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Mendelian Genetics

Exam — Mendelian Genetics

Pre-med style practice questions on Mendelian inheritance, segregation, independent assortment, pedigrees, and probability

22 items — Printable Exam

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1 **In Mendelian genetics, which statement best distinguishes genotype from phenotype for a simple trait with complete dominance?**

A Genotype describes the observable characteristics; phenotype describes the alleles present.

B Genotype describes the alleles present; phenotype describes the observable characteristics.

C Genotype is determined only by the environment; phenotype is determined only by genes.

D Genotype and phenotype are synonymous terms in Mendelian genetics.

E Genotype refers only to recessive alleles; phenotype refers only to dominant alleles.

2 **In peas, tall (T) is completely dominant to dwarf (t). Which pair of genotypes produces the same phenotype but different genotypes?**

A TT and tt

B TT and Tt

C Tt and tt

D TT and TT

E Tt and Tt

3 **Which description best states Mendel's law of segregation?**

A Different genes sort independently into gametes.

B Each individual carries only one allele for each gene at all times.

C Each gamete receives one allele of each gene because the two alleles separate during gamete formation.

D Alleles are destroyed if they are recessive.

E Only dominant alleles are transmitted to offspring.

4 **Which statement best describes Mendel's law of independent assortment for two genes on different chromosome pairs?**

A Alleles for one gene determine which alleles of another gene are inherited.

B Each pair of homologous chromosomes lines up and separates independently of other pairs during meiosis I.

C All genes assort together as a single unit from each parent.

D Independent assortment applies only to genes on the same chromosome.

E Independent assortment requires that crossing over never occurs.

5 **In peas, purple flowers (P) are dominant to white (p). Two heterozygous plants (Pp × Pp) are crossed. What phenotypic ratio of purple to white flowers is expected in their offspring, assuming complete dominance?**

A 1 purple : 3 white

B 3 purple : 1 white

C 1 purple : 1 white

D All purple

E All white

6 **In the cross Pp × Pp described above, what is the probability that a randomly chosen offspring will be heterozygous (Pp)?**

A 1/4

B 1/2

C 3/4

D 1/3

E 2/3

7 **A plant shows the dominant phenotype for seed shape (round, R), but its genotype is unknown (RR or Rr). It is crossed with a homozygous recessive wrinkled plant (rr). Half of the offspring are round and half are wrinkled. What is the genotype of the unknown parent?**

A RR

B Rr

C rr

D Cannot be determined from this cross

E RR or Rr are equally likely

8 **In Mendel's experiments, a 'true-breeding' line for a trait (such as round seeds) is best described genetically as:**

A Heterozygous for the trait

B Homozygous for the allele controlling the trait

C Carrying no alleles for the trait

D Carrying both dominant and recessive alleles for the trait

E Having a different genotype every generation

9 **A red-flowered plant (RR) is crossed with a white-flowered plant (WW). All F1 offspring are pink (RW). When two F1 plants are crossed, the F2 generation shows red, pink, and white flowers in a 1:2:1 ratio. Which type of inheritance best explains these results?**

A Complete dominance of R over W

B Incomplete dominance

C Codominance

D X-linked dominance

E Autosomal recessive inheritance

10 **Which example best illustrates codominance in human genetics?**

A A cross between red and white snapdragons producing pink flowers in all F1 offspring

B A person with genotype IAi having blood group A

C A person with genotype IAIB expressing both A and B antigens in the AB blood group

D A person with genotype ii having blood group O

E The dominance of brown eye colour over blue eye colour

11 **Two individuals with genotype AaBb are crossed. The two genes assort independently and show complete dominance (A over a, B over b). What phenotypic ratio is expected in the offspring?**

A 3:1

B 1:2:1

C 9:3:3:1

D 1:1:1:1

E 2:1:1:0

12 **In the AaBb × AaBb cross described above (independent assortment, complete dominance), what is the probability that an offspring will show both dominant phenotypes (A_ B_)?**

A 1/16

B 3/16

C 9/16

D 1/4

E 3/4

13 **A man with blood group A and genotype IAi has a child with a woman of blood group B and genotype IBi. Which ABO blood groups are possible in their children?**

A Only A and B

B Only AB and O

C A, B, and AB only

D A, B, AB, and O

E Only O

14 **A woman is a carrier for an X-linked recessive disorder (genotype X^A X^{a}). Her partner is unaffected (X^A Y). They are expecting a son. What is the probability that this son will have the disorder?**

A 0

B 1/4

C 1/2

D 3/4

E 1

15 Which pedigree pattern most strongly suggests an X-linked recessive disorder rather than an autosomal recessive one?

A Trait affects males and females equally in large numbers; unaffected parents can have affected sons or daughters.

B Trait appears in every generation and is equally common in males and females.

C Trait appears almost exclusively in males; affected fathers do not pass the trait directly to their sons, but all daughters of affected fathers are carriers.

D Trait only appears in females; affected mothers pass it to all children.

E Trait appears only in one generation and then disappears completely.

16 In an autosomal dominant disorder with complete penetrance, which observation in a large pedigree is most consistent with this mode of inheritance?

A Trait often skips generations; unaffected parents have affected children.

B Trait appears in every generation, and each affected person has at least one affected parent.

C Trait affects only males and is passed from affected fathers to all sons.

D Trait affects only females and never appears in males.

E Trait appears only in siblings of affected individuals, never in their offspring.

17 **A rare autosomal recessive disease is caused by genotype aa. Two unaffected parents have an affected child. Assuming the disease is truly rare in the population and the parents are not related, what are the most likely genotypes of the parents?**

A AA and aa

B AA and AA

C Aa and Aa

D aa and aa

E AA and Aa

18 **In the family described above (Aa × Aa parents, autosomal recessive aa disease), an unaffected sibling of the affected child is born. What is the probability that this unaffected sibling is a carrier (Aa)?**

A 1/4

B 1/2

C 2/3

D 3/4

E 1

19 **Two carriers of a rare autosomal recessive disease (Aa × Aa) plan to have three children. Assuming independent outcomes for each child, what is the probability that exactly two of the three children will be affected (aa)?**

A 1/64

B 3/64

C 9/64

D 27/64

E 1/16

20 **In a cross between two plants that are each AaBb for two genes affecting flower colour, the F2 phenotypes appear in a 9 coloured : 7 white ratio instead of the expected 9:3:3:1. Which genetic explanation best fits this observation?**

A Simple independent assortment with complete dominance at both loci

B Incomplete dominance at both loci

C Complementary gene action (recessive epistasis), where both dominant alleles A and B are required for colour

D X-linked inheritance of both genes

E A mistake in counting the offspring; such a ratio is impossible

21 **In a certain mouse strain, the allele Y gives yellow coat colour when heterozygous (Yy), but the homozygous genotype YY is lethal before birth. The recessive genotype yy produces non-yellow (agouti) mice. When two yellow mice are crossed, the observed live offspring are 2 yellow : 1 agouti. Which explanation is most consistent with these data?**

A Y is a completely dominant allele with normal viability.

B Y is recessive and only yy mice are yellow.

C Y is a dominant allele that is lethal in the homozygous state, so YY embryos die and are not counted among the offspring.

D Y is an X-linked allele expressed only in males.

E Agouti genotype yy is lethal and removed from the population.

22 **A particular autosomal dominant disorder shows incomplete penetrance: only 80% of individuals with genotype Dd actually show the disease phenotype. Genotype DD is lethal and dd is normal. A heterozygous affected person (Dd) and an unaffected person with genotype dd have a child. What is the probability that the child will SHOW the disease phenotype?**

A 1/2 (50%)

B 2/5 (40%)

C 1/4 (25%)

D 4/5 (80%)

E 0

Answer Key

#	Ans	Answer Text
1	B	Genotype describes the alleles present; phenotype describes the observab...
2	B	TT and Tt
3	C	Each gamete receives one allele of each gene because the two alleles sep...
4	B	Each pair of homologous chromosomes lines up and separates independently...
5	B	3 purple : 1 white
6	B	1/2
7	B	Rr
8	B	Homozygous for the allele controlling the trait
9	B	Incomplete dominance
10	C	A person with genotype IAIB expressing both A and B antigens in the AB b...
11	C	9:3:3:1
12	C	9/16
13	D	A, B, AB, and O
14	C	1/2
15	C	Trait appears almost exclusively in males; affected fathers do not pass ...
16	B	Trait appears in every generation, and each affected person has at least...
17	C	Aa and Aa
18	C	2/3
19	C	9/64
20	C	Complementary gene action (recessive epistasis), where both dominant all...
21	C	Y is a dominant allele that is lethal in the homozygous state, so YY emb...
22	B	2/5 (40%)