

Do. Believe and Conquer.

2019 HSC BIOLOGY LECTURE GIFT

1000 QUESTIONS
(FREE RESPONSE & MCQ QUESTIONS)

PART I
(100/1000)

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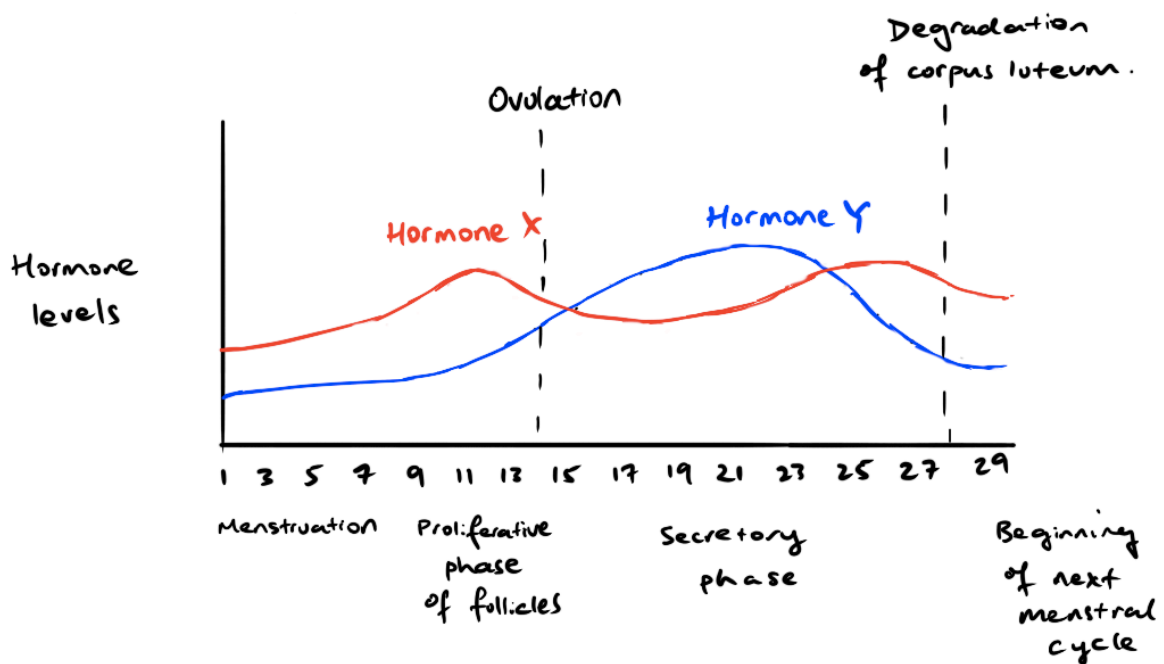
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FREE RESPONSE QUESTIONS

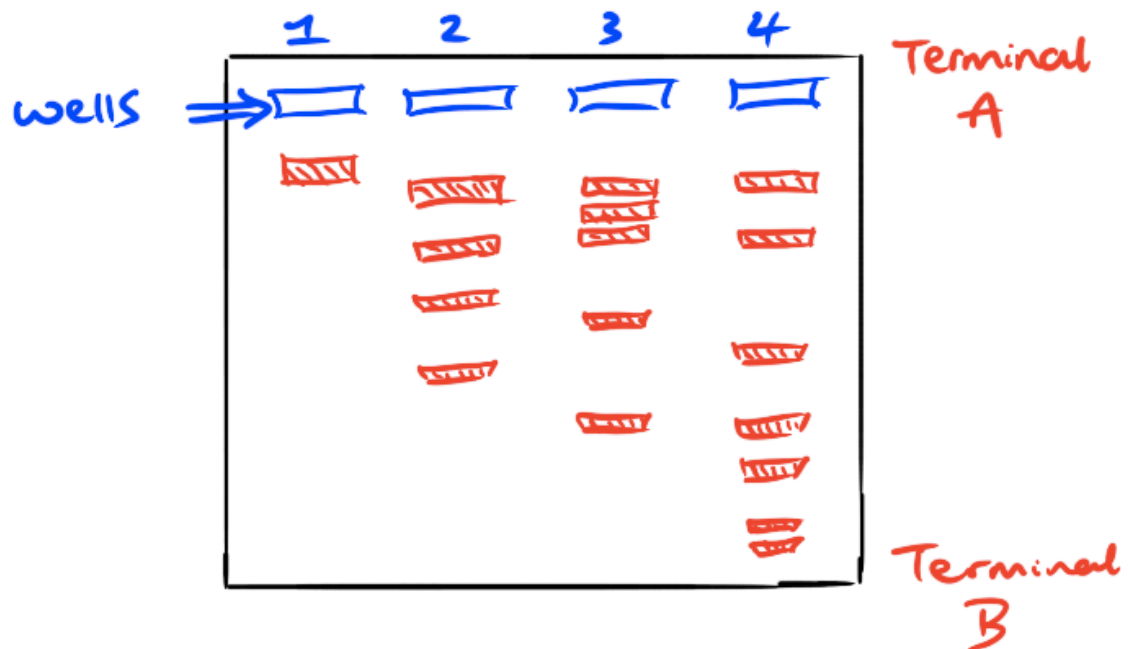
Question 1: A self-crossing over was performed on a pink coloured snapdragon plant exhibiting incomplete dominance. You are given that 69 snapdragon offspring had red colour as a result of the crossing. Determine the number of snapdragon offspring that would exhibit white and red colour using a Punnett Square.

Question 2: Use the graph below to answer part (a) – (e).



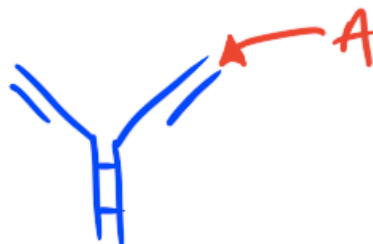
- Identify the names of Hormone X and Y.
- Define the source of Hormone X and Y.
- Account for the reason why the level of hormone X spikes before Y.
- Compare Hormone X and Y in terms of their function.
- Outline a situation where hormone Y will persist in high amounts during the 28th day of the menstrual cycle?

Question 3: Use the diagram below to answer part (a) – (c)



- (a) Identify the positive and negative ends of the gel electrophoresis machine labelled as 'X' or 'Y'.
- (b) Explain the charge of DNA and the mechanism in which the gel electrophoresis employs to separate DNA strands.
- (c) **OUTSIDE OF SYLLABUS SUB-QUESTION (For Fun):** Outline the process whereby DNA fragments are isolated from the gel electrophoresis machine after separation.

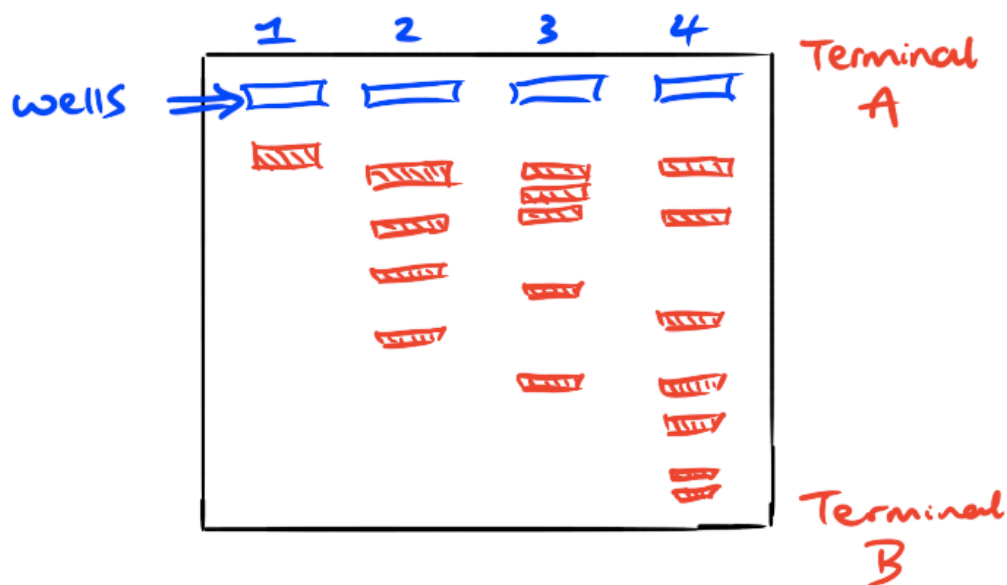
Question 4: The diagram below illustrates a biological substance that exists in a mammalian organism.



- (a) Name the part of the molecule that is labelled 'X'
- (b) Name the molecule depicted in the diagram.
- (c) Name the molecule that produces the molecule shown in diagram.

Question 5: Suppose that a patient has their thymus gland removed. Explain the effect of this removal on the patient's immune system.

Question 6: Refer to the following diagram to answer part (a) – (c)



- (a) Explain the mechanism in which DNA fragments move in the gel electrophoresis machine and why.
- (b) Outline the way in which the lane marked as '1' on the diagram differs from other lanes.
- (c) **Technically outside syllabus sub-question:** Propose a method that can be used in order to see DNA fragments in visible light.

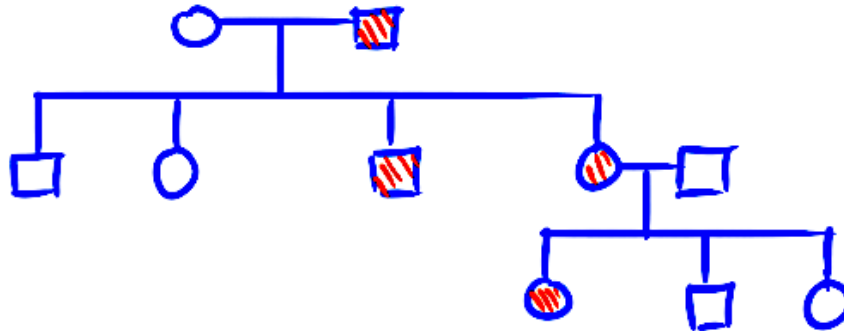
Question 7: Refer the nucleotide sequence of the DNA template strand below to answer part (a) – (c)

DNA Template Strand Nucleotide Sequence: A-T-G-C-A-T-G-C-A-T-A-C

- (a) Draw the corresponding mRNA strand to the figure provided above.
- (b) Name two processes that occurs when a DNA double helix is 'unzipped'.

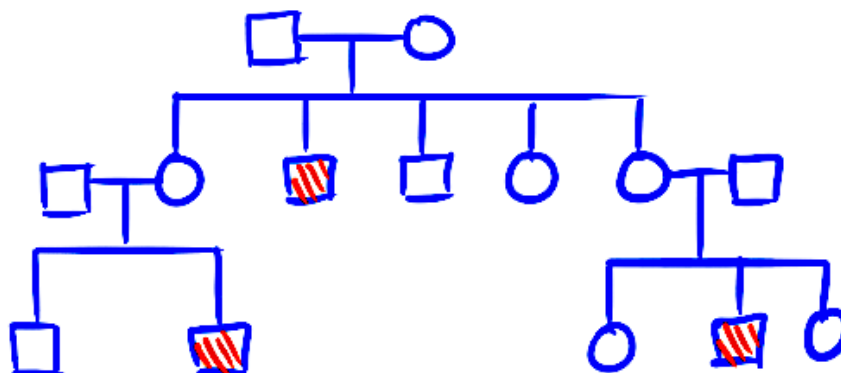
(c) Suppose that both strands of DNA are involved in the transcription process. Provide a prediction on the result of this error.

Question 8: Using the pedigree depicted below, answer part (a) – (c)



- Explain whether the mode of inheritance for the trait is dominant or recessive
- Explain whether the mode of inheritance for the trait is autosomal or sex-linked. If sex-linked, is it X-linked or Y-linked?
- Identify the genotype of the parents in the first generation, individual-3 in the second generation and individual-1 in the third generation.

Question 9: The pedigree depicted below shows a sex-linked disease. Use the pedigree diagram to answer part (a) and (b).



- Identify the genotype of individual-4, 5 and 6 depicted in the pedigree.

(b) Calculate the probability at which the offspring of individual-14 and 15 of inheriting haemophilia.

Question 10: Contrast the process of spermatogenesis with oogenesis.

Question 11: Given the template strand of the DNA below, draw the corresponding coding DNA strand and mRNA strand.

Question 12: Explain the process which the placenta is formed in a female human.

Question 13: List two hormones which is secreted by the placenta in a female human whom is pregnant.

Question 14: Draw a diagram depicting the male sperm and label 3 parts and their functions that allows the sperm to reach and enter a female gamete.

Question 15: [For students who chose to memorise Malaria as an infectious disease, this is a quick flashcard question]. Name the living state at which the pathogen responsible for causing malaria as it initially enters human body. Also, outline the different stages of the pathogen inside the human body.

Question 16: Identify and outline the function of two lymphoid organs or tissues within the human body.

Question 17: Explain three reasons for humans living today to support the conservation of Earth's biodiversity and providing two processes that results in the decrease in biodiversity today.

Question 18: Outline the hormonal process of spermatogenesis in male humans.

Question 19: Explain the reasons why the baby is considered to acquire passive immunity from antibodies of mother's breastmilk. However, the baby is considered to acquire active immunity when vaccination is performed on the baby.

Question 20: Identify three forms of RNA and outline their function in a prokaryotes's protein synthesis process.

Question 21: Describe the founder effect.

Question 22: Name two cells that is part of a human's innate immunity and describe their function.

Question 23: Explain the role of pituitary and ovarian hormones in the female menstrual cycle.

Question 24: Describe the method of use and purpose of a named technology in agricultural biotechnology.

Question 25: Explain the mechanism of fertilisation and implantation in humans.

Question 26: Explain how mutation can lead to the formation of new alleles and the reason why these created alleles may not all be part of the population's gene pool.

Question 27: Explain how gene flow, genetic drift and natural selection can result in the changes in a population's gene pool over time.

Question 28: Explain the difference in resulting phenotype due to complete dominance, incomplete dominance and co-dominance, providing definition and examples for each.

Question 29: Discuss the effect of independent assortment and mutation on genetic variation.

Question 30: Rainbow unicorns invaded Planet X million years ago. Since then, they have been on our mind as prestige species. Rainbow unicorns was originally from Egypt but they later attacked and colonised Merrylands, Sydney. It was only recently where a study revealed that there is a strong founder effect of Rainbow unicorn colonising Merrylands with ten founding unicorns. The recent study's results show that there are rainbow unicorns at Merrylands had fewer number of alleles at each of their chromosomes' locus than those at Egypt. Explain the findings of the recent study.

Question 31: Alien Swordfish have been geographically & genetically isolated from other swordfish for a billion years due to the decreasing sea levels on Planet Y. Now it is found that only eight alien swordfish lives in an isolated lake in Western Australia. Explain the effects of gene flow, gene drift can result in alterations to the allele frequencies of the isolated Alien Swordfish residing in the isolated lake in Western Australia.

Question 32: A lethal allele is an allele that is responsible for the death of an organism, during any stage of life, when expressed. An example of a disease that results from lethal alleles is cystic fibrosis. Explain how mutation can lead to the formation of lethal alleles and why these alleles are present in the gene pool if they cause the death of the organism.

Question 33: Distinguish between active and passive immunity, providing an example of each.

Question 34: Define the term 'vaccine' and how a child can get vaccinated to acquire long-term immunity for a specific disease.

Question 35: Your teacher said that a tiny drop of blood or tissue sample is sufficient for use in paternity testing. Justify your teacher's statement.

Question 36: Propose a mode of inheritance where the second generation of a monohybrid cross exhibits a phenotypic and genotypic ratio of 1:2:1. Support your answer with a relevant Punnett Square diagram.

Question 37: Colour-blindness is a sex-linked disease. Explain the reason towards the finding of why the probability of female being affected by colour-blindness is only about 5% of the probability which a male suffering from colour-blindness.

Question 38: Explain the process of implantation.

Question 39: Many rainbow unicorns were killed by meteor strike. The parents of the unicorn want to identify their mother, however, the great impact resulted in the unicorns to be beyond recognition based on visual appearance. Identify and explain the methodology of a technology that can be used to identify the dead rainbow unicorns.

Question 40: Explain the role of satellite DNA in DNA profiling.

Question 41: Show, using a monohybrid cross, how the cross between tall pea plants with dwarf pea plants yields a 50% : 50% ratio of tall : dwarf pea plant offsprings in the first generation (F₁).

Question 42: Propose a reason to the high quantities of gametes produced by moss plants which travel through water.

Question 43: Outline the benefit of maintaining a constant internal environment and an alternative to achieve a constant internal environment besides physiological regulation.

Question 44: Using what you have learnt in Module 7 and 8 in the HSC Biology course, answer part (a) and (b).

- (a) Propose a reason to why a member of the community health department would visit an ordinary school about slum dwellers & its importance.
- (b) Suggest two control procedures that could be used to control diseases that could be prevalent near slums.

Question 45: Explain the reason towards why the secondary immune response is more intense than the primary immune response in humans in terms of memory B and T cells.

Question 46: Explain how gene flow, genetic drift, meiosis, mutation and natural selection can change the allele frequencies in a population's gene pool.

Question 47: Outline the invasion pathway in which a virus can invade a human's immune system causing a disease such as HIV.

Question 48: Define the term mutagen, providing an example of a mutagen that is also a physical factor encountered by living organisms on Earth.

Question 49: Distinguish between the law of segregation, independent assortment and dominance proposed by Gregor Mendel.

Question 50: Propose a reason to why human suffering from chickenpox and survived have high probability that they will not suffer from the disease again later on in their lives. Include the name of this form of immunity against chickenpox.

Question 51: Describe the work of Louis Pasteur on his contribution towards countering the theory of spontaneous generation.

Question 52: Explain why we tend to sweat during summer and shiver during winter.

Question 53: Describe the relationship between luteinising hormone and the endometrium in the female human.

Question 54: Contrast innate immunity with acquired immunity

Question 55: Define what is meant by a transgenic organism.

Question 56: Explain the events that occur during the fertilisation of a female gamete in the female body.

Question 57: Define the term genetic diversity, species diversity and ecosystem diversity.

Question 58: Contrast binary fission with budding.

Question 59: Queen bees are able to produce two different types of eggs. One of which are eggs that are able to produce male drone bees without the need of fertilisation by a male gamete. That being said, the male drone bee that is derived from such eggs exhibit genetic variation, explain how this is happen.

Question 60: Explain the purpose of having regular booster injections to immune an animal.

Question 61: Describe genetic drift and the bottleneck effect with reference to allele frequencies.

Question 62: Name the cells that is capable of producing antibodies in the human body.

Question 63: Define the terms 'homeostasis' and 'stimulus'.

Question 64: Justify your classification of virus as a cellular or non-cellular pathogen.

Question 65: Describe two components of the first line of defence that provides an unvaccinated human immunity against virus during a holiday trip.

Question 66: If an unvaccinated alien is returning to its alien country from an infectious planet, explain the reason why boarder officials would request vaccination documents from the alien prior to allowing the alien to return to its country.

Question 67: Draw a diagram to show the process of DNA replication, including any annotations when appropriate.

Question 68: Describe the difference between the mechanisms of binary fission and mitosis.

Question 69: Define the term 'homologous chromosomes'.

Question 70: Describe the general function of a hormone.

Question 71: Identify the three sections of a DNA nucleotide.

Question 72: Describe the function of a named cell that is stimulated by a phagocyte-Helper T cell complex.

Question 73: Explain the reason why the DNA fragments belonging to unique individual species would vary in their size in gel electrophoresis with the same restriction enzyme being used.

Question 74: Describe the term 'gene regulation'.

Question 75: Describe the adaptations of two pathogens that allows their entry into a host cell.

Question 76: Explain the ways a named reproductive technology is capable of intervening in the evolutionary process.

Question 77: Explain how an antibiotic can lose its effectiveness over time despite its initial success.

Question 78: Describe the main components of the nervous system in the human body.

Question 79: Describe the main components of the endocrine system in the human body.

Question 80: Describe the difference between isolation and quarantine.

Question 81: Compare the secondary immune response with the primary immune response.

Question 82: Explain the reason why active immunity gives long-term defence against a disease whereas passive immunity only offers short-term protection.

Question 83: Explain the reason why vaccines do not provide protection against diseases immediately but, on average, 14 days after vaccination.

Question 84: State three differences between mitosis and meiosis.

Question 85: Explain the terms 'haploid' and 'diploid'.

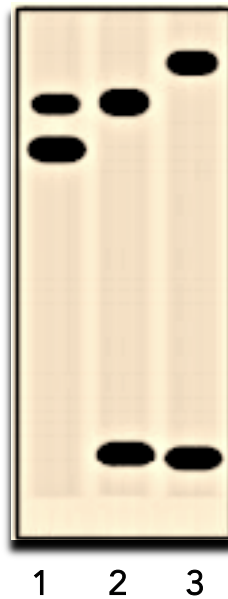
Question 86: Explain why your blood glucose level will drop after going on a run.

Question 87: Justify the statement "Genetic drift can lead to speciation".

Question 88: Name three common types of mutagenic agents that you have studied in the HSC Biology course.

Question 89: Explain the reason why DNA profiling is useful in forensic science and the reason why two people are unlikely to have the same 'genetic fingerprint'.

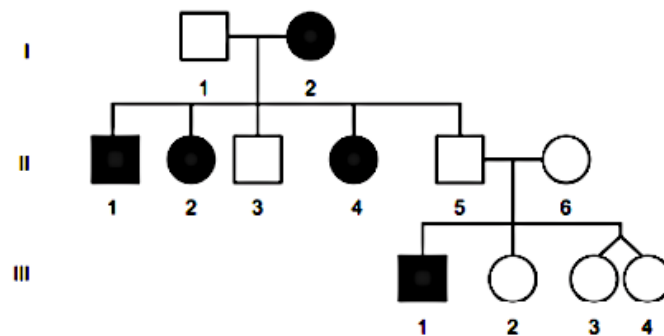
Question 90: The following diagram shows the end result of gel electrophoresis in DNA profiling. Lane 1, 2 and 3 are the 'DNA bands' or DNA fingerprints of the mother, child and potential father respectively.



Explain your interpretation of the diagram.

Question 91: Explain the function of sensory and motor neurones.

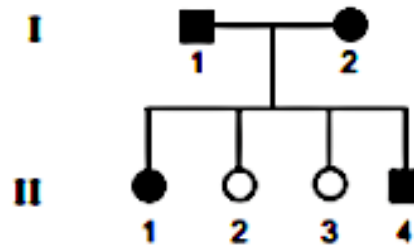
Question 92: Study the following pedigree.



- State the most likely mode of inheritance responsible for the trait of concern. Provide two reasons to support your answer.
- The twins in the third generation are not affected as shown in the pedigree. When the twins turned twenty, genetic studies were

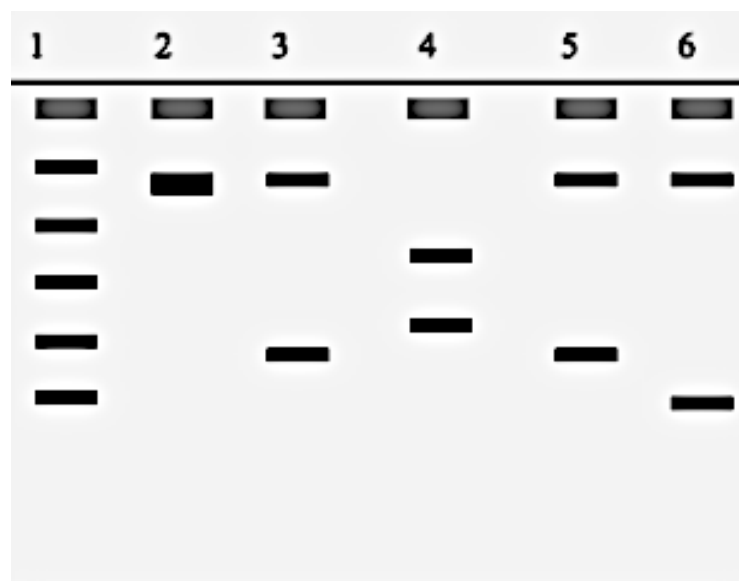
conducted on them on various other traits other than the trait of concern shown in the above pedigree. Predict and explain what the findings of the genetic studies would reveal for the two twins when they are age twenty.

Question 93: Study the following pedigree.



State the most likely mode of inheritance responsible for the trait of concern. Provide two reasons to support your answer.

Question 94: Study the following result of a gel electrophoresis. The DNA fragments are from one locus from a chromosome of each test individual's DNA. Lane 1 is the reference DNA, Lane 2 is the DNA from individual who was attacked by a rainbow unicorn. Lane 3 is DNA that was obtained from the blood of a rainbow unicorn found on the victim's clothes. Lane 4, 5 and 6 are DNA of suspecting rainbow unicorn who attacked the victim.

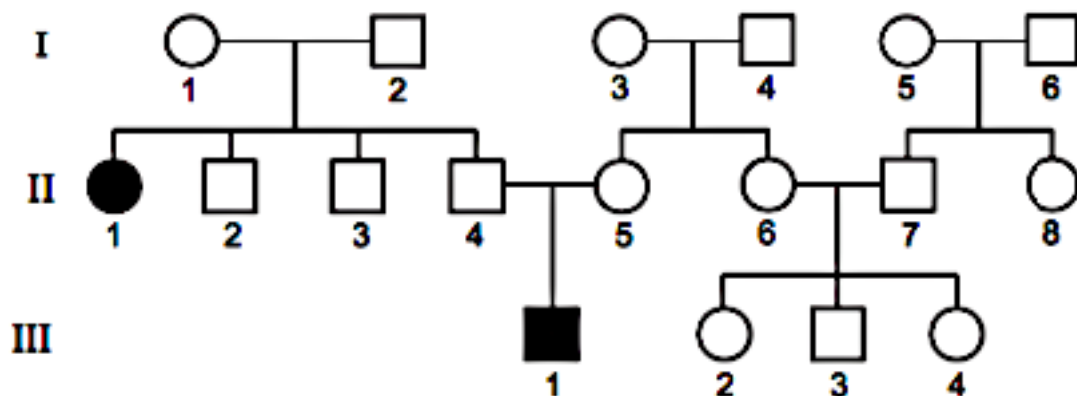


- (A) Explain the reason to the presence of a single band in lane two and multiple bands in lane three, four, five and six.
- (B) State the number of non-identical alleles present in the DNA fragment in all lanes except lane one.
- (C) Explain which lane most likely contains the DNA fragment of the unicorn who attacked the individual.

Question 95: In population genetics, describe the term founder effect.

Question 96: Explain the reason to why mutation on short tandem repeats in DNA may not have an effect on an individual.

Question 97: Study the following pedigree.



State the most likely mode of inheritance responsible for the trait of concern. Provide two reasons to support your answer.

Question 98: Define external fertilisation and distinguish it from internal fertilisation.

Question 99: Define the term 'clone'.

Question 100: Alleles frequencies in a population can change as a result of genetic drift and selective pressures outlined in Darwin's Theory of Evolution by Natural Selection. Explain the difference and how they both can led to the decline in allele frequencies.

Question 101: Define the term 'population genetics'.

MULTIPLE CHOICE QUESTION

MCQ 1: Gregor Mendel's experiment with pea plants revealed discrete hereditary units that occurred in pairs which he called factors. What do we call these 'factors' today?

- (a) Antibodies
- (b) Antigens
- (c) Alleles
- (d) Double-stranded chromosomes

MCQ 2: Gregor Mendel's experiment with pea plants revealed discrete hereditary units that occurred in pairs which he called factors. What do we call these 'factors' today?

- (a) Genes
- (b) Chromosomes
- (c) Phenotype
- (d) Genotype

MCQ 3: In which of following stage of meiosis does the segregation of an independent pair of non-homologous chromosomes occur?

- (a) Cytokinesis I
- (b) Interphase I
- (c) Anaphase I
- (d) Anaphase II

MCQ 4: Which of the following event will occur as a result of a spike in the level of luteinising hormone.

- (a) Formation of bone tissue
- (b) Ovulation
- (c) Menstruation
- (d) Breakdown of the corpus luteum

MCQ 5: Which of the following about polymorphism is true?

- (a) A form of multiple alleles mode of inheritance
- (b) An inheritable mutation that is present in more than 1% of population
- (c) An inheritable mutation is that is in less than 1% of population
- (d) An evolutionary theory by mutation proposed by Hugo de Vries.

MCQ 6: During which stage of the female reproductive cycle does the placenta develop?

- (a) After implantation
- (b) Before the release of Luteinising hormone
- (c) After birth of offspring
- (d) None of the above

MCQ 7: Which of the following correctly describes the function of the placenta

- (a) Only removes carbon dioxide and nitrogenous waste produced by the embryo and also gives oxygen supply and nutrients to embryo.
- (b) Only supplies oxygen and nutrients to embryo
- (c) Only removes carbon dioxide and nitrogenous waste produced by embryo
- (d) removes carbon dioxide and nitrogenous waste produced by the embryo, gives oxygen supply and nutrients to embryo as well as produce HCG, oestrogen and progesterone.

MCQ 8: One reason to why pedigree analysis is useful in studying human inheritance pattern is that

- (a) The genetic material of not identical between humans.
- (b) Pedigree is only able to analysis the inheritance of a trait one generation at a time
- (c) Control crosses is not possible to be established.
- (d) It is able to prove a mode of inheritance for a trait of concern.

MCQ 9: A born baby is born with _____ and the immunity that the baby gets from the mother's milk is a form of _____ and _____ immunity.

- (a) Adaptive immunity, acquired and active immunity.
- (b) Innate immunity, acquired and active immunity.
- (c) Innate immunity, adaptive and passive immunity.
- (d) Innate Immunity, acquired and passive immunity respectively.

MCQ 10: Arrange the following hormones in order of secretion in a pregnant female human's body.

Unassorted Hormones: Relaxin, hCG, FSH, LH

- (a) Relaxin, FSH, LH, hCG
- (b) hCG, relaxin, FSH, LH
- (c) FSH, LH, hCG, relaxin
- (d) LH, FSH, relaxin, hCG

MCQ 11: In order as the hormones are listed below, the sources of these hormones are

Hormones: Relaxin, hCG, FSH, LH

- (a) Ovary, Placenta, Anterior Pituitary Gland, Anterior Pituitary Gland
- (b) Anterior Pituitary Gland, Placenta, Ovary, Hypothalamus
- (c) Hypothalamus, Anterior Pituitary Gland, Adrenal Gland, Ovary
- (d) Placenta, Anterior Pituitary Gland, Ovary, Hypothalamus

MCQ 12: In evolutionary biology, the term 'gene flow' is the same as

- (A) Genetic Drift
- (B) Mutation
- (C) Natural Selection
- (D) Migration

FUN MCQ QUESTION: To insert foreign gene into a **plant** host cell, which of the following technique would be suitable?

- (a) Fluorescent In-Situ Hybridisation
- (b) Electric Shock
- (c) Gene Gun
- (d) Microinjection

FUN MCQ QUESTION: To insert foreign gene into an **animal** host cell, which of the following technique would be suitable?

- (a) Fluorescent In-Situ Hybridisation
- (b) Electric Shock
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