

GENOME371

EXAM 2B YELLOW KEY

Autumn 2003

1A) (3 points) a. autosomal

1B) (3 points) f. D3/d1

1C) (1 point each)

Recombinant type 1 = D1 15%

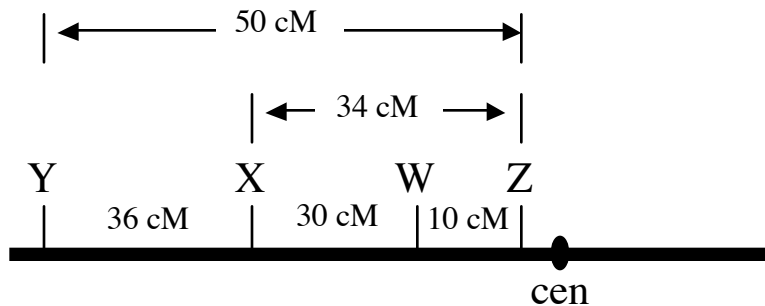
Recombinant type 2 = d3 15%

1D) (6 points) 70%. Explanation: The possible gametes from parent II-3 are D1 = 15%, d3 = 15%, D3 = 35%, and d1 = 35%. We know that son III-1 inherited the d2 allele from his Dad and he has the "3" allele from his Mom. The probability that he is "D" is $35\% / [35\% + 15\%] = 70\%$.

2) (1 point each)

Events at Meiosis	Earth	Mars
A. The stage when breaks in the DNA are made.	B	4
B. The division when alleles of centromere-linked genes segregate.	C	5
C. The division where homologues segregate from one another.	C	5
D. The stage when chromosome replication occurs.	none	none
E. The stage at which homologues are paired.	B	4
F. The division where ploidy is reduced.	C	5
G. The division when sister centromeres separate.	E	1
H. The stage at which heteroduplexes are present.	B	4
I. The division when cohesin is cleaved.	C	1
J. The stage when resolvase functions.	B	4

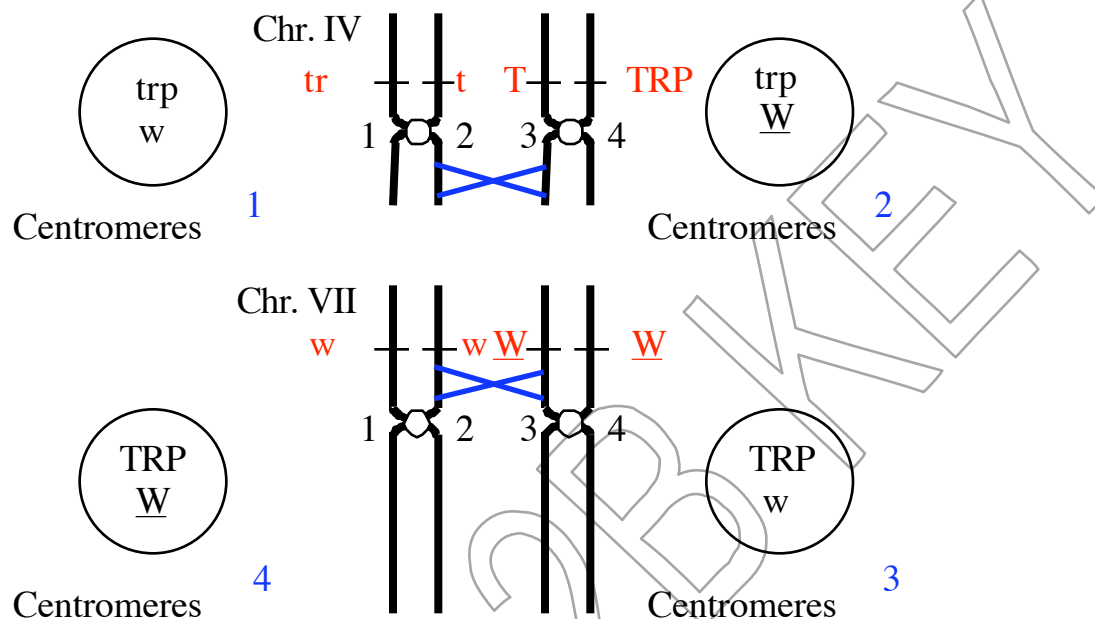
3A) (6 points)



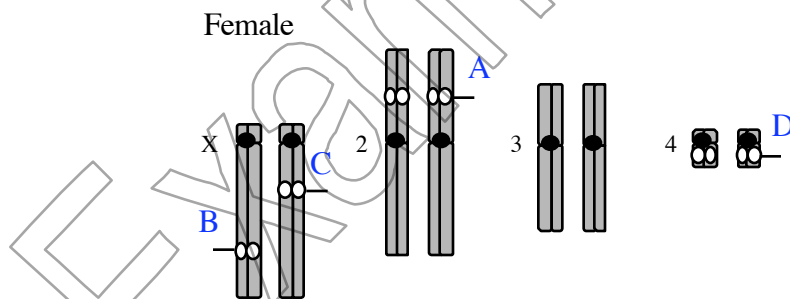
3B) (2 points) 66 cM

3C) (6 points) The "Z" gene is closest to the centromere. It is the only gene with no crossovers (no tetratypes and P = NPD) amongst its 12 tetrads.

3D) (6 points)



4A) (2 points each)



4B) (2 points) Transposition

4C) (2 points) Segregation

4D) (2 points) Deletion

4E) (2 points) Crossing over

4F) (2 points) Segregation

4G) (2 points) Non-disjunction

5A1) (3 points) A nonsense mutation in the *ade2* gene creates a stop codon in the mRNA that terminates production of the Ade2 protein.

5A2) (4 points) The revertant carries a dominant, gain-of-function mutation in the tRNA gene that would normally insert an amino acid when the ribosome reaches that site in the mRNA. Its anti-codon loop now recognizes the aberrant stop codon in *ade2* and inserts an amino acid, allowing continued translation and production of a functional Ade2 protein.

5A3) (4 points) *ade2/ADE2; SUP/sup*, where *ade2* is the original mutation in the starting red colony, *ADE2* is the wild-type gene from the wild-type parent, *SUP* is the dominant gain-of-function tRNA gene from the revertant, and *sup* is the wild-type tRNA from the wild-type parent.

5A4) (4 points) Red spore: *ade2; sup*, White spore 1) *ade2; SUP*; White spore 2: *ADE2; sup*; White spore 3: *ADE2; SUP*.

Those who created second mutations in the *ade2* gene, thereby restoring enzyme function (*ade2^{rev}*), received partial credit. Such a reversion mutation cannot give a red spore after mating with wild type; all spores will be white and able to grow on – adenine plates.

5B1) (3 points) Any loss-of-function mutation in the *ade2* gene that disrupts the production or activity of the Ade2 protein.

5B2) (4 points) The revertant carries a second, loss-of-function mutation in the *ade3* gene. Loss of Ade3 protein or activity means that the precursor X does not build up and get converted to red pigment by "Gene ?".

5B3) (4 points) *ade2/ADE2; ade3/ADE3*, where *ade2* is the original mutation in the starting red colony, *ADE2* is the wild-type gene from the wild-type parent, *ade3* is the loss-of-function allele from the revertant, and *ADE3* is the wild-type allele from the wild-type parent.

5B4) (4 points) Red spore: *ade2; ADE3* (requires adenine for growth), White spore 1) *ade2; ade3* (requires adenine for growth); White spore 2: *ADE2; ade3* (requires adenine for growth); White spore 3: *ADE2; ADE3* (does not need adenine for growth).

6A) (3 points) d. Notch is dominant and sex-linked.

6B) (3 points) e. Cannot determine from the above data.

6C) (3 points) a. 1, 2 and 3 are co-dominant and sex-linked.