non-disjunction in the formation of an egg, that could lead to the formation of a Down's syndrome zygote?



12. The family tree below was assembled by a genetic counsellor for Mr and Mrs X who suffer from heart disease due to hypercholesterolaemia. Children who inherit the dominant mutant allele from both parents rarely survive beyond puberty.



- key
- affected male
 - unaffected male
 - affected female
 - unaffected female

What is the probability that Mr and Mrs X's third child will be unaffected?

- A 0.0
- B 0.25
- C 0.5
- D 0.75

13. Which of the following is **not** a characteristic of a transgenic organism?

- A It has desirable and improved characteristics.
- B It is an organism that requires a foreign gene in its body.
- C It can carry out gene expression of the foreign gene normally.
- D it is engineered for the benefit of humans in agriculture and medical field.

14. The following steps are involved in genetic engineering. Rearrange them into the correct sequence

- I Cleave the plasmid and the human DNA with the same restriction enzyme
- II Screen for bacteria that contain recombinant DNA
- III Insert DNA fragment into opened plasmid
- IV Isolate the bacterial plasmid and human DNA
- V Transformation

- A I → II → III → IV → V
- B IV → I → III → II → V
- C IV → I → III → V → II
- D I → IV → III → V → II

15. Polymerase chain reaction (PCR) was invented by Mullis in 1983 and patented in 1985. Its principle is based on the use of special type of enzyme to make million copies of DNA sequence. Now it is the most reliable technique as diagnostic test for Covid-19.

The procedure of PCR requires all below **except**

- A *Taq* polymerase
- B Free nucleotides
- C Antibody
- D Primers

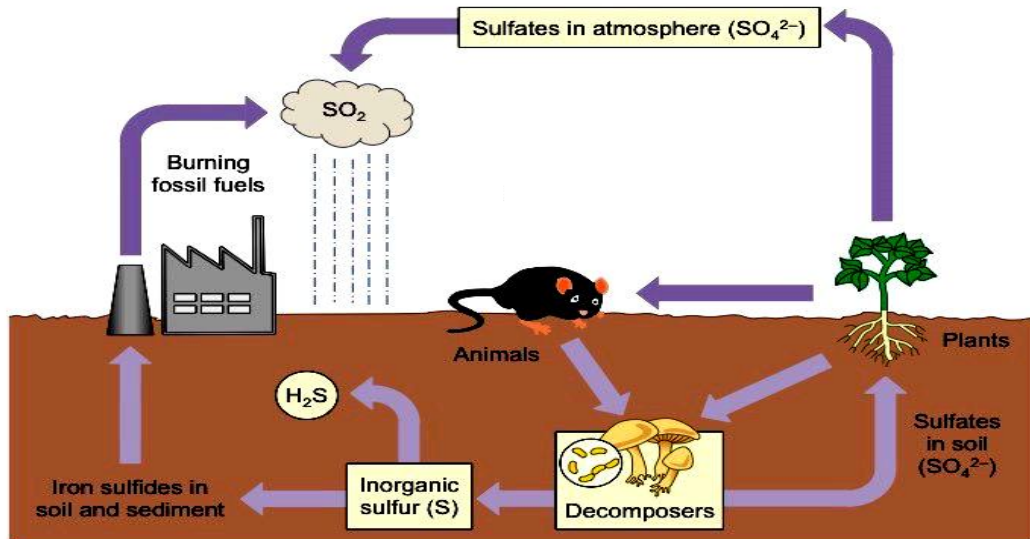
ANSWER:

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

SECTION B (15 marks)

Answer all questions in this section.

16. The diagram below shows a sulphur cycle.



a) Based on the diagram, biogeochemical cycle of sulphur involves the main reservoir and environment in form of organic and inorganic materials.

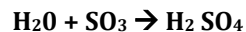
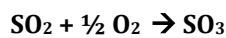
i) What is the main reservoir of sulphur? [1m]

Sedimentary rock

ii) Human activity is responsible for more than 30% of the release of sedimentary sulphur into the environment. State two human activities that affect the cycle of sulphur element. [2m]

1. Burning fossil fuels (coal).
2. Sulphur mining/ extraction.

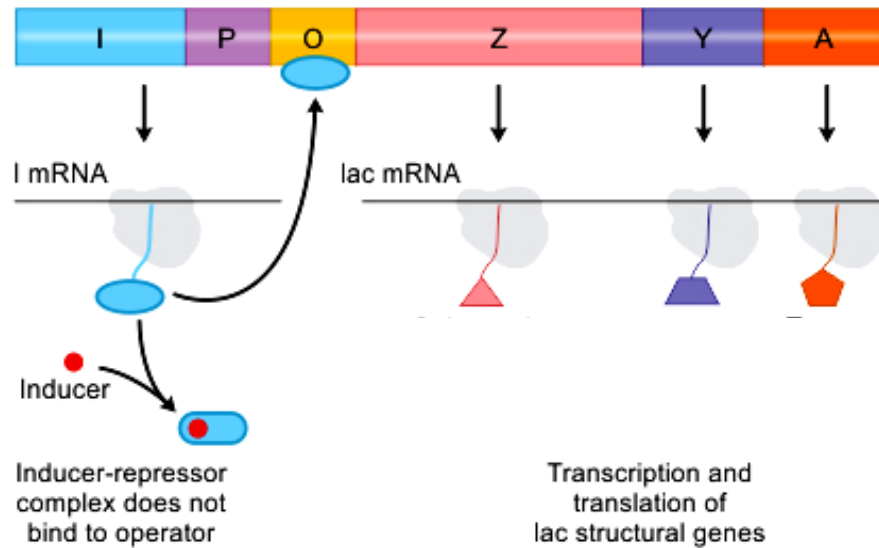
b) Sulphur dioxide in atmosphere might harm aquatic organisms and amphibians, show the reaction that shows formation of acidic precipitation. [1m]



c) There are microorganisms that able to utilise sulphates in soil and iron sulphides in soil and sediment. Name the microorganism and the metabolism process. [3m]

Microorganism	Metabolism process
<i>Chromatium</i> // <i>Chlorobium</i>	Oxidise hydrogen sulphide (H ₂ S) into sulphur (S)
<i>Thiobacillus</i>	Oxidise sulphur (S) to sulphate (SO ₄ ²⁻)
<i>Desulphovibrio</i>	Decompose/ convert organic sulphur into hydrogen sulphide (H ₂ S)
<i>Beggiatoa</i>	Oxidise hydrogen sulphide (H ₂ S) into sulphate (SO ₄ ²⁻)

17. Jacob and Monod study gene regulation for protein synthesis in bacterial cell and found that bacteria can control the production of certain enzymes via genetic mechanism. They has ability to regulate the expression of the genes encoding the enzymes. *Lac* operon is an example of gene regulation and expression.



a) Name the components of an operon and its function [3m]

1. Promoter gene – binding site of RNA Polymerase
2. Operator gene – binding site of regulatory/ repressor protein
3. Structural gene – contain genetic code/ encode synthesis of 3 enzymes (beta-galactosidase, lactose permease, transacetylase) needed for lactose metabolism.

b) Name the possible inducer for *Lac* operon. [1m]

Allolactose

c) Explain the effect of absence of inducer to the operon. [3m]

1. When lactose is absent, the active repressor molecule binds to the operator ,(also covers part of the promoter)
2. This prevents the binding of RNA polymerase to the promoter site.
3. The operator acts as a switch and the lactose operon is switched off.
4. There is no transcription of the genes of lac Z, lac Y and lac A, enzymes (β -galactosidase, lactose permease and transacetylase) are not produced.

d) What is the enzyme coded by gene Z? [1m]

Beta-galactosidase// β -galactosidase

SECTION C [30 Marks]

Answer **two** questions only in this section.

18. a) Ex-situ conservation involves conserving biological diversity in human-controlled settings. Describe ex-situ conservation and the main objectives. [6m]

b)i) By using a specific example of organisms in a tropical rain forest, describe the energy flow. [6m]

ii) The light energy that fall onto the plant leaves is not 100% absorbed. Describe why. [3m]

19. a) Genetic code is the sequence of nucleotides in DNA and RNA that determines the amino acid sequence in protein. Describe the features of genetic code. [6m]

b) DNA replication involves a few type of protein. Name the protein and its function. [4m]

c) Differentiate between trisomy and triploidy. [5m]

20. a) Human growth hormone (HGH) is essential for proper growth in children. Some children, however, have disorders that cause reduced HGH levels. Explain how a named bacteria can be engineered to secrete HGH. [9m]

b) Describe amniocentesis. [6m]

-----end of question-----

SECTION C

ANSWER :

18.a)	Ex-situ conservation involves conserving biological diversity in human-controlled settings. Describe ex-situ conservation and the main objectives.	[6m]
	<p>P1 Ex-situ conservation is to conserve biological diversity by keeping the flora and fauna outside their original habitat.</p> <p>P2 The conservation of endangered such as Malayan tiger allow them to breed to avoid extinction.</p> <p>P3 Ex-situ conservation also important for preserving/ conserve endemic species of Malaysia such as Orang utan, Tapir/ Asian elephant etc for</p> <p>P4 Zoo and Botanical garden also easily access by school/ school children for education of young generation/ raise awareness of public.</p> <p>P5 Zoos like Zoo Negara / Aquaria such as KLCC Aquaria are set up to resemble their natural habitat.</p> <p>P6 Botanical gardens such as Penang Botanical Garden/ Forest Research Institute of Malaysia conserve plants and study their importance/ herbal constituent/ growth/ pest.</p> <p>P7 Gene and germplasm banks such as seed banks, egg banks and sperm banks cryogenically frozen the seed,egg and sperm to protect/ save genetic variation of a species</p>	
b)i)	By using a specific example of organisms in a tropical rain forest, describe the energy flow.	[6m]
	<p>P1 Energy flow is the conversion of energy from sunlight to organic substances during photosynthesis</p> <p>P2 nutrients from abiotic components is transferred to animals and finally lost in soil/ atmosphere after the animal die.</p> <p>P3 An example of such energy flow is in the tropical rain forest involve food chain of fern, grasshopper, parrot and eagle. [Any suitable food chain exist in tropical rainforest]</p> <p>P4 The forest plants/ Fern are producers carry out photosynthesis to convert light energy into chemical energy in the form of biomass.</p> <p>P5 The energy in the plants flows to the primary consumers like grasshopper/ monkeys / deer when they eat parts of plants.</p> <p>P6 This energy in turn flows to the secondary consumers like parrot/rat when it feeds on the primary consumers.</p> <p>P7 This energy in turn flows to the tertiary consumers like eagle/fox when it feeds on the secondary consumers.</p> <p>P8 When the plants and animals die, the chemical energy within them flows partly to the decomposers like bacteria and fungi, some to the detritivores and animals that feed on the dead body but mainly loss as heat to the atmosphere.</p>	
ii)	The light energy that fall onto the plant leaves is not 100% absorbed. Describe why.	[3m]
	<p>The light energy that fall onto the plant leaves is not 100% absorbed due to;</p> <p>P1 the light energy is reflected by waxy cuticle</p> <p>P2 the light energy is radiated back to environment</p> <p>P3 only certain wavelength of light is absorbed for photosynthesis</p> <p>P4 the light energy do not struck/ hit the chlorophyll.</p>	<p>1</p> <p>1</p> <p>1</p> <p>1</p>

19. a)	19. a) Genetic code is the sequence of nucleotides in DNA and RNA that determines the amino acid sequence in protein. Describe the features of genetic code.	[6m]																								
	<p>P1 It is a triplet code. Three bases in DNA code for one amino acid in a protein.</p> <p>P2 It is degenerate / redundant. A single amino acid may be coded by more than one codon, for example, glycine coded for by GGU, GGC, GGA, and GGG codons.</p> <p>P3 It is universal. The same code codes for the same amino acid in almost organisms.</p> <p>P4 It is non-overlapping. The base in the code is read once and codes for one amino acid.</p> <p>P5 It is collinear with the amino acid sequence in the polypeptide.</p> <p>P6 No base acts as the border between two codes. Every three bases are read one after another without any base left out.</p> <p>P7 There are 3 nonsense codes which acts as termination code, ATT, ATC and ACT. It is found at the end of a gene marking the end of the codes for the series of amino acids in a polypeptide.</p>	<p>1</p> <p>1</p> <p>1</p> <p>1</p> <p>1</p> <p>1</p> <p>1</p>																								
b)	DNA replication involves a few type of protein. Name the protein and its function.	[4m]																								
	<p>P1 Helicase. It separate/unwind/uncoil the double helix DNA strands by breaking H bonds</p> <p>P2 DNA polymerase III. Helps to synthesis new DNA strand from the RNA primer</p> <p>P3 DNA polymerase I. It replace RNA primer with DNA/nucleotide // remove RNA primer and replace with DNA/nucleotide</p> <p>P4 DNA ligase. It catalyse the joining of Okazaki fragments / lagging strand</p> <p>P5 RNA primase. It catalyse the synthesis of RNA primer</p> <p>P6 Gyrase. It helps to uncoil the DNA helix</p> <p>P7 Topoisomerase. It helps to relieve over winding strand</p> <p>P8 Single stranded binding protein. binds to and stabilise single stranded DNA until it is used as a template.</p> <p>[Name of protein and function must be correct to get 1 mark.]</p>	<p>1</p> <p>1</p> <p>1</p> <p>1</p> <p>1</p> <p>1</p> <p>1</p> <p>1</p> <p>1</p>																								
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20.	20. a) Human growth hormone (HGH) is essential for proper growth in children. Some children, however, have disorders that cause reduced HGH levels. Explain how a named bacteria can be engineered to secrete HGH.	[9m]
	<p>P1 Gene that codes for Human Growth hormone (HGH) is isolated by taking mRNA from the cells of anterior lobe of pituitary gland. 1</p> <p>P2 The mRNA is treated with reverse transcriptase to synthesis cDNA. 1</p> <p>Or</p> <p>P1 Gene that codes for Human Growth hormone (HGH) is isolated by taking DNA from the cells of anterior lobe of pituitary gland. 1</p> <p>P2 DNA is isolated by ultracentrifugation after the cells are homogenised. 1</p> <p>P3 A choosen plasmid/ and the DNA are cleaved using the same restriction enzymes 1</p> <p>P4 The segment of plasmid and DNA has complementary sticky ends 1</p> <p>P5 The target DNA //cDNA is inserted into the plasmid 1</p> <p>P6 DNA ligase joined the cDNA and plasmid, recombinant plasmid is formed 1</p> <p>P7 The recombinant plasmid is introduce into <i>E. coli</i> 1</p> <p>P8 by transformation 1</p> <p>P9 The transformed <i>E. coli</i> are amplified/ cultured and 1</p> <p>P10 those that carry the target DNA is identified by screening 1</p> <p>P11 The selected bacteria that contains rDNA is then placed into large fermenter tanks 1</p> <p>P12 The genetically modified bacteria uses the gene to synthesis HGH. 1</p>	
b)	Describe amniocentesis.	[6m]
	<p>P1 Amniocentesis is prenatal diagnostic procedure for fetus/ prenatal screening in the womb of its mother. 1</p> <p>P2 It is done at the 15th to 20th weeks of pregnancy. 1</p> <p>P3 A sterile fine needle is inserted through the abdomen guided by ultrasound device. 1</p> <p>P4 A sample of amnion fluid that contain fetal cells are extracted. 1</p> <p>P5 The cells are cultured and karyotyped 1</p> <p>P6 Chromosomes abnormality is observed for genetic diseases/ mutation/ defective genes 1</p> <p>P7 High risk mother – pregnant at old age might need to diagnose their baby for Down’s Syndrome// Couple who are carrier of mutant genes such as thalassemia. 1</p>	