1. (3) In a linear tetrad analysis, the M2 segregation frequency of the cyh locus is 16%. The map distance between cyh and the centromere is  
   a) 4m.u.  b) 8m.u.  c) 16m.u.  d) 32m.u.  e) 50m.u.  
   Answer - b

2. (REMOVED BECAUSE THIS MATERIAL WAS NOT COVERED IN 2001)

3. (5) Given the linkage map shown below, predict how many progeny of genotype Abc will be produced if an individual that is ABC/abc is test crossed and produces 1000 total progeny.  
   Answer - 46

   A---------10m.u.--------B-----8m.u.-----C

4. (3) What are RFLPs and what are they used for?

   Restriction fragment length polymorphisms. They are used as physical (molecular) markers on the chromosome that can be used to map genes.

5. (REMOVED BECAUSE THIS MATERIAL WAS NOT COVERED IN 2001)

6. (12) A three point test cross produces the following progeny classes:

   +  +  +  353
   +  +  c  12
   +  b  +  38
   +  b  c  117
   a  +  +  124
   a  +  c  40
   a  b  +  11
   a  b  c  305

   a) List the parental and DCO classes?

   Parental : +++ and abc    DCO: ++c and ab+

   b) Draw a linkage map of the genes on the chromosome and show how you calculated these distances.

   Based on the calculated recombination frequencies and the fact that c is the only locus altered in DCO’s, c must be in the middle.

   a---------26.4-----------c--------10.1--------b    The a-b distance is 31.9

   c) Calculate the interference value.

   Answer – 0.138
7. (3) A test cross is made that produces the following numbers of F1 progeny:

\[
\begin{array}{ll}
A\cdot b & 347 \\
a\cdot B & 376 \\
A\cdot B & 23 \\
a\cdot b & 19 \\
\end{array}
\]

What are the genotypes of the parents?

Ab/aB and ab/ab

8. (4) The following pedigree is for a dominant phenotype governed by an autosomal gene. What does this pedigree suggest about the phenotype and what is the genotype of individual A?

A/+ has disease   +/- is wild type
A/+ and +/-

A/+, +/-, A/+, A/+ and +/-

A/+ and A/+ 

The phenotype must not be completely penetrant because individual A must have the disease allele, but does not show symptoms of the disease.

9. (3) In mice, the phenotypic ratio for coat color is 9 black:4 white:3 brown when you self B/b;C/c black animals because the C gene is _______epistatic__________________ to the B gene.

10. (5) In roses, two pathways combine to produce orange colored flowers in wild type:

\[
\begin{align*}
\text{Enz1} \\
\text{white} \rightarrow \text{yellow} & \quad \text{orange} \\
\text{white} \rightarrow \text{red} & \end{align*}
\]

Enz 2

A rose homozygous for a nonfunctional Enz1 mutant is crossed to a rose homozygous for a nonfunctional Enz2 mutant. If the F1 progeny are selfed, the F2 progeny will be __________c______________.

a) 9 orange:7 white   b) All orange   c) 9 orange: 3 red: 3 yellow: 1 white 

d) 9 orange: 4 red: 3 yellow   e) 9 orange: 4 yellow: 3 red
11. (4) In *Drosophila*, the Curly (Cy) mutation in causes curly wings and is dominant over straight wings (+). When curly winged males and females are crossed they produced the following progeny:

342 curly winged 179 straight winged

How do you account for this result?

Cy/+ x Cy/+ yields 1 Cy/Cy which is dead, 2 Cy/+ having curly wings and 1 +/+ with straight wings

12. (4) Two plants with pink colored flowers are crossed and produce progeny with the following phenotypes:

54 pink flowers 24 red flowers 28 white flowers

What is the genetic basis of inheriting flower color in this plant? Incomplete dominance or codominance

13. (4) Two pure breeding mutants produce white color pumpkins rather than the traditional orange color. You cross the pure breeding mutants to each other and find that all of the F1s are orange.

a) What is this test called? Complementation test

b) Are the mutants defective in the same or in different genes? They are in different genes because if they were in the same gene a mutant phenotype would result (they would not complement).

14. (3) Which histone is responsible for the formation of solenoids?

H1 histone

15. (3) Euchromatin contains ______c_________.

a) no genes b) only nonfunctional genes c) More genes per unit DNA than heterochromatin
d) Only a few genes e) The same number of genes per unit DNA as heterochromatin

16. (3) Define the term nondisjunction.

When two sister chromatids do not segregate during meiosis.

17. (6) a) In *Drosophila*, indicate whether the following genotypes will be male, female or dead.

XXY (male) XX (female) XXX (dead) XY (male)

b) In humans, indicate whether the following genotypes will be male, female or dead.

XXXXXY (male) XX (female) XXXXX (female) XY (male)
18. (5) Briefly state the differences between mitosis and meiosis I.

During mitosis, chromosomes line up on the metaphase plate and the sister chromatids segregate into different daughter cells. No crossing over occurs in somatic cells.

During meiosis, the chromosomes first pair and line up along the metaphase plate. Then pairs of chromosomes segregate into daughter cells, crossing over (chiasmata) occurs. This happens in germ line cells.

19. (2) State the different stages of mitosis in the correct temporal order.

Interphase, prophase, metaphase, anaphase and telophase.

20. (3) A man with genophobia disease marries a normal woman. They have 8 children (4 boys and 4 girls). All of the girls have the disease, but none of the boys. How is this disease inherited?

Answer - d

a) Autosomal recessive
b) Y linked
c) Autosomal dominant
d) X-linked dominant
e) X-linked recessive

21. (3) The pedigree below shows the inheritance of a rare hereditary disease.

![Pedigree Diagram]

What is the most likely mode of inheritance?

X-linked recessive

22. (5) PKU is an autosomal recessive disorder. In the pedigree below, the couple marked A & B are planning to have a baby but are worried that it might have PKU. Assume that people marrying into the pedigree are not carriers unless there is evidence to the contrary.

![Pedigree Diagram]

What is the probability that the child (?) will have PKU?

The probability is 1/12
23. (3) Assuming random assortment, a test crossed A/a;B/b plant will give progeny in what phenotypic ratios? Answer - c
   a) 1:1       b) 1:2:1      c) 1:1:1:1      d) 9:3:3:1      e) 3:1

24. (3) Assuming random assortment, a selfed A/a;B/b plant will give progeny in what phenotypic ratio? Answer - d
   a) 1:1       b) 1:2:1      c) 1:1:1:1      d) 9:3:3:1      e) 3:1

25. (2) In rabbits a black (B/b) male is crossed to a white (b/b) female. What proportion of offspring will be white? 
        1/2 will be white.