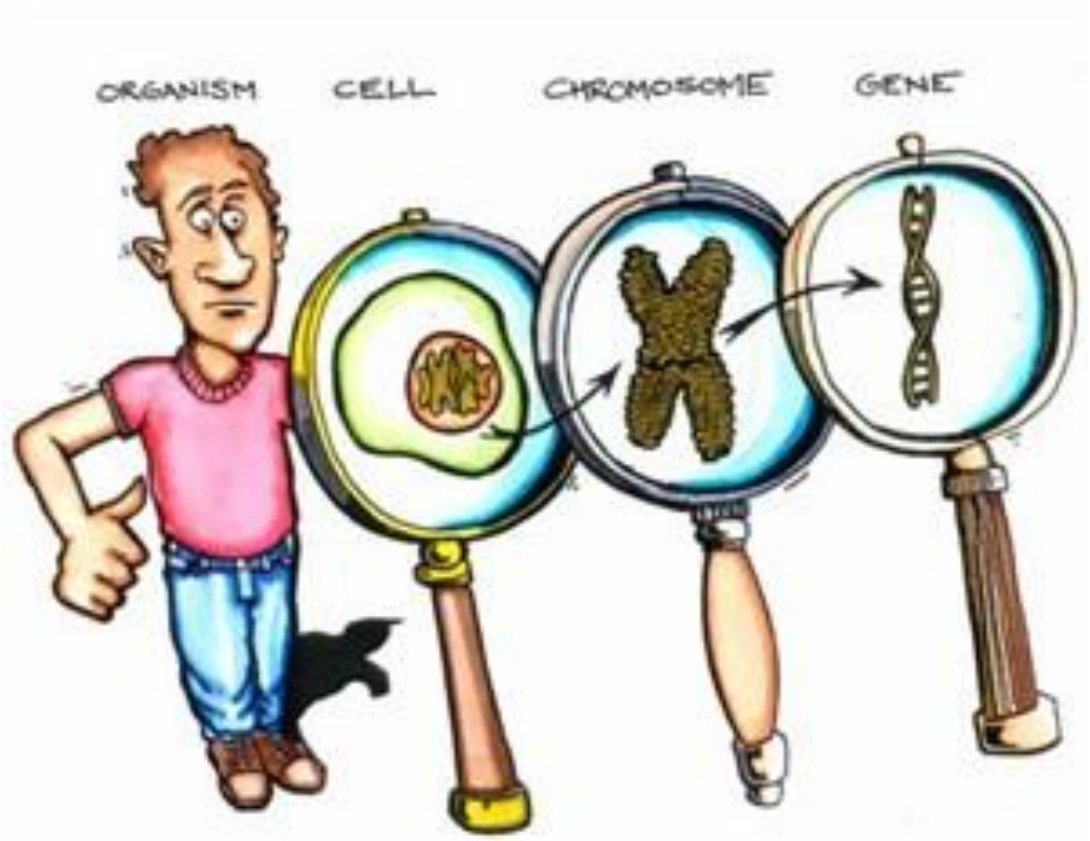
2016 UNIT 2 BIOLOGY



EXAM REVISION BOOKLET

Unit 2 Checklist

Area of Study 1 – How does reproduction maintain the continuity of life?

	Revised	Know
The Cell Cycle ✓ derivation of all cells from pre-existing cells through completion of the cell cycle		
✓ the rapid procession of prokaryotic cells through their cell cycle by binary fission		
✓ the key events in the phases (G1, S, G2, M and C) of the eukaryotic cell cycle, including the characteristics of the sub-phases of mitosis (prophase, metaphase, anaphase and telophase) and cytokinesis in plant and animal cells.		
Asexual Reproduction ✓ the types of asexual reproduction including fission, budding, vegetative propagation and spore formation		
✓ the biological advantages and disadvantages of asexual reproduction		
✓ emerging issues associated with cloning, including applications in agriculture and horticulture.		
Sexual reproduction ✓ how an offspring from two parents has a unique genetic identity		
✓ the key events in meiosis that result in the production of gametes from somatic cells including the significance of crossing over of chromatids between homologous chromosomes in Prophase 1 and the non-dividing of the centromere in Metaphase 1		
✓ the biological advantage of sexual reproduction, specifically the genetic diversity in offspring.		
Cell growth and cell differentiation ✓ the types and function of stem cells in human development, including the distinction between embryonic and adult stem cells and their potential use in the development of medical therapies		
✓ the consequences of stem cell differentiation in human prenatal development including the development of germ layers, types of tissues formed from germ layers and the distinction between embryo and foetus		
✓ the disruption of the regulation of the cell cycle through genetic predisposition or the action of mutagens that gives rise to uncontrolled cell division including cancer and abnormal embryonic development.		

Area of Study 2 – How is inheritance explained?

	Revised	Know
Genomes, genes and alleles ✓ the distinction between a genome, gene and allele		
✓ the genome as the sum total of an organism's DNA measured in the number of base pairs contained in a haploid set of chromosomes		
✓ the role of genomic research since the Human Genome Project, with reference to the sequencing of the genes of many organisms, comparing relatedness between species, determining gene function and genomic applications for the early detection and diagnosis of human diseases.		
Chromosomes ✓ the role of chromosomes as structures that package DNA, their variability in terms of size and the number of genes they carry in different organisms, the distinction between an autosome and a sex chromosome and the nature of a homologous pair of chromosomes (one maternal and one paternal) as carrying the same gene loci		
✓ presentation of an organism's set of chromosomes as a karyotype that can be used to identify chromosome number abnormalities including Down's, Klinefelter's and Turner's syndromes in humans.		
Genotypes and phenotypes ✓ the use of symbols in the writing of the genotypes for the alleles present at a particular gene locus		
✓ the distinction between a dominant and recessive phenotype		
✓ the relative influences of genetic material, environmental factors and interactions of DNA with other molecules (epigenetic factors) on phenotypes		
✓ qualitative treatment of polygenic inheritance as contributing to continuous variation in a population, illustrated by the determination of human skin colour through the genes involved in melanin production or by variation in height.		
Pedigree charts, genetic cross outcomes and genetic decision-making ✓ pedigree charts and patterns of inheritance including autosomal dominant, autosomal recessive, X-linked and Y-linked traits		
✓ the determination of genotypes and prediction of the outcomes of genetic crosses including monohybrid crosses, and monohybrid test crosses		
✓ the inheritance of two characteristics as either independent or linked, and the biological consequence of crossing over for linked genes		
✓ the nature and uses of genetic testing for screening of embryos and adults, and its social and ethical implications.		

1. Bacteria reproduce asexually through binary fission. How do they do this?

_____

_____

_____

_____

2. What is the result of mitosis and cytokinesis?

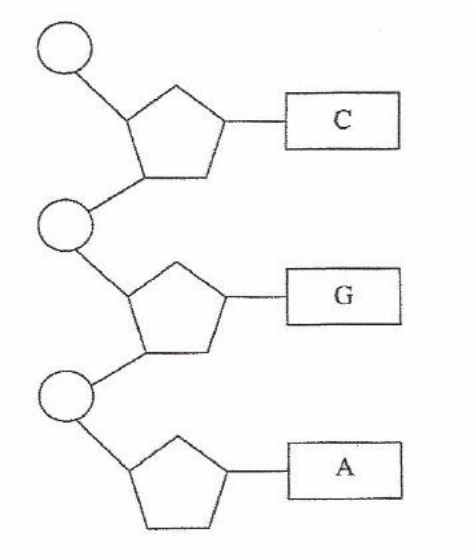
_____

_____

3. The mitotic cycle consists of interphase, mitosis and the cytokinesis. Complete the table.

	Stage	**Major Events**
Interphase		
Mitosis		
Cytokinesis		

4. The following diagram shows a short section of a polynucleotide.



a) On the diagram label a nucleotide, a phosphate group, a deoxyribose sugar, and a nitrogenous base.

b) Draw on the diagram the complementary strand of polynucleotide.

c) Describe how DNA is packaged into a chromosome

_____

_____

5. When does DNA Replication occur in the life cycle of a cell?

_____

6. Name the material of which genes and chromosomes are made.

_____

7. Describe the relationship between DNA, Genes and Chromosomes.

_____

8. In reference to humans, how many chromosomes are in:

a) Normal body cells (somatic cells)? _____

b) Sex cells (gametes)? _____

9. Which cells of your body are diploid?

_____

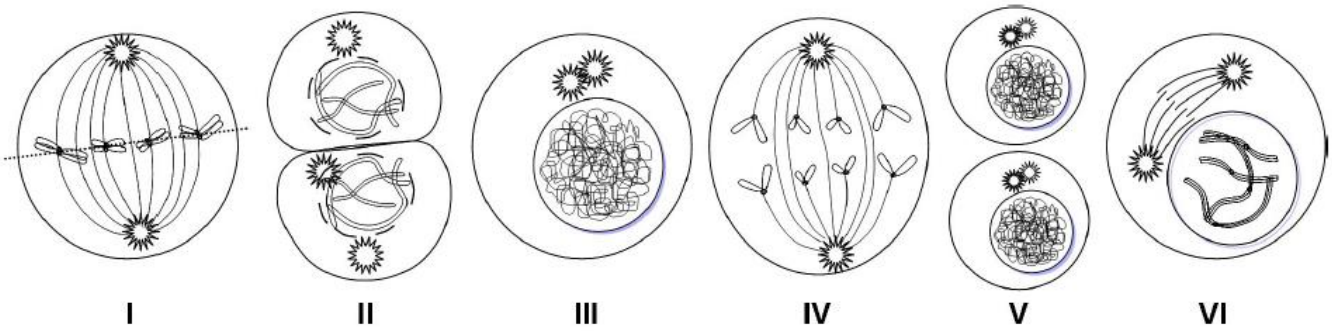
10. Why is meiosis significant to sexually reproducing organisms?

_____

11. Complete the table to summarise the differences between mitosis and meiosis

	Mitosis	**Meiosis**
Number of divisions		
Parent cell haploid/diploid		
What happens in metaphase?		
What happens in anaphase?		
Number of cells produced		
Number of chromosomes in daughter cells		
Genetic variation in daughter cells		

Use the following diagram to answer the questions.



12. Refer to the diagram. Arrange the stages in order.

_____

13. During which part of the cell cycle does this process occur?

_____

14. What is a stem cell?

_____

15. Complete the following table in regards to stem cells.

	Totipotent	**Pluripotent**	**Multipotent**
Can differentiate into..			
Found in..			

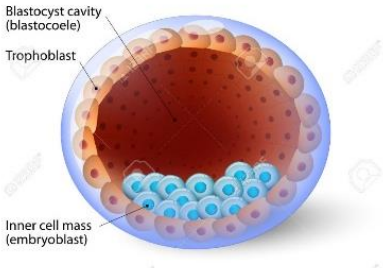
16. What will each part of a blastocyst form into?

_____

_____

_____

_____



17. What are some structures are formed by the 3 primary germ layers?

Ectoderm	Mesoderm	Endoderm

18. Distinguish between the terms 'embryo' and 'foetus'

_____

_____

19. What is a mutagen? Give two examples

_____

_____

20. Using the term 'apoptosis' in your answer, explain what 'cancer' is.

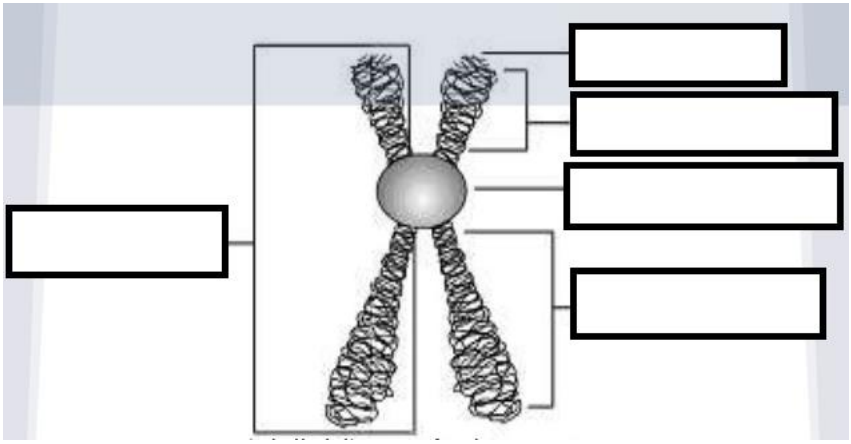
_____

_____

21. Fill in the table in relation to genetic technology.

Genetic Technology	**Explanation**
DNA Sequencing	
Gene Cloning	
Gene Therapy	
Cloning	
DNA Profiling	

22. Label the diagram



23. Name two processes occurring during meiosis that lead to variation within the gametes produced.

_____

_____

24. Homologous chromosomes are the same size and shape. State one other feature that homologous chromosomes have in common.

_____

_____

25. Name the points of contact that can form between homologous chromosomes during meiosis.

_____

26. The events below occur during the process of meiosis. Give the order in which they occur.

a) Chromatids are pulled apart

b) Homologous pairs of chromosomes separate

c) Chromosomes form homologous pairs

d) Chiasmata form and crossing over occurs

27. Describe how recombination can lead to variation in the genotype of gametes.

_____

_____

_____

_____

28. Define the terms ‘locus’ and ‘linkage’ using the terms ‘genes’ and ‘chromosomes’

_____

_____

29. Describe what may happen to linked genes during the crossing over process. Why is crossing over important?

_____

_____

_____

_____

30. What information is encoded by a gene?

_____

31. List 3 causes of mutations

1) _____
2) _____
3) _____

32. Distinguish between the terms ‘homologous’, ‘homozygous’, and ‘heterozygous’.

_____

_____

_____

_____

33. A normal woman’s chromosomes are homologous. Is the same true for a normal male?

_____

34. A gene’s locus is on the X-chromosome. Does this affect its inheritance patterns? How/why?

_____

_____

35. What is epigenetics?

_____

_____

36. A male is said to be 'hemizygous'. What does this term mean?

_____

_____

37. True or false?

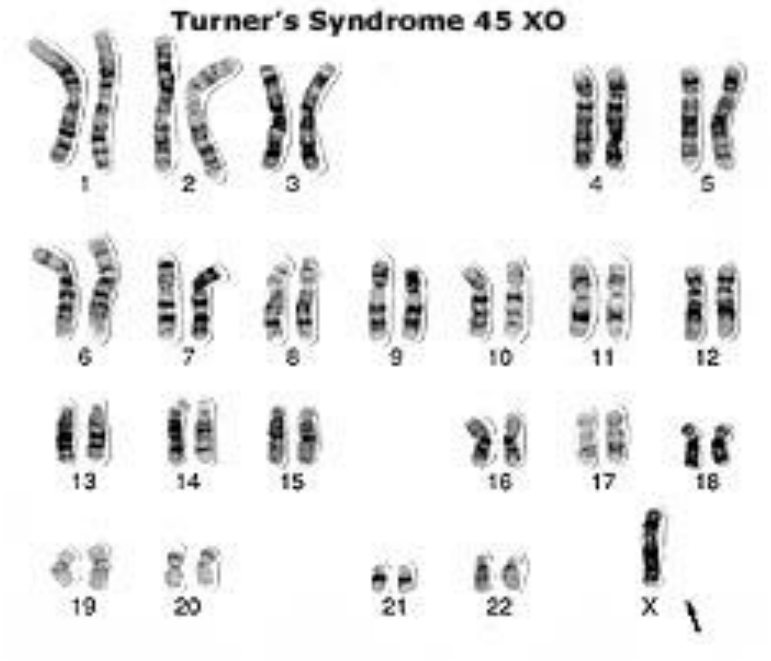
a) The Y chromosome has no active genes in humans
b) Linked genes are independently assorted
c) Down's syndrome in humans is an example of polyploidy
d) DNA replication occurs during mitosis
e) Your phenotype can change throughout your life
f) 1 gene is responsible for 1 trait
g) Genes code directly for our traits
h) Genetic disorders are always passed on
i) During meiosis, chromosomes number reduction takes place in anaphase II
j) A gene can have a maximum of 2 alleles
k) A 1:1 phenotypic ratio is expected from a monohybrid testcross with complete dominance
l) Linkage always occurs when two loci are on the same chromosome
m) Mitotic crossing over is more common than meiotic crossing over
n) In co-dominance, two alleles are expressed at the same time
o) A karyotype is a picture of cells undergoing crossing over
p) The production of egg cells by meiosis is called oogenesis
q) XXY represents a female with Turner's syndrome
r) Only men can be carriers of sex-linked disorders
s) A gene coded by multiple alleles is an example of polygenic inheritance
t) The mesoderm becomes the nervous system
u) Umbilical cord blood contains totipotent stem cells
v) Gel electrophoresis is used in DNA profiling
w) Hair colour is an example of polygenic inheritance
x) The term genome refers to ever gene present in a cell
y) All cells are constantly dividing
z) Identical twins have identical genotypes

38. What is a karyotype?

_____

_____

39. With respect to the below karyotype – answer the following questions.

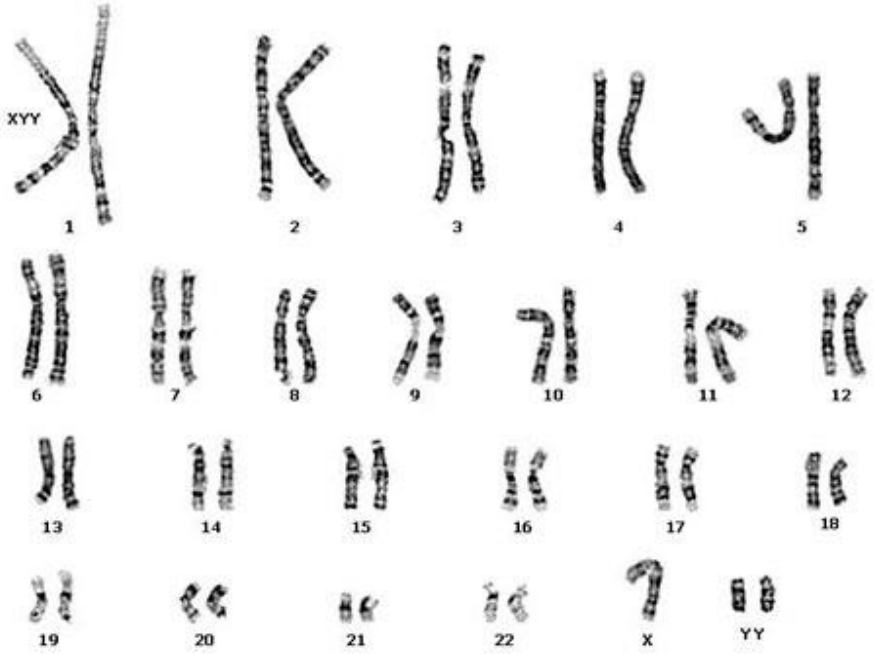


a) What is the gender of this person? _____

b) How many chromosomes do they have? _____

c) How would you diagnose this person? _____

40. With respect to the below karyotype – answer the following questions.

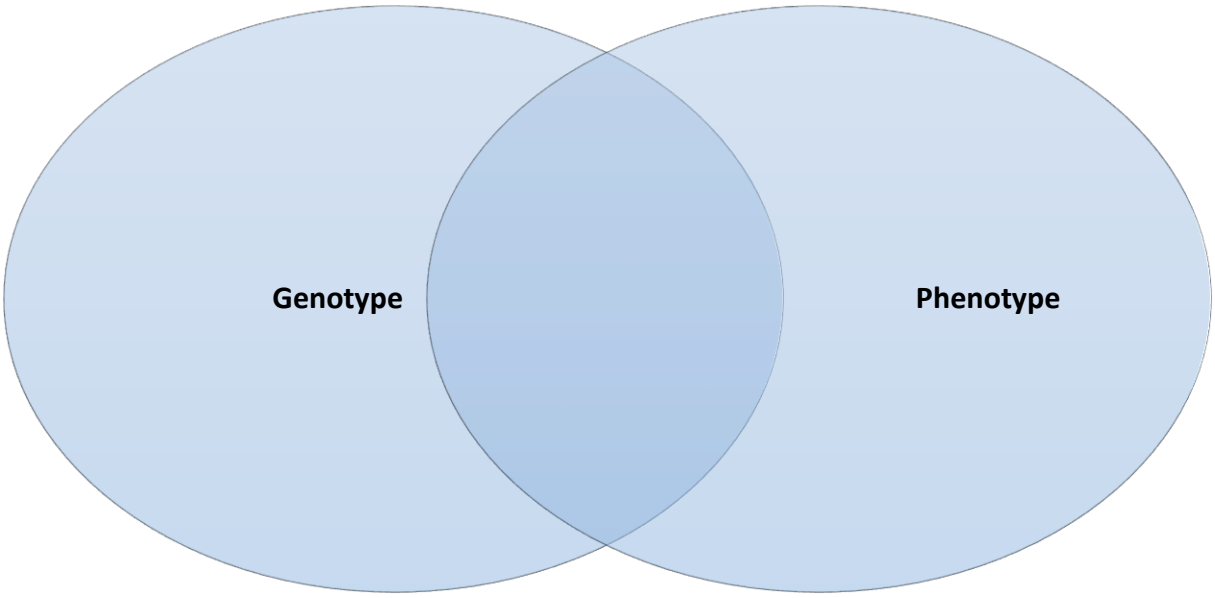


a) What is the gender of this person? _____

b) How many chromosomes do they have? _____

c) How would you diagnose this person? _____

41. Complete the Venn diagram below on Genotype and Phenotype, making sure you include at least 2 similarities and 2 differences.



42. Distinguish between the terms 'complete dominance' and 'co-dominance'.

_____

_____

_____

_____

43. List all the possible genotypes and phenotypes for an example of complete dominance.

_____

_____

44. List all the possible genotypes and phenotypes for an example of co-dominance.

_____

_____

45. Human blood type is an example of co-dominance. Fill in the following table.

Blood Type (Phenotype)	Possible Alleles
Group O	
Group A	
Group B	
Group AB	

46. What is the major difference between and monohybrid cross and a dihybrid cross?

_____

_____

_____

_____

47. A man and a woman are heterozygous for a gene. The gene has two possible alleles and there are two phenotypes. Use ***D*** to represent the allele whose expression results in the dominant phenotype and ***d*** to represent the allele that results in the recessive phenotype. Using the space provided, calculate the following probabilities.

a) The two individuals produce a heterozygous dominant offspring _____

b) The two individuals produce a homozygous dominant offspring _____

c) The two individuals produce a homozygous recessive offspring _____

d) The two individuals produce two homozygous recessive offspring _____

e) The probability that the child is heterozygous given the two individuals produce a child with the dominant phenotype _____

f) The expected ratio for a dominant to recessive phenotype _____

48. In the previous question, the mode of inheritance was complete dominance. Using the same allele symbols, show a cross involving a homozygous recessive man and a woman heterozygous for the gene. What are the possible genotypes and phenotypes of their offspring and in what proportions?

49. Coat colour variation in cattle shows a co-dominance inheritance pattern. Cattle can be red, white or roan. Roan cattle have a mixture of red hairs and white hairs. Use C^R as the symbol for the allele that causes the production of red hair pigments, and use C^W for the allele that causes the production of white hair pigments. If a roan cow (C^RC^W) and roan bull (C^RC^W) mate, calculate the following probabilities.

a) The cattle produce a heterozygous calf _____

b) The cattle produce a white calf _____

c) The cattle produce a red calf _____

d) The cattle produce two roan calves _____

e) The cattle produce three red calves _____

50. When referring to recessive conditions (sex-linked or autosomal), what is meant by a carrier?

_____

_____

_____

51. A woman with a colour-blind father has children with a man with normal vision.

a) What is the probability that a child is colour blind? _____

b) What is the probability a son is colour blind? _____

c) What is the probability a daughter is colour blind? _____

52. Consider two genes each with two alternative alleles. Both are on different chromosomes. A gene with the alleles ***B*** (abnormally high cholesterol) and ***b*** (normal cholesterol levels) is on chromosomes 19. Another gene controls Rhesus blood type (***D*** – Rhesus positive, and ***d*** – Rhesus negative). Its locus is on chromosome 1.

A couple are both heterozygous for the two genes. What is the expected phenotypic ratio among their offspring given they produce a huge number of children?

53. Use the background information from the previous question. In another couple, the father is heterozygous for both characteristics and the mother has low cholesterol levels and is Rhesus negative. Calculate the expected phenotypic ratios of their offspring.

54. Explain why X-linked conditions such as colour blindness are more common in men than in women.

_____

_____

55. Describe the drawing of pedigrees. What symbols are used and how are the generations numbered?

_____

_____

56. What patterns do you look for in a pedigree to distinguish between autosomal recessive inheritance and autosomal dominant inheritance?

_____

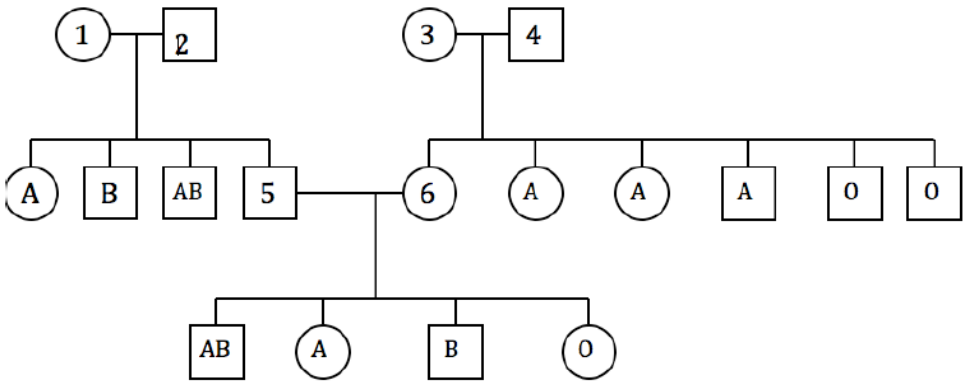
_____

57. What patterns do you look for in a pedigree to distinguish between X-linked recessive inheritance and X-linked dominant inheritance?

_____

_____

58. The pedigree below shows the blood types of three generations of family members. Notice that some of the blood phenotypes have already been given to you. What is the genotype of the individuals numbered 1 – 6? Give the probable genotype of all other family members.



Individual 1 –

Individual 2 –

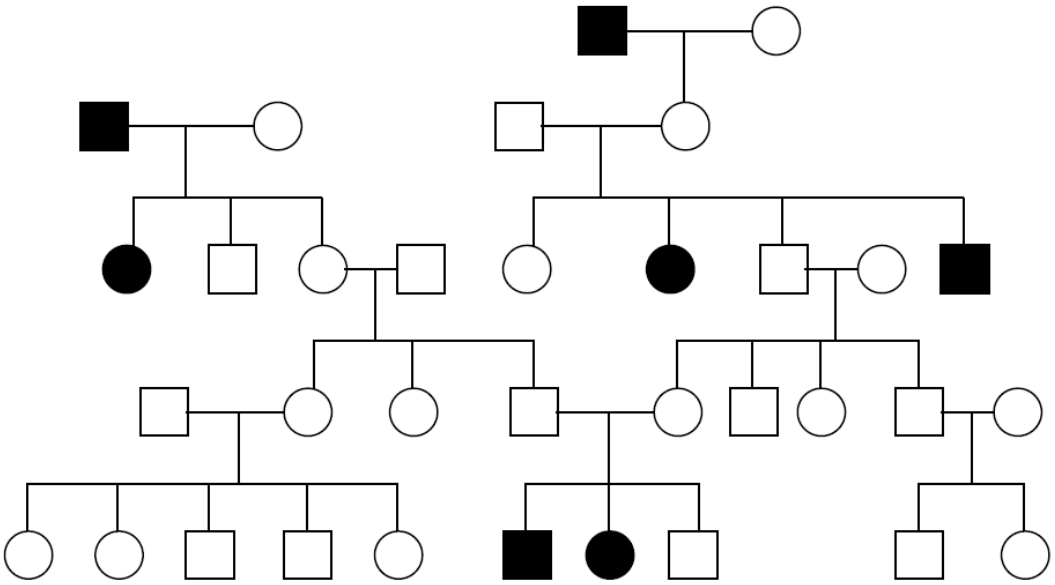
Individual 3 –

Individual 4 –

Individual 5 –

Individual 6 –

59. The following pedigree is for Schwartz-Jampel syndrome.



a) Is the trait dominant or recessive? _____

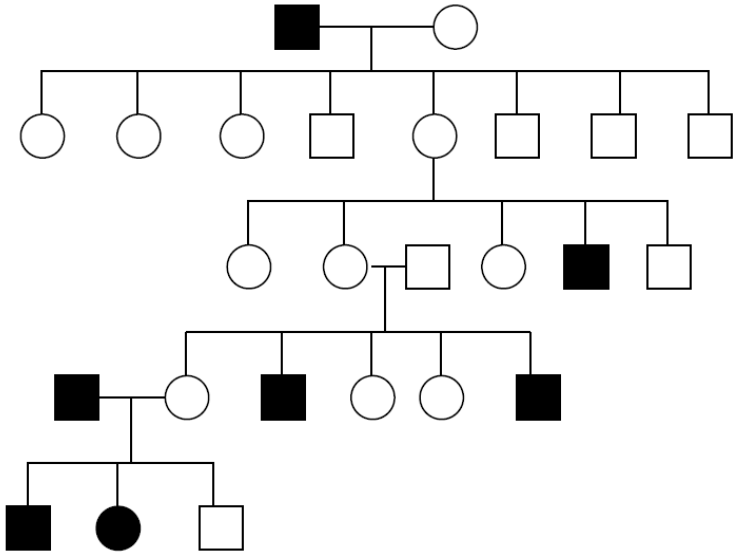
b) Is the trait sex-linked or autosomal? _____

c) Give two reasons to support your above answers.

i. _____

ii. _____

60. The following pedigree is for the condition Charcot Marie Tooth Disease.



a) Is the trait dominant or recessive? _____

b) Is the trait sex-linked or autosomal? _____

c) Give two reasons to support your above answers.

i. _____

ii. _____

61. Using any of the materials listed below, design an experimental procedure that could be used to test the hypothesis that 'Trypsin is more effective at hydrolysing proteins than other enzymes found in the small intestine'.

- Seven bottles each containing a different enzyme. The enzymes trypsin, pancreatic amylase, maltase, peptidase, lipase, nuclease and nucleosidase are at the same concentration and at basic PH
- A bottle containing a protein solution of known concentration
- Test tubes and a test tube rack
- A device capable of measuring the concentration of a protein in a solution
- A water bath capable of maintaining the bottles and test tubes at a constant temperature