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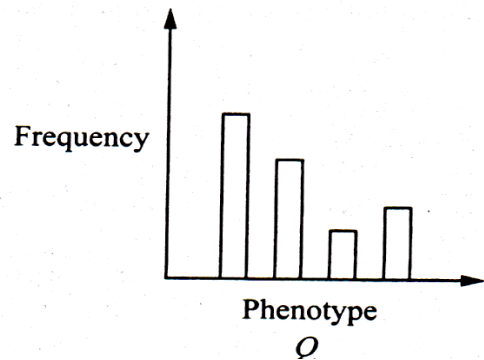
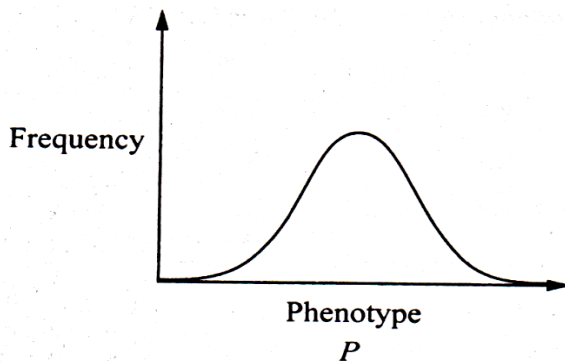
SMK SEPAGAYA LAHAD DATU

**PENTAKSIRAN ALTERNATIF 2020
BIOLOGY STPM
PAPER 3
TIME: 1 HOUR 30 MINUTES**

Section A (15 marks)

Answer all the questions in this section.

1. Two types of variations, P and Q, are shown in the diagrams below

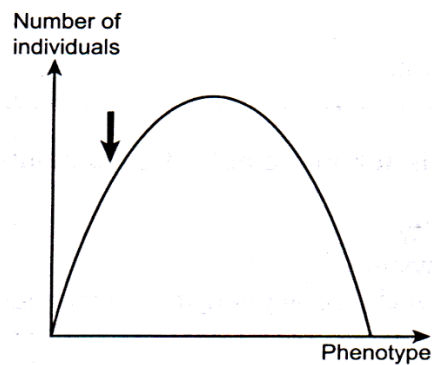


Which is true about P and Q?

	P	Q
I	Controlled by polygenes	Controlled by a single gene
II	Distinct group of organisms is present	Intermediate group of organisms is present
III	Qualitative variation	Quantitative variation
IV	Influenced by environment	Not influenced by environment

- A I and II B I and IV C II and III D III and IV
2. In a study done by a group of biologists on *Aristelliger* lizard, it is found that small lizards have a hard time defending their territories, while large lizards are more likely to be preyed upon by owls. Therefore, the average-sized lizards have a higher chance to survive. Which type of selection is correct about the study?
- A Natural B Disruptive C Stabilising D Directional
3. Which statement best describes polymorphism?
- A It makes organisms better adapted to survive in a certain environment.
B It gives a special modification naturally with attractive characteristics.
C It exists in different phenotypic variants within the same species.
D It is heritable and can be modified by natural selection.

4. The diagram below shows a type of selection process.

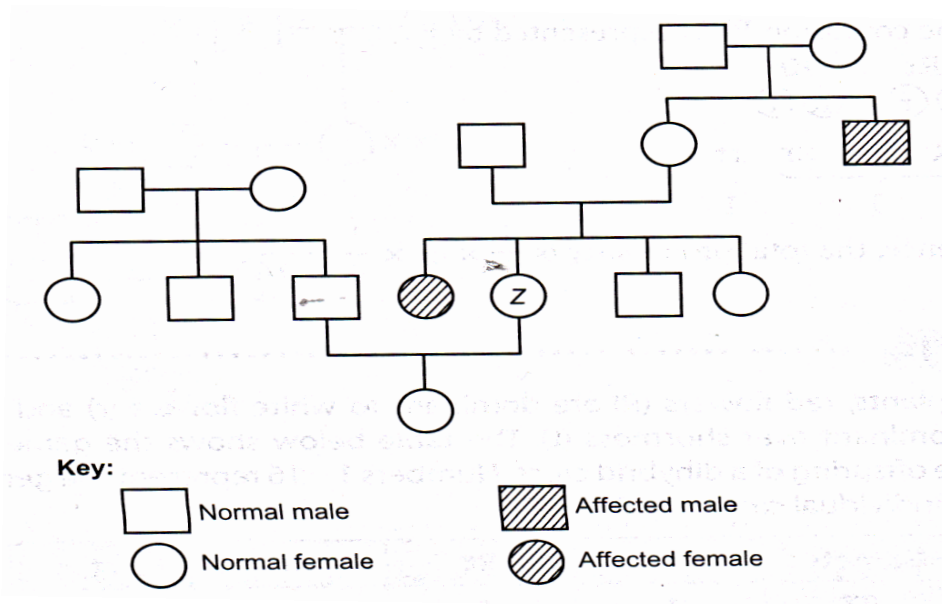


The arrow shows the direction of natural selection. Which of the following examples can be explained using the diagram above?

- A Increased survival rate for the newly born human babies with average weight.
 - B Increased in antibiotic resistance among pathogenic bacteria.
 - C Formation of two subpopulation of grass: toxic -tolerant and non- tolerant grasses
 - D Increased population of trees with average height in the forest as compared to short and tall trees
5. The examples of reproductive isolating mechanism in the formation of new species are given below.
- I Two populations of lizard live in two different islands.
 - II Two different populations of buffalo mate and their offspring are sterile.
 - III Two different populations of fish mate but their offspring fail to develop.
 - IV Two different populations of snails live in the same area but do not mate due to different structure of the reproductive organ.
- Which statements are the examples of post-zygotic isolating mechanisms?
- A I and II
 - B I and IV
 - C II and III
 - D III and IV
6. The frequency of the melanic form of the peppered moth, *Biston belaturia*, found in industrialised areas of Britain is increased compared to the pale form of the peppered moth. This is result of
- A. adaptive radiation
 - B. natural selection
 - C. Convergent evolution
 - D. divergent evolution
7. Which of the following has a greater chance of occurring when a population is small?
- A Mutation
 - B Natural selection
 - C Genetic drift
 - D Gene flow

8. Which of the following has developed mainly as a result of artificial selection?
- A Increased tolerance of lichens to heavy metals on tree bark around mines.
 B Increased production of antibiotics by the fungus, *Penicillium sp.*
 C Darker colouring of the peppered moth, *Biston betularia* near industrial area.
 D Increased resistance of rats to anticoagulant poison.
9. A cross between an Antirrhinum plant with alleles, RR for red flowers and an Antirrhinum plant with alleles, WW for white flowers produced heterozygous, RW offspring with pink flowers. What is the percentage of the progeny to have pink flowers if a cross is made between RW and RW?
- A 0% B 25% C 50% D 75%
10. The coat colour in mice is controlled by several alleles. C represents normal colour, C^{ch} chinchilla colour, C^h Himalayan colour, and c an albino. The hierarchy of dominance of allele is C > C^{ch} > C^h > c. If a cross between a chinchilla mice and a Himalayan mice produces chinchilla and Himalayan offspring in the ratio 1 : 1, which is true of the parental genotypes of the mice?
- A C^{ch} C^{ch} x C^h C^h
 B C^{ch} C^h x C^{ch} C^h
 C C^{ch} C^h x C^h C^h
 D C^{ch}c x C^hc
11. Red-green colour blindness is a sex-linked recessive condition in human. A man with normal vision and his colour-blind wife would expect to produce
- A colour-blind sons, sons with normal vision, colour-blind daughters and daughters with normal vision.
 B colour-blind sons, colour-blind daughters and daughters with normal vision only.
 C colour-blind sons and daughters with normal vision only.
 D sons with normal vision and colour-blind daughters only.
12. In the garden pea plant, purple flower (P) is dominant over white flower (p), and long stem (S) is dominant over short stem (s). Self-crossing of a double heterozygous plant produced 1 000 plants. How many of the 1 000 plants have white flowers with long stem?
- A 63 B 188 C 250 D 563
13. Manx cats are heterozygous for a dominant mutation that results in no tails (or very short tails), large hind legs and a distinctive gait. The mating of two Manx cats yields two Manx kittens that are normal, long-tailed kitten, rather than 3 : 1 as would be predicted from Mendelian genetics. Therefore, the allele causing the Manx cat phenotype is likely to be
- A lethal.
 B sex-linked.
 C codominant.
 D incomplete dominance.

14. Galactosemia is a condition caused by a recessive allele of an autosomal gene in which galactose cannot be metabolised. The diagram below shows the pattern of inheritance of galactosaemia in a family.

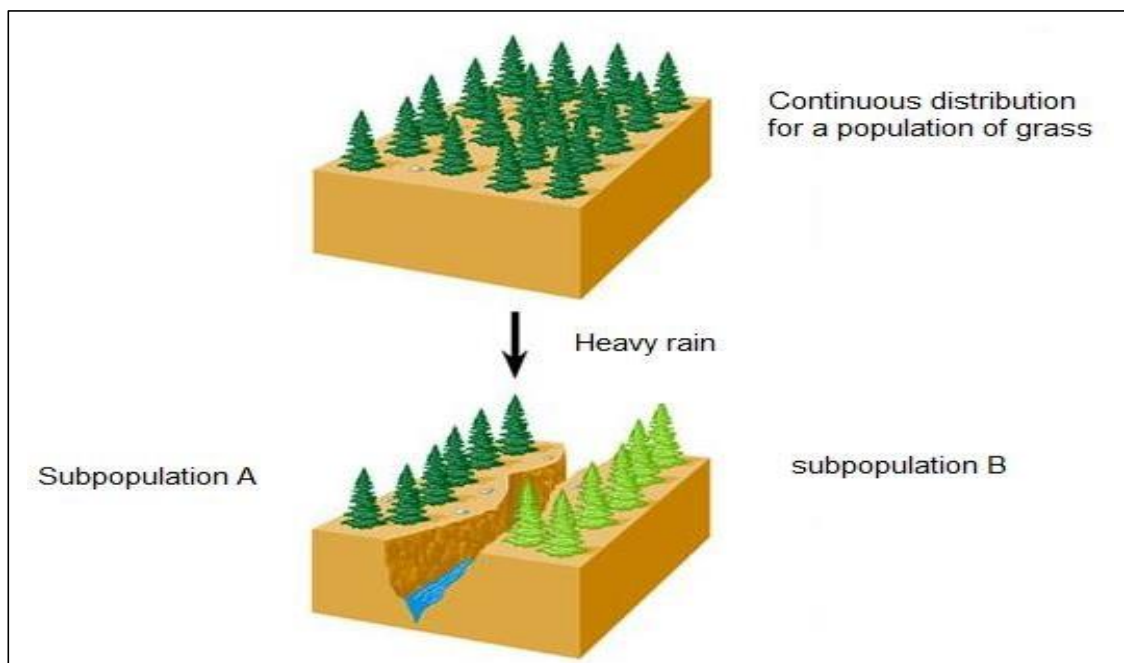


What is the probability that individual Z is a carrier of the condition?

- A $\frac{1}{2}$ B $\frac{1}{3}$ C $\frac{1}{4}$ D $\frac{2}{3}$
15. A type of gene interaction in which the product of one gene overrides the effect of another gene is called
- A linkage B mutation C epistasis D codominance

Section B (15 marks)
Answer all question in this section.

16. The diagram below shows a type of speciation method for grasses.



(a) What is meant by speciation? [1 mark]

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(b) State the type of speciation of the grass population as shown above. [1 mark]

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(c) Explain **one** main factor that should be prevented so that each subpopulation is able to undergo the speciation process. [1 mark]

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(d) Explain **one** factors that can cause speciation in the grass subpopulation. [1 marks]

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(e) With a suitable example, explain briefly how seasonal isolation can occur. [2 marks]

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(f) State another two types reproductive isolation mechanism, and give one example of each type. [2 marks]

Reproductive isolation mechanism	Example

17. An example of interactions of alleles that are illustrated by multiple alleles is the ABO blood group system.

(a) State the possible allele combinations in the ABO blood group system. [2 marks]

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(b) The table below shows the blood groups of three couples and the percentage of the number of children produced according to their respective blood groups.

Couple	Parents' blood group	% number of children according to blood group				Parents' genotype
		A	B	AB	O	
First	O × A	50	–	–	50	_____ × _____
Second	B × A	25	25	25	25	_____ × _____
Third	A × AB	50	25	25	–	_____ × _____

State the parents' genotype for each of the crosses. [3 marks]

(a) ABO blood group system is an example of codominant alleles.

(i) Give the definition for the term codominant alleles. [1 mark]

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(ii) Name the codominant alleles in the blood group system. [1 mark]

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Section C (30 marks)
Answer two questions in this section

18. With the aid of the graph, describe the type of selection. [15 marks]

- a. Stabilising selection
- b. Directional selection
- c. Disruptive selection

19. (a) Define the term *genetic drift*. Explain how genetic drift occurs in a population. [6 marks]

(b) (i) Define the term epistasis. [1 mark]

- (ii) In a plant summer squash, fruit colour may be white, yellow or green. White fruits are produced by a dominant epistatic allele **W** and allele **w** has no effect on colour. At another locus, allele **Y** for yellow fruit is dominant to its allele **y** for green fruits. Dominant white hides the effect of yellow or green. If a cross is carried between a male summer squash **WWYY** and a female **wwyy**, what is the possible phenotypic ratio if F1 generation are **selfed**.

Use a genetic diagram to shows a result of the cross. [8 marks]

20. In tomatoes, alleles for smooth skin (**L**) is dominant over wrinkled skin (**l**), and red flower (**R**) is dominant over white flower (**r**). A plant that is homozygous for both smooth skin tomato and red flower is crossed with a plant producing wrinkled skin tomato and white flower. A test cross is done on F₁, and the progeny produced are given below.

Smooth skin, red flower	295
Wrinkled skin, white flower	305
Wrinkled skin, red flower	99
Smooth skin, white flower	101

Based on the results above,

- (a) calculate the map distance between the two genes and draw its genetic map. [5 marks]
(b) draw the test cross above. [7 marks]
(c) explain why such ratio is obtained from the test cross [3 marks]

GOOD LUCK

PREPARED BY:

(MADAM CHIN YEN SIE)
SUBJECT TEACHER