A' LEVEL GENETICS TOPICAL DISCUSSION QUESTIONS

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Author's word.

Greetings to all students. Hopefully you'll have good time with this hand out. You ought to Always be ready to move on no matter what hinderence stands in your way. You're what you're due to the decision you previously made . Therefore, change your attitude to reach a higher altitude. Opportunities come to those who are always busy looking for them. I wish you Success as you carefully digest,absorb and assimilate the biology content in this handout. God bless you.

PROBLEMS THAT NEED STUDENTS' SOLUTIONS.

1.One form of baldness in humans is controlled by two alleles, B and b, of a single gene. This gene is not on the X chromosome but the expression of the gene is affected by the sex of a person. Men who are BB or Bb will become bald. Men who are bb will not become bald. Women who are BB will become bald. Women who are Bb or bb will not become bald. One type of colour blindness is controlled by a sex-linked gene, found on the X chromosome. The dominant allele X^A leads to normal colour vision and the recessive allele X^a leads to colour blindness.

(a) (i) Give all the possible genotypes of a bald man who has normal colour vision.

(ii) Give all the possible genotypes of a woman who will not become bald and who carries one allele for colour blindness.

(b) A mother and a father are both heterozygous for the gene for baldness. The father has normal colour vision and the mother is heterozygous for the gene for colour blindness.

(I) Determine the genotypes and phenotypes of the offsprings.

(II)Probability of son being colour blind but not becoming bald

(III) What would be the probability of the daughter being bald with norma vision if the father was homozygous for baldness and mother lacks bald yet heterozygous for colour blindness? Show your working.

(c) What would be the probability of a daughter being becoming bald and having a normal colour vision if the father is homozygous for baldness and a mother a carrier for colourblindness but has no bald.

2. Chickens have a structure called a comb on their heads. The drawings show two types of comb.

Pea comb

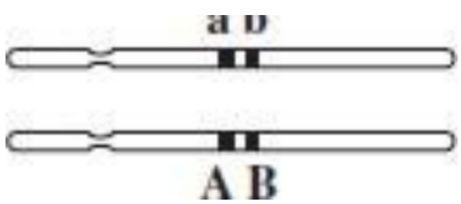
Single comb

The shape of the comb is controlled by two alleles of one gene. The allele for pea comb, A, is dominant to the allele for single comb, a.

The colour of chicken eggs is controlled by two alleles of a different gene. The allele for blue eggs, B, is dominant to the allele for white eggs, b.The genes for comb shape and egg colour are situated on the same chromosome.A farmer crossed a male chicken with the genotype AaBb with a female chicken that had a single comb and produced white eggs.

(a) What was the genotype of the female parent?

The diagram shows how the alleles of the genes were arranged on the chromosomes of the male parent.



(b) Which two genotypes will be most frequent in the offspring?

(c) The farmer could identify which of the female offspring from this cross would

eventually produce blue eggs. Explain how.

(d) identify which of the female offspring would produce blue eggs. Explain why.

(e) Suggest two environmental factors which are likely to affect egg product

(d) In chickens it is the males which are XX and the females which are XY.

A gene on the X chromosome controls the rate of feather production. The allele for slowfeather production, F, is dominant to the allele for rapid feather production, f.A farmer made a cross between two chickens with known genotypes. He chose these chickens so that he could tell the sex of the offspring soon after they hatched by looking at their feathers.Which of the crosses shown in the table did he make? Explain your answer.

Cross	Genotype of male parent	Genotype of female parent
A	$X_F X_F$	X^fY
B	$X_F X_f$	X^fY
C	$X_f X_f$	X^FY
D	$X_F X_f$	X^FY

(g) Female chickens are more likely than male chickens to show recessive sex-linkedcharacteristics. Explain why.

3. Hair type in dachshund dogs is controlled by two genes which are on different chromosomes.Dogs with the H allele have wiry hair and dogs with the genotype hh have non-wiry hair.The length of wiry hair is always the same. Dogs with non-wiry hair have either long or short hair. The length of non-wiry hair is controlled by another gene. Dogs with the D allele have short hair and those with the genotype dd have long hair.

(a) Give all the possible genotypes for dachshunds with non-wiry, short hair.

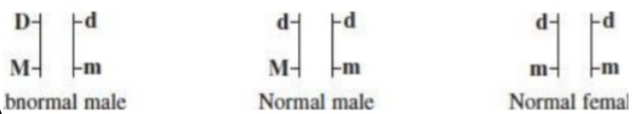
(b) What type of interaction is occurring between the two genes? Explain your answer.

(c) A wiry-haired male with the genotype HhDd was mated with a non-wiry, long-haired female with the genotype hhdd. Complete the genetic diagram to show the ratio of offspring phenotypes expected in this cross.

4. (a) Explain one way in which the behaviour of chromosomes during meiosis produces genetic variation in gametes.

(b) In mosquitoes, the sex of an individual is determined by one gene. Males have the genotype Mm and females mm.

Another gene is carried on the same chromosome. Normal males and females are homozygous dd for this gene. Abnormal males have a dominant D allele.The possible genotypes are shown below. The vertical lines represent homologous chromosomes.



A

During meiosis, allele D causes the homologous chromosome carrying the m allele to disintegrate. Cells lacking this chromosome do not develop further. Complete the genetic diagram to show how allele D is transmitted from an abnormal male to its offspring.

5.Coat colour in Labrador dogs is controlled by two different genes. Each gene has a dominant and a recessive allele. The two genes are inherited independently but the effects of the alleles interact to produce three different coat colours. The table gives four genotypes and the phenotypes they produce.

Genotype	Phenotype
BbEe	black
bbEe	chocolate
Bbee	yellow
bbee	yellow

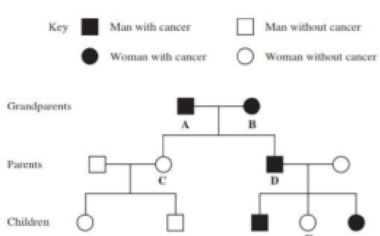
3.7.1 Inheritance pack 2

(a) What colour coat would you expect each of the following genotypes to give?

(i) BBEe (ii) bbEE

(b) A BbEe male was crossed with a bbee female. Complete the genetic diagram to show the ratio of offspring you would expect.

6. Li-Fraumeni syndrome is a rare inherited condition. It makes someone much more likely to develop cancer at an early age. The diagram shows part of the family history of a family affected by Li-Fraumeni syndrome. Li-Fraumeni syndrome is caused by the dominant allele of a gene. The gene is not sex-linked.



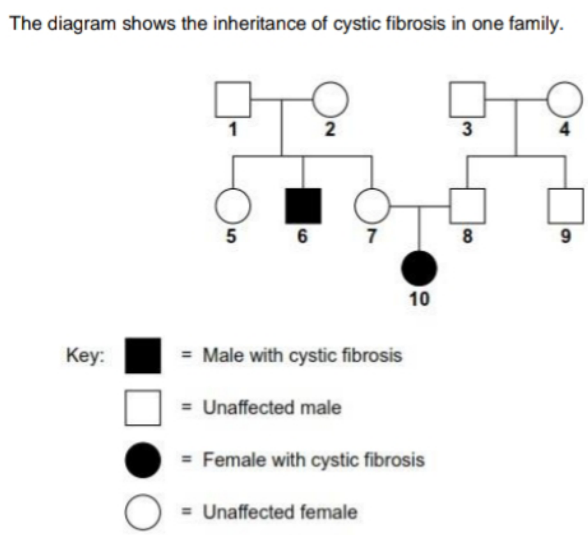
The grandparents, A and B, had two children, girl C and boy D. Explain how the phenotypes of these children provide evidence that Li-Fraumeni syndrome is

(a) caused by a dominant allele

(b) not sex-linked.

(c) This family's history of cancer was investigated when person E asked for genetic counselling. At the time she was 25 years old. What advice could a genetic counsellor give her about her probability of developing cancer?

7. The diagram shows the inheritance of cystic fibrosis in one family.



(a) Cystic fibrosis is caused by a recessive allele.Explain the evidence for this given in the diagram.

(b) Couple 7 and 8 decide to have another child.

What is the probability that this child will be a girl with cystic fibrosis?

Complete the genetic diagram to explain your answer.Use the symbols N for the dominant allele and n for the recessive allele

8. (a) In cats, long hair is recessive to short hair. A true-breeding (homozygous) short-

haired male is mated to a long-haired female.

(a) What will their kittens look like?

(b). Two cats are mated. One of the parent cats is long-haired (recessive allele). The litter which results contains two short-haired and three long-haired kittens. What does the second parent look like, and what is its genotype?

9. A couple has a child with achondroplasia, an autosomal dorminant disorder. If the father has the disease, what is the probability that their next child will inherit the disorder?

10.Mrs. And Mr. Kibiito both have widow’s peaks (dominant). Their first child also has a widow’s peak, but their second child doesn’t. Mr. Kibiito accuses Mrs. Kibiito of being unfaithful to him. Is he necessarily justified? Why or why not? Work the genetics problem predicting the frequencies of the versions of this trait among their prospective children.

11. Mr. and Mrs. Ronald have six children. Three of them have attached earlobes (recessive) like their father, and the other three have free earlobes like their mother. What are the genotypes of Mr. and Mrs. Ronald and of their numerous offsprings?

12. Mr. and Mrs. Jamesboth have tightly curled hair. (The hair form gene shows incomplete dominance. There are two alleles, curly and straight. The heterozygote has wavy hair.) The Andersons have a child with wavy hair. Mr. Jamesaccuses Mrs. Jamesof being unfaithful to him. Is he necessarily justified? Why or why not?

13. Two wavy haired people (one male and one female) marry and have eight children. Of these eight, how many would you expect to be curly haired, how many wavy haired and how many straight haired, assuming that the family follows the expected statistically predicted pattern? Suppose you examine the actual children and discover that three of the eight have curly hair. What do you suppose went wrong?

14. Basic body color for horses is influenced by several genes, one of which has several different alleles. Two of these alleles—the chestnut (dark brown) allele and a diluting (pale cream) allele (often incorrectly called 'albino')—display incomplete dominance. A horse heterozygous for these two alleles is a palomino (golden body color with flaxen mane and tail). Is it possible to produce a herd of pure-breeding palomino horses? Why or why not? Work the Punnett's square for mating a palomino to a palomino and predict the phenotypic ratio among their offspring.

15. In certain portions of the Jewish population, there is a genetic disease called Tay Sachs disease, which is fatal to infants within the first five years of life. This disease is caused by a recessive allele of a single gene. Why does this disease persist, even though it is invariably fatal long before the afflicted individual reaches reproductive age? (In other words, why doesn't the allele for Tay Sachs disease simply disappear?)

16.. About 80% of the human population can taste the chemical phenolthiocarbamide (PTC), while the other 20% can't. This characteristic is governed by a single gene with two alleles, a tasting allele and a non-tasting allele. What does this statistic tell us about which allele (tasting or non-tasting) is dominant?

17. In fruit flies, the gene for wing shape has an unusual allele called 'curly' (designated 'Cy'). The normal (wild type) allele is designated 'cy.' A fly homozygous for cy (cy cy) has normal, straight wings. The heterozygote (Cy cy) has wings which curl up on the ends (and, incidentally, can't really fly). The homozygote for the Cy allele (Cy Cy) never hatches out of the egg. In other words, this allele is lethal in the homozygous condition. If two curly winged flies are mated, and the female lays 100 eggs, predict the following, showing appropriate work:

a. How many eggs will produce living offspring?

b. How many straight winged flies do you expect among the living offspring?

c. What percentage of the living offspring do you expect to be curly winged like the parents?

18. In cattle, there is an allele called dwarf which, in the heterozygote, produces calves

with legs which are shorter than normal. This, again, is a homozygous lethal (the homozygous dwarf calves spontaneously abort early or a stillborn). If a dwarf bull is mated to 400 dwarf cows, what phenotypic ratio to you expect among the living offspring?

19. A man with dark (dominant), curly (see problem 12 above) hair marries a woman with light, straight hair.Their daughter, who happens to have dark hair, marries a man with light, wavy hair. Answer the following questions about this dark-haired daughter and her family.

a. Draw a Punnett's square for this marriage, and predict the phenotypic ratio among the offspring of the daughter and her husband.

b. What is the chance that they will have a child with hair just like his or her father's?

20. In cats, again, black color is dominant to a special, temperature-sensitive albino gene which produces cats with dark legs, faces and tails (Siamese cats, in case you don't recognize it). A short haired (dominant) Siamese colored female is bred to a long-haired black male. They have eight kittens: 2 black, short-haired; 2 black, long-haired; 2 Siamese, short-haired; and 2 Siamese, long-haired. What were the genotypes of the two parents?

21. Rebekah is married to Isaac, and they have four children. Rebekah has a straight nose (recessive) and is able to roll her tongue (dominant). Isaac is also able to roll his tongue, but he has a convex (Roman) nose (dominant). Of their four children, Rachael is just like her father, and Jacob is just like his mother. The other children—Miriam, who has a convex nose, and Elijah, who has a straight nose—are unable to roll their tongues. Please answer the following questions about this family.

a. What are the genotypes of Rebekah and Isaac?

b. Elizabeth's father was a straight-nosed roller, while her mother was a convex-nosed non-roller. What can you figure out about their genotypes?

c. Isaac's father was a straight-nosed roller, while his mother was a convex-nosed roller. What can you determine about their genotypes?

d. Diagram the three described generations of this family in accepted pedigree form, including the phenotypes for these two traits.

22. If a pure-breeding (homozygous) black (dominant), long-haired (recessive) cat is mated to a pure-breeding Siamese, short-haired cat, and one of their male offspring is

mated to one of their female offspring, what is the chance of producing a Siamese colored, short-haired kitten?

23. In horses, one which runs best in water (or in wet conditions) is called (WATER), and one which runs best in dry conditions is called (DRY). (WATER) is recessive to (DRY). A horse can also be either a trotter, which we will designate (GAIT) or a pacer, which we will designate (PACE). (PACE) is recessive to (GAIT). We have mated two horses, a Stallion and a mare named Mare. Stallion is a (WATER)(PACER), while Mare is a (DRY)(GAIT). One of Mare's parents was a (WATER)(PACER). What are the chances of Mare and Stallion producing a (WATER)(GAIT) foal (that's a baby horse, in case you didn't know)?

24. When a male pig from a line of true-breeding (homozygous) black, solid-hooved pigs was crossed to a female from a breed (homozygous) of red, cloven-hooved pigs, their several progeny all looked alike with regard to color and hooves. These progeny were all mated to members of the same breed as their red, cloven-hooved mother pig. The offspring from this final cross were: 11 black, cloven-hooved; 8 black, solid-hooved; 14 red, cloven-hooved; and 10 red, solid-hooved. For each of these two genes (coat color and hoof type) determine which allele is the dominant one. Explain your reasoning. What were the phenotypes of the progeny produced by the first mating in this problem?

25. In garden peas, long stems are dominant to short stems, and yellow seeds are dominant to green seeds. 100 long/yellow pea plants, all of which had one short/green parent, are interbred (bred to each other). 1600 progeny result. Please answer the following questions about these progeny.

a. Assuming that these two genes are unlinked, about how many long/green pea plants would you expect to find among the offspring?

b. What ratio of yellow to green seed color would you expect among the offspring?

c. What would you expect the overall phenotypic ratio among the 1600 offspring to be (taking into consideration both traits)?

26. Plutonian Tickle-bellies have a sex determination system just like mammals. Hairy Snout is a holandric trait (carried on the Y chromosome). MyxRotcccc, a handsome male Tickle-belly, has lovely orange hair on his snout. He and his mate, OrgggWny, have six offspring, three boys and three girls. Please answer the following questions about this family.

a. How many of MyxRotcccc's and OrgggWny's offspring have hairy snouts? Can you predict which ones?

b. Their eldest son, Bob, marries and has a son. What is the chance that Bob's son will also have a hairy snout?

c. JoKchew, MyxRotcccc's and OrgggWny's youngest daughter, marries a male who has a smooth, hairless purple snout. She has eight offspring, each one lovelier than the last, and all boys. What percentage of these offspring do you expect to have hairy snouts? Explain.

27. In fruit flies (Drosophila), one eye color gene is X-linked, with a recessive white allele and a dominant red allele. If white-eyed female flies are bred to red-eyed male flies, describe the expected offspring (assume all parental flies are true-breeding). What results do you expect if you do the reciprocal cross(reverse the phenotypes of the parent flies)?

28. Earl has normal color vision, while his wife Erma is colorblind. . Colorblindness is an X-linked trait, and the normal allele is dominant to the colorblindness allele. If they have a large family, in what ways should the colorblindness trait affect their children?

29. Ethan is colorblind. His wife, Edna, is homozygous for the normal color vision allele. If they have eight children, how man of them would you expect to be colorblind? Using Punnett's squares, derive and compare the genotypic and phenotypic ratios expected for the offspring of this marriage and those expected for the offspring of the marriage described above.

30. Marian's father is colorblind, as is her maternal grandfather (her mother's father). Marian herself has normal color vision. Marian and her husband, Martin, who is also colorblind, have just had their first child, a son they have named Mickey. Please answer the following questions about this small family.

a. What is the probability that this child will be colorblind?

b. Three sources of the colorblindness allele are mentioned in this family. If Mickey is colorblind, from which of these three men (Marian's grandfather, Marian's father, or Martin) did he inherit the allele?

c. Using proper pedigree format, diagram the available information about the four generations of this family described, assuming that Mickey is colorblind.

d. If Martin were not colorblind, how would this affect the prediction about Mickey?

31. In cats, there is a coat color gene located on the X chromosome. This gene is a different gene from the black/Siamese gene discussed in earlier problems. This gene has two alleles—orange and black. A heterozygous cat has tortoiseshell color (a splotchy mixture of orange and black). Predict the genotypic and phenotypic frequencies among the offspring of the following crosses. Pay careful attention to the genders of the offspring.

a. Black female X Orange male

b. Orange female X Black male

c. Tortoiseshell female X Black male

d. Tortoiseshell female X Orange male

32. In a particular family, one parent has Type A blood, the other has Type B. They have four children. One has Type A, one has Type B, one has Type AB, and the last has Type O. What are the genotypes of all six people in this family?

NOTE: The ABO blood type gene has three alleles. I A and IB are codominant; i (for Type O) is recessive to both.

33. Refer to problem I.3. Mrs. Kibiito has blood type A. Mr. Kibiito has blood type B. Their first child has blood type AB. Their second child has blood type O. Now is Mr. Kibiito justified? What are Mr. and Mrs. Kibiito 's genotypes for these two genes?

34. In a recent case in Spokane, Washington, a young woman accused a soldier of being the father of her child. The soldier, of course, denied it. The soldier's lawyer demanded that blood types be taken to prove the innocence of his client. The following results were obtained: Alleged father, Type O. Mother, Type A. Child, Type AB. The court found the soldier guilty on the basis of the woman's remarkable memory for dates and details that apparently eliminated all other possible fathers.

a. What are the possible genotypes for these three people?

b. Do you agree with the court's decision? Why or why not?

35. It was suspected that two babies had been exchanged in a hospital. Mr. and Mrs. Ronald received baby #1 and Mr. and Mrs. Simon received baby #2. Blood typing tests

on the parents and the babies showed the following:

Mr. Jones: Type A Mrs. Jones: Type O	Mr. Simon: Type AB Mrs. Simons: Type O
Baby #1: Type A	Baby #2 Type O

ies switched? How do you know whether they were or they
ype O blood marries a woman with Type AB blood. Among
pect to have blood types like one or the other of these paren

36. A man with type O blood marries a woman with Type AB blood. Among their children, what proportion would you expect to have blood types like one or the other of these parents? What proportion would have expect to have blood types different from both parents? Explain

37. A woman has a daughter. There are three men whom she claims might have been the father of the child. The judge in the paternity court orders that all three men, the child, and the mother have blood tests. The results are: mother, Type A; Daughter, Type O; Man #1, Type AB; Man #2, Type B; Man #3, Type O. The mother claims that this proves that Man #3 must be the little girl's father.

a. Is the mother correct? Why or why not?

b. The judge isn't satisfied, so he asks for the medical records of the people involved. He discovers that the little girl is colorblind. Men #'s 1 and 2 are also colorblind; Man #3 has normal color vision, as does the mother. (NOTE: Colorblindness is X-linked and recessive.) Assuming that one of these three men must be the father, can you now determine which of the three it is?

38. Another woman has the same problem. Her blood type is A, her child's is B. She again has three candidates for fatherhood. Their blood types are: Man #1, B; Man #2, AB; Man #3, O. Based on blood types, the mother says it must have been #1.

a. Do you agree? Why or why not?

b. This child, a son this time, is also colorblind. The only one of the men in question to share this characteristic is #2. The mother is not colorblind. Can you now determine who the father of the little boy is, assuming it must be one of these men? Explain your answer.

39. In cats, there is a gene which produces ticked fur (bands of different colors on each hair) called Agouti (H). The recessive allele (h) for this gene produces hair which is a solid color from end to end. In addition, there is a coat color gene which has a recessive

albino allele (a) which, in the homozygote, prevents the production of any coat color pigment, resulting in a white cat with pink eyes, the traditional albino. Note that this problem has described two completely different genes. These genes are unlinked. An albino female cat is mated to a solid brown male cat. All of their offspring are Agouti. The males and females among these offspring are allowed to freely intermate, producing a flock of F2 kittens. Predict the phenotypic ratio for fur color among these many grandkittens.

40.. In Drosophila (fruit flies), the wild type eye color, brick red, is actually produced by the deposition of two pigments in the eyes, a dull brown pigment and a brilliant red pigment. These two pigments are produced by the action of two different, non-allelic (and non-linked) genes. Each of these genes has two alleles, a dominant one which causes normal the production of the pigment controlled by the gene, and a recessive one which is defective, and causes none of that pigment to be produced. Thus, a normal eye-color fruit fly must have at least one dominant allele for each of these genes. If a fly is homozygous for the defective, recessive allele of the gene which produces the brown pigment, that fly will have only the brilliant red pigment in its eyes. This condition is called "cinnabar." For this reason, the gene responsible for producing the brown pigment is called the "cinnabar" gene (genes are often named for the effect their mutant alleles have on the phenotype). The symbol for this gene is a two-letter symbol, cn. The dominant allele is Cn and the recessive allele is cn. Careful with this symbol. Never separate the c's from the n's. So a cinnabar-eyed fly would have the genotype cn cn. If a fly is homozygous for the defective, recessive allele of the gene which produces the brilliant red pigment, that fly will have only the dull brown pigment in its eyes. This produces "brown" eyes, so this gene is called the "brown" gene. The symbol for this gene is br. The dominant allele is Br, the recessive br. A brown-eyed fly would be br br. Again, be careful not to separate the b and the r. Note that all flies have two alleles for each of these genes, so the cinnabar eyed fly would actually have the genotype cn cn Br Br or cn cn Br br, and the brown eyed fly would actually have the genotype Cn Cn br br or Cn cn br br. A mating is made between a Cn Cn br br fruit fly and a cn cn Br Br fruit fly. 200 offspring result (the F1). These offspring are allowed to freely interbreed, and produce 40,000 (whew! Whatever happened to population control!) offspring (the F2).

a. What color eyes did the original parents have?

b. What were the genotypes and phenotypes of the F1 offspring?

c. What color eyes do the cn cn br br flies have?

d. What phenotypic ratio do you predict among the F2 offspring?

41. Meiosis reduces chromosome number and rearranges genetic information.

a. Explain how the reduction and rearrangement are accomplished in meiosis.

b. Several human disorders occur as a result of defects in the meiotic process. Identify ONE such chromosomal abnormality; what effects does it have on the phenotype of people with that disorder?

c. Describe how the above abnormality could result from a defect in meiosis.

42. In guinea pig there are 2 alleles for hair colour, black and white and 2 alleles for hair length, short and long. In the breeding experiment all the phenotype produced from a cross between all the phenotype produced from a cross between pure breeding and black parent were all long haired with white fur

a) Explain which alleles are dominant

b)What is the expected proportion of the F2 phenotype

43. A pure breeding drosophila fly with broad abdomen and long wings was crossed with a pure breeding drosophilafly with narrow abdomen and vestigial wing. If the allele for broad abdomen is dominant over the narrow abdomen while long wings being dominant over vestigial wings,

a) determine the genotype and phenotype of the F2 generation.

b) Why is drosophila preferred in genetic experiments?

44. if purple flowered plants with long pollen grains are crossed with red flowered plants having short pollen grains and the F1 off springs selfed to obtain the F2 generation, the following results were obtained.

Purple flowers long pollen grains = 56

Purple flowers short pollen grains = 13

Red flowers long pollen grains = 11

Red flowers short pollen grains = 48

a) Calculate the cross over value.

b)

45. when homozygous red and homozygous white flowered plant were crossed, the f1

off springs did not produce the expected results of either white or red is recessive or dominant but both have the same powers of expression such that they contribute equally to the final colour resulting into an immediate colour which is pink.

Show the phenotypes and genotypes of offsprings of the cross.

46. (a).Explain what is meant by sex linked and sex limited traits

(b).Giving examples, discuss the inheritance of sex linked and autosomal traits

(c).Explain using an appropriate example why many sex-linked diseases occur more frequently in men than women.

47.Both haemophilia and colour blindness are transmitted in the same way.

(a).What are the effects of each disease

(b).Describe the transmission of the diseases

(c).Explain why there are more colour blind individuals than hemophiliacs among human population despite the similar transmission modality

48.(a).Explain what is meant by genetic counselling

(b).Explain the importance of genetic counselling in health care provision

(c).State how non-disjunction in the production of female gametes can result in chromosomal aberrations

49. (a).Distinguish between sister chromatids and homologous chromosomes

(b).Why is the study of genetics important in the day to day life

(c).Explain the factors that affect crossing over

50.(a).Explain what is meant by gene reshuffling

(b).Explain the causes of gene reshuffling

(c).Why is reshuffling considered to be of little consequence in evolution

51.Discuss Mendel’s laws of segregation and independent assortment with respect to

(a).Genes that are not linked

(b).Sex-linkage

(c).Down syndrome

(d).Turner syndrome

52.(a).How is sex determined in humans?

(b).A woman has four sons, one of whom is a haemophiliac and the other three are normal.

(i). What are the possible genotypes of the woman and her husband

(ii) Is it possible for the couple to have a haemophiliac daughter? Explain your answer

53.(a).Describe the biochemical processes involved in transforming the information stored in a gene into the expression of a physical trait.

(b).Contrast the ways in which bacteria and viruses cause disease.

54.(a).Explain why a single base deletion from one Deoxyribonucleic molecule usually causes greater effect than the replacement of one base by another different base.

(b).Using a named example, describe how a gene mutation may affect a phenotype of an organism.

55. (a)(i).What is meant by genetic recombination?

(a)(ii).State the importance of genetic recombination in the process of evolution

(b).Outline the factors that limit degree of recombination in populations of sexually reproducing organisms

(c).Discuss how Mendel’s law of segregation and independent assortment correlate with;

(i).Genes that are linked

(ii).Crossing over

56. (a)(i).How do the different forms of gene interractions differ

(a)(ii).Describe the different forms of epistaxis using relevant examples in each case

(b)(i). What are cross over values and why they are usually computed (b)(ii) Discuss the conditions that will lead to emergence of polyploidy in a population

57. (a).Describe how

(i). nucleic acids are formed from nucleotides

(ii) gene and chromosome mutations cause change in the structure of DNA

(b).Why is it important for a mutation to occur in asexually produced organisms

58. (a).Derive the Hardy-Weinberg equation from first principles.

(b).Describe how the following affect the allele frequency of sexually reproducing population;

(i). Random mating

(ii).Genetic drift.

(iii).Geographical isolation

(c). A particular species of insects may occur in either light or dark form. The dark trait is dominant. In a certain population of 5000 such insects, there are 950 which are dark. Using the Hardy Weinberg's equation, calculate and show your working.

(i). The frequency of light allele

(ii).The frequency of the dark allele

(iii).The number in the population which are heterozygote

59. (a). Explain the meaning of the following;

(i). Genetic isolation

(ii).Reproductive isolation

(b).Explain how the gene frequency of population may be altered.

60.In Drosophila, the gene for wing length and shape or the abdomen are slinked. The gene for long wing and broad abdomen arc dominant over those for vestigial wings and narrow abdomen.

(a).Work out the phenotypes resulting from a cross between a vestigial winged and broad abdomen male & a homozygous long winged and narrow abdomen female fly in the;

(i). F1 generation.

(ii).F2 generation.

(b). A cross between a female from the F1 generation in (a)(i) with a vestigial winged and narrow abdomen

male fly gave the following results;

Long winged narrow abdomen flies = 35.

Long winged, broad abdomen flies = 17.

Vestigial winged and narrow abdomen flies = 36

Vestigial winged, broad abdomen flies = 18.

Account for the phenotypes and their relative numbers in the cross.

(c) Explain why Drosophila are commonly used in genetic experiments.

61.(a).State Mendel’s laws of genetic inheritance

(b).Using meiosis, explain how the laws described in (a) above operate

(c).Explain why Mendel used garden peas for his experiments

62.(a).Explain what is meant by cross over values

(b).Outline the differences between

(i) Continuous and discontinuous variation

(ii)Monogenic and polygenic inheritance

(c).Outline the importances of pedigree analysis in genetics

63. (a)What is meant by the term gene mutation?

(b)Describe the role of mutation in arising of sickle cell anemia in individual.

c).Explain the ecological significance of the existence of sickle cell trait in African population.

64. (a).Define the terms gene and allele and explain how they differ.

(b).Outline how the process of meiosis can lead to Down's syndrome.

(c).Karyotyping involves arranging the chromosomes of an individual into pairs. Describe one application of this process, including the way in which the chromosomes are obtained.

(d).Explain why Mendel used Drosophilla melanogaster (fruit flies) in his experiments

65.(a)What is meant by genetic drift?

(b).Describe the two main causes of genetic drift in natural populations

(c).Explain why genetic drift;

(i).Leads to a random loss or fixation of alleles.

(ii)Is particularly important as an evolutionary force in small populations

66. (a) Define the following terms as population genetics

(i). Deme

(ii) Genetic equilibrium

(iii) Reproductive isolation

(b). State the Hardy Weinberg's principle of population genetics

(c). Describe how genetic equilibrium can be upset in a population

(d). Give an account of how reproductive isolation is brought about

67. In sugarcane, the genes for yellow midrib (y) and land internodes (n) are recessive to queen midrib (Y) and short internode (N), and are on the same chromosomes. A yellow sugarcane with long intermodes was crossed with a sugarcane helewzygous for yellow midrib and long internode. The off-springs were

256 YyNn	38Yynn
272 yynn,	34 yyNn

Calculate the cross over value (COV)

68.In Drosophilla ,grey body is dominant over black body and is non sex linked. Red eye is dominant over white eye and is sex linked

a) Reconstruct the genotype and phenotype of the parents for the following described progenies. (Let G represent the grey body allele, g the black body allele, R the red eye allele and r the white eye allele)

Males ¾ grey, white: ¼ black white

Females ¾ grey, red: ¼ black red

Show your reasoning

b) (i) Using the genotypes determined above work out the coat colour and eye colour ratios in males and females

(ii) Explain your results in (i) above

69. a) Give the meaning of the following terms

Locus

Dihybrid inheritance

(b) In pea plants,the seeds maybe enclosed by either green testa or yellow testa. A cross between two varieties of pea plants one with heterozygous green testa seeds and the other with recessive yellow testa seeds was carried out.

(I)Use suitable genetic symbols to work out the genotypes and phenotypes of the offsprings.

(ii) What are the phenotypic and genetic ratios of the offsprings.

70. (a) Define the following terms:

(i) Genetic equilibrium

(ii) Genetic load

(b) Mention any four factors which can upset the genetic equilibrium of a large sexually reproducing population of organisms.

(c) Some people can taste phenylthiocarbomate while others cannot. The allele for tasters is dominant to that for non tasters. The percentage of all tasters is 71.2%.

(i) What is the percentage for non tasters?

(II)What is the probability of someone being a homozygous taster? (show your working)

(III) Calculate the genotype frequency of heterozygous tasters.

71.Work out a cross between round yellow and wrinkled green peas that gave rise to only round yellow and wrinkled yellow off spring if Round and yellow where dominant phenotypes.

72. . (a) Explain the meaning of the Hardy-Weinberg equilibrium principle

(b) State four conditions that must be fulfilled in order for the principle to hold true

(c) Brown eyes in a human population is caused by a dominant. If in a population, 84%

of the people have brown eye, using Hardy-Weinberg formula, determine the

percentage of the population who are.

(i) Heterozygous for eye colour. Show your working.

(II) Homozygous dominant for eye colour. Show your working

73.In white leghorn fowl, plumage colour is controlled by two sets of genes, including the following; White(W) is dorminant over red (w) and black(B) is dorminant over brown (b).

The heterozygous F1 genotype WwBb is white. Account for this type of gene interaction and show the phenotypic ratio of the F2 generation.

74. In a species, an individual homozygous for allele A and a die. Another independent gene B blocks this effect in the homozygous state, otherwise it has no other effect on the organism.

Work out the expected phenotypic and genotypic ratio of the viable offspring of a cross between AaBb and AaBB.

75. Individuals of genotype AaBb were mated to individuals of genotype AaBb. 1000 offsprings were counted with the following results 474AaBb ,480 AaBb,20Aabb and 26 aaBb.

(I) Which of these are parental combinations and which ones are recombinants?

(II) Work out the cross over value between these alleles.

(III) How many map units apart are they?

76. Mr and Mrs. John are concerned because their own blood group types are A and B respectively but their new son, Reagan is blood type O. Could Richard be their child? Explain your answer with genetic diagrams.

77. A woman bears a child out of wedlock and sues a particular man for support of the child claiming that he is the father. Blood typing shows that she is group A ,her child is of group O and the man group B. The man says that this proves that he is not the father but the judge says that it proves no such a thing. Who is correct,father or judge? Show your arguments by genetic illustrations.

78. A walnut combes rooster is mated to three hens. Hen A which is walnut combed has offsprings in the ratio of 3 walnut:3 pea : 1 rose: 1 single. Hen C which is walnut combed has only walnut combed offsprings. What are the genotypes of the rooster and the hens?

79. The cross over frequency between linked genes A and B is 40% ,B and C is 20% ,C and D is 10% , C and A is 20% and D and B is 20%. What is the sequence of the genes on the chromosome?

80. Genes A and B are 6 map units apart,A and C are 4 map units apart,which gene is in the middle if B and C are 2 map units apart?

81.Miriam (group O) is not sure which is the father of her baby son (group O). It could be Charles (group AB) or Frank (group A). Who is more likely to be the father? Explain your answer.

82. In the fruit fly,Drosophila melanogaster , vestigial wing is recessive to Normal wing and white eye color is recessive to the normal red eye color . These genes are carried on the X chromosomes and in drosophila,the male is heterogametic.

(a) How would you distinguish male from female offsprings?

(b) What phenotypes would be expected in the F1 offsprings of a cross between a vestigial winged red eyed male drosophila and a homozygous normal winged white eyed female drosophila?

(c) What phenotypes would be expected in the F2 generation when F1 flies are interbred?

83. a) The gene for tallness ,T is dorminant over a gene for shortness ,t.

(a) What is the probability of a tall offspring from a cross between pure breeds of a tall and a short plant?

b) Show the cross for selfing the F1 offsprings using a Punnett square.

c) State the genotypic and phenotypic ratios of the F2 offsprings.

84. . In a cross between a red-flowered and a white-flowered plant, the F1 generation is pink-flowered. What can you conclude about the genetics of flower color?

a) Write the genotype of the parents.

b) Determine the F1 offsprings phenotypes. Show the cross using a Punnett square.

c) Determine the phenotypes of the F2 generation.

85. A couple has a child with cystic fibrosis. What are the genotypes of the parents?

a) Explain the possible genotypes of the parents.

b) Show the cross using a Punnett square.

c) Calculate the probability of another child inheriting the disease.

86. In a population of birds, the allele for black feathers (B) is dominant over the allele for white feathers (b). What is the genotype of a bird with black feathers?

a) Write the possible genotypes.

b) Explain the phenotype of each genotype.

c) Calculate the frequency of the B allele in the population.

87. A plant has the genotype RrYy. What is the probability of an offspring with the genotype rryy?

a) Show the cross using a Punnett square.

b) Explain the probability of each offspring genotype.

c) Calculate the probability of the offspring having the genotype rryy.

88. What is the probability of a color-blind son from a color-blind father and a mother who is a carrier?

a) Explain the genetics of color blindness.

b) Show the cross using a Punnett square.

c) Calculate the probability of a color-blind son.

89. In a cross between two plants with the genotype AaBb, what is the probability of producing an offspring with the genotype AABB?

a) Show the cross using a Punnett square.

b) Explain the probability of each offspring genotype.

c) Calculate the probability of the offspring having the genotype AABB.

90. A couple has a child with sickle-cell anemia. What are the genotypes of the parents?

a) Explain the genetics of sickle-cell anemia.

b) Show the cross using a Punnett square.

c) Calculate the probability of another child inheriting the disease.

91. In a population of insects, the allele for long wings (L) is dominant over the allele for short wings (l). What is the genotype of an insect with long wings?

a) Write the possible genotypes.

b) Explain the phenotype of each genotype.

c) Calculate the frequency of the L allele in the population.

92. A plant has the genotype RRYy. What is the probability of an offspring with the genotype rryy?

a) Show the cross using a Punnett square.

b) Explain the probability of each offspring genotype.

c) Calculate the probability of the offspring having the genotype rryy.

93. What is the probability of a freckled offspring from a cross between a freckled and a non-freckled parent?

a) Explain the genetics of freckles.

b) Show the cross using a Punnett square.

c) Calculate the probability of a freckled offspring.

94. In a cross between two plants with the genotype AaBb, what is the probability of an offspring with the genotype aabb?

a) Show the cross using a Punnett square.

b) Explain the probability of each offspring genotype.

c) Calculate the probability of the offspring having the genotype aabb.

95. A couple has a child with Huntington's disease. What are the genotypes of the parents?

a) Explain the genetics of Huntington's disease.

b) Show the cross using a Punnett square.

c) Calculate the probability of another child inheriting the disease.

96. In a population of animals, the allele for black fur (B) is recessive to the allele for brown fur (b). What is the genotype of an animal with black fur?

a) Write the possible genotypes.

b) Explain the phenotype of each genotype.

c) Calculate the frequency of the B allele in the population.

97. A plant has the genotype rrYY. What is the probability of an offspring with the genotype RRyy?

a) Show the cross using a Punnett square.

b) Explain the probability of each offspring genotype.

c) Calculate the probability of the offspring having the genotype RRyy.

98. What is the probability of a lactose-intolerant offspring from a cross between a

lactose-intolerant and a lactose-tolerant parent?

a) Explain the genetics of lactose intolerance.

b) Show the cross using a Punnett square.

c) Calculate the probability of a lactose-intolerant offspring.

99. (a) In a cross between a plant with the genotype RrYyZz and a plant with the genotype RryyZz, what is the probability of an offspring with the genotype rryyzz? Assume that the genes are linked and that the recombination frequency between the R and Y genes is 20% and between the Y and Z genes is 30%.

I) Show the cross using a Punnett square.

II) Explain the probability of each offspring genotype.

III) Calculate the probability of the offspring having the genotype rryyzz.

(b) In a population of humans, the allele for red hair (R) is recessive to the allele for non-red hair (r). The allele for freckles (F) is dominant over the allele for no freckles (f). If 10% of the population has red hair and 20% has freckles, what is the frequency of the RF haplotype? Assume that the genes are linked and that the recombination frequency between the R and F genes is 15%.

I) Explain the genetics of red hair and freckles.

II) Show the cross using a Punnett square.

III) Calculate the frequency of the RF haplotype.

100. Two parents produced offspring with the following genotypes:

- Offspring 1: RrYy

- Offspring 2: rryy

- Offspring 3: RRYy

- Offspring 4: rryY

Using this information, determine the genotypes of the two parents. Assume that the genes are linked, with a recombination frequency of 20% between the R and Y genes.

a) Show the possible genotypes of the parents.

b) Explain how you determined the parental genotypes.

c) Calculate the probability of each offspring genotype.

GOOD LUCK MY STUDENTS!

James 1:5, Revelation 10:7 & Luke 11:9-13.

THE BRAIN IS A FACTORY; IT PRODUCES THE QUALITY AND QUANTITY OF THE PRODUCTS DEPENDING ON THE QUALITY AND QUANTITY OF THE RAW MATERIALS YOU SUPPLY TO IT.