

BIOLOGY

Sc 10

Miss Brown
Genetics Review Assignment

Science 10

Name: _____

Genetics Review Assignment

1. Describe the shape of a DNA molecule. Use the following terms in your answer: sugar molecules, phosphates, double helix, nitrogen bases.

2 chain of nucleotides - made from a sugar & phosphate side with nitrogen bases in the middle - ~~the~~ twisted into a double helix

2. What does DNA stand for?

deoxyribonucleic acid.

3. DNA Replication:

- a. Write the steps of DNA replication.

① DNA double helix is broken apart by DNA helicase.

② new matching nucleotides are added by DNA polymerase.

- b. Why is this an important process?

• mitosis - cell division for growth & repair.

4. Add the pairs for the following DNA chain:

G C

C G

T A

T A

C G

G C

A T

G C

5. Which scientists discovered the structure of DNA?

Watson & Crick.

6. Explain the relationship between DNA, genes and chromosomes.

All of a person's DNA is divided into 46 chromosomes. A DNA sequence on a chromosome that codes for a trait is a gene.

7. Mendel discovered that in pea plants the green pea pod is dominant over the yellow pea pod.

Using G to represent the allele for green pods, and g to represent the allele for yellow pods, write the genotypes for:

- i a homozygous plant with yellow pods: gg
ii a heterozygous plant with green pods: Gg

8. John has genotype NN . His genotype would best be described as:

- A homozygous recessive
☒ B homozygous dominant
C heterozygous recessive
D heterozygous dominant

9. For each of the genotypes (AA , Aa or aa) below determine what the phenotype would be.

Purple flowers are dominant to white flowers.

PP P Pp P pp w

Hairy knuckles are dominant to non-hairy knuckles in humans.

HH H Hh H hh NH

No-cleft chin is dominant. Cleft chin is recessive.

CC NC Cc NC cc C

13. If mom is heterozygous and dad has blue eyes, what is the probability of their child having brown eyes? (B = Brown eyes, b = blue eyes)

a) 100% b) 75% c) 50% d) 25% e) 0%

Bb *bb*

<i>b</i>	<i>Bb</i>	<i>bb</i>
<i>b</i>	<i>Bb</i>	<i>bb</i>

14. If mom is homozygous dominant and dad heterozygous, what is the probability of their child having brown eyes? (B = Brown eyes, b = blue eyes)

a) 100% b) 75% c) 50% d) 25% e) 0%

BB *Bb*

<i>B</i>	<i>BB</i>	<i>BB</i>
<i>b</i>	<i>Bb</i>	<i>Bb</i>

15. If mom and dad are both heterozygous, what is the probability of their child having brown eyes? (B = Brown eyes, b = blue eyes)

a) 100% b) 75% c) 50% d) 25% e) 0%

Bb

<i>B</i>	<i>BB</i>	<i>Bb</i>
<i>b</i>	<i>Bb</i>	<i>bb</i>

16. Widow's Peaks are dominant. Look at the phenotypes of Beyonce and Jay Z. If these two had children, could they have children with a widow's peak? Why or why not? Use a Punnett Square to explain your answer.



ww - both homozygous recessive

	<i>w</i>	<i>w</i>
<i>w</i>	<i>ww</i>	<i>ww</i>
<i>w</i>	<i>ww</i>	<i>ww</i>

no widow's peak.

10. For each of the following write whether it is homozygous dominant, heterozygous or homozygous recessive.

- a) AA *HD*
- b) Ff *He*
- c) Aa *He*
- d) gg *HR*
- e) GG *HD*
- f) Pp *He*
- g) ll *HD*
- h) tt *HR*
- i) TT *HD*
- j) Tt *He*
- k) aa *HR*

11. If mom and dad both have blue eyes, what is the probability of their child having brown eyes?
(B = Brown eyes, b = blue eyes)

- a) 100% b) 75% c) 50% d) 25% **e) 0%**

	<i>b</i>	<i>b</i>
<i>b</i>	<i>bb</i>	<i>bb</i>
<i>b</i>	<i>bb</i>	<i>bb</i>

12. If mom is homozygous dominant and dad is homozygous recessive, what is the probability of their child having brown eyes? (B = Brown eyes, b = blue eyes)

- a) 100%** b) 75% c) 50% d) 25% e) 0%

	<i>B</i>	<i>B</i>
<i>b</i>	<i>Bb</i>	<i>Bb</i>
<i>b</i>	<i>Bb</i>	<i>Bb</i>

NAME _____

Mutations Worksheet

Deletion, Insertion & Substitution



There are several types of mutation:

> **DELETION** (a base is lost/deleted)> **INSERTION** (an extra base is added/inserted)--- Deletion & Insertion may cause what's called a **FRAMESHIFT** mutation, meaning the reading "frame" changes, thus changing the amino acid sequence from this point forward> **SUBSTITUTION** (one base is substituted for another)

Complete the boxes below. Classify each as Deletion, Insertion or Substitution AND as either frameshift or point mutation (Hint: Deletion & Insertion will always be frameshift).

Original DNA Sequence: T A C A C C T T G G C G A C G A C T ...

mRNA Sequence: A U G U A C A A C C G U G C U G A

Amino Acid Sequence: met - trp - asn - arg - cys - stop

Mutated DNA Sequence #1 T A C A T C T T G G C G A C G A C T ...

What's the mRNA sequence? A U G U A G A A C C G U G C U G A (Circle the change)

What will be the amino acid sequence? met - stop

Will there likely be effects? yes What type of mutation is this? nonsense (point)

Mutated DNA Sequence #2 T A C G A C C T T G G C G A C G A C T ...

What's the mRNA sequence? A U G C U G G A A C C G U G C U G A (Circle the change)

What will be the amino acid sequence? met - leu - glu - pro - leu

Will there likely be effects? yes What type of mutation is this? frameshift (insert)

Mutated DNA Sequence #3 T A C A C C T T A G C G A C G A C T ...

What's the mRNA sequence? A U G U G G A A U C G C U G C U G A (Circle the change)

What will be the amino acid sequence? met - trp - asn - arg - cys - stop

Will there likely be effects? no What type of mutation is this? point - silent

Mutated DNA Sequence #4 T A C A C C T T G G C G A C T A C T ...

What's the mRNA sequence? A U G U G G A A C C G C U G A U G A (Circle the change)

What will be the amino acid sequence? met - trp - asn - arg - stop

Will there likely be effects? yes What type of mutation is this? point - nonsense

Original DNA Sequence: T A C A C C T T G G C G A C G A C T ...

mRNA Sequence: AUG UGG AAC CGC UGC UGA

Amino Acid Sequence: met - trp - asn - arg - cys - stop

Mutated DNA Sequence #5 T A C A C C T T G G G A C G A C T ...

What's the mRNA sequence? AUG UGG AAC CCU GCU GA

(Circle the change)

What will be the amino acid sequence? met - trp - asn - pro - ala

Will there likely be effects? yes What type of mutation is this? frameshift (deletion)

1. Which type of mutation is responsible for new variations of a trait? missense (point)
2. Which type of mutation does not result in an abnormal amino acid sequence? silent (point)
3. Which type of mutation stops the translation of an mRNA molecule? nonsense (point)

Sickle Cell Anemia



Sickle cell anemia is the result of a type of mutation in the gene that codes for part of the hemoglobin molecule. Recall that hemoglobin carries oxygen in your red blood cells. The mutation causes these red blood cells to become stiff & sickle-shaped when they release their oxygen. The sickled cells tend to get stuck in blood vessels, causing pain and increased risk of stroke, blindness, damage to the heart & lungs, and other conditions.

--- Analyze the DNA strands below to determine what amino acid is changed AND what type of mutation occurred

Normal hemoglobin DNA

C A C G T A G A C T G A G G A C T C ...

Normal hemoglobin mRNA

GUG CAU CUG ACU CCU GAG

Normal hemoglobin AA sequence

val - his - leu - thr - pro - glu

Sickle cell hemoglobin DNA

C A C G T A G A C T G A G G A C A C ...

Sickle cell hemoglobin mRNA

GUG CAU CUG ACU CCU GUG

Sickle cell hemoglobin AA sequence

val - his - leu - thr - pro - val.

4. What type of mutation is this? Please explain why.

point - missense

→ only 1 base changed.

→ only 1 A.A. changed

Science 10
Genetics Practice Problems

1. What gametes can be produced by:

- a. Ww
- b. $WwXx$
- c. $AaBbccDc$

2. The color of fruit in squash is a dominant pattern of inheritance where white is dominant over yellow. Determine genotypes and phenotype ratio of the F1 from a cross between two heterozygous parents.

Ww

	W	w
W	WW	Ww
w	Ww	ww

Geno	Pheno.
WW	white
Ww	white
ww	yellow

3. A white fruited plant when crossed with a yellow fruited plant produces offspring about which half are white and half are yellow, what are the genotypes of the parents?

	W	w
w	Ww	ww
w	Ww	ww

4. Diagram a cross between a male whose phenotype is AB and a female also AB, show the genotypes and phenotypes of their children.

$$AB = I^A I^B$$

	I^A	I^B
I^A	$I^A I^A$	$I^A I^B$
I^B	$I^A I^B$	$I^B I^B$

Geno	Pheno
$I^A I^A$	A
$I^A I^B$	AB
$I^B I^B$	B

5. The children of a man with type A blood and a woman with type B were testing for blood type. Of the four children, one had type A, one had type B, one AB and one child had type O, what were the genotypes of the offspring?

	I^A	i
I^B	$I^A I^B$	$I^B i$
i	$I^A i$	ii

6. Suppose a father with type A and a mother with type AB had 4 children, show using a Punnett square what the probability of having a child with type O blood would be.

	I^A	i
I^A	$I^A I^A$	$I^A i$
I^B	$I^A I^B$	$I^B i$

type O = 0%

7. Two newborn babies were accidentally mixed up in the hospital, and there was a question of which baby belonged to which parents. From the following blood types determine which baby belongs to which parents.

a. Baby 1 – type O

Baby 2 – type A

Ⓐ Mrs. Brown – B:

Mr. Brown – AB

baby 2

Ⓑ Mrs. Smith – B:

Mr. Smith – B

baby 1

Ⓐ

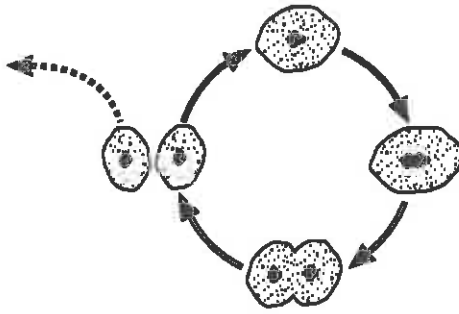
	I^A	I^B
I^B	$I^A I^B$	$I^B I^B$
i	$I^A i$	$I^B i$

Ⓑ

	I^B	i
I^B	$I^B I^B$	$I^B i$
i	$I^B i$	ii

type O.

17. An *Amoeba* reproduces as shown in the diagram.



Which of the following describes this type of reproduction?

- A. budding
- ☒ B. binary fission
- C. fragmentation
- D. vegetative reproduction

LIFE SCIENCE

Genetics

18. True or false? The genotype AA is homozygous.

- ☒ A. True
- B. False

Use the following information to answer question 19.

A purebred male brown hamster was mated with a purebred female golden hamster. All the offspring were brown. — dominant.

Brown Hamster (♂) Golden Hamster (♀)

Two illustrations of hamsters are shown side-by-side. The one on the left is a brown hamster, and the one on the right is a golden hamster. Both are shown in a standing position, facing forward.

19. Which of the following best describes the genotype of the male parent?

- A. heterozygous
- B. homozygous recessive
- ☒ C. homozygous dominant
- D. heterozygous dominant and homozygous recessive

Use the following Punnett Square to answer questions 20 to 22.

♂ \ ♀	T	t
	TT	Tt
T	TT	Tt
t	Tt	tt

LEGEND
T = tall
t = short

20. There are three different genotypes for the offspring in the Punnett Square.

- ☒ A. This statement is supported by the diagram.
- ☐ B. This statement is refuted by the diagram.
- ☐ C. This statement is neither supported nor refuted by the diagram.

21. The probability of an offspring being tall is 75%.

- ☒ A. This statement is supported by the diagram.
- ☐ B. This statement is refuted by the diagram.
- ☐ C. This statement is neither supported nor refuted by the diagram.

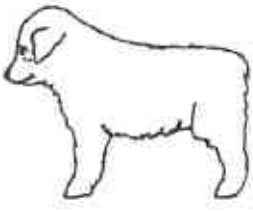
22. The Punnett Square shows a purebred cross.

- ☐ A. This statement is supported by the diagram.
- ☒ B. This statement is refuted by the diagram.
- ☐ C. This statement is neither supported nor refuted by the diagram.

Use the following information to answer question 23.

Australian Shepherd dogs

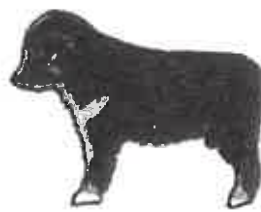
Australian Shepherd dogs have white coats, merled coats or tricolour coats.
Homozygous dominant dogs are white and have serious eye disorders.



white (MM)
with serious eye disorders



merle (Mm)
with normal eyes



tricolour (mm)
with normal eyes

23. Which of the following would be expected from a heterozygous merle mated with a homozygous tricolour?

- A. 100% merle
B. 100% tricolour
C. 25% merle, 75% tricolour
D. 50% merle, 50% tricolour

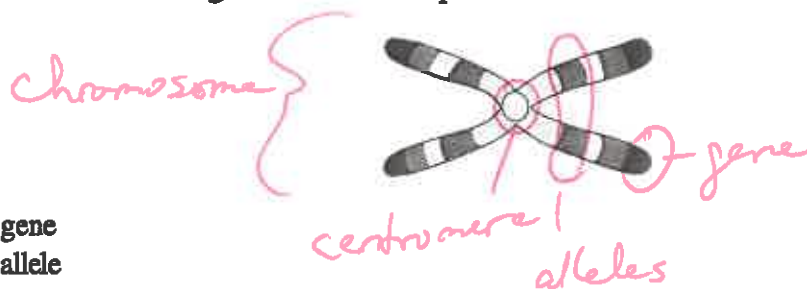
	M	m
m	Mm	mm
m	Mm	mm

24. In determining the colour of watermelon, let G = the allele for solid green and g = the allele for striped green. If two Gg plants are crossed, what is the probability of producing a striped watermelon?

- A. 0%
B. 25%
C. 75%
D. 100%

	G	g
G	GG	Gg
g	Gg	gg

25. Which of the following structures is composed of the other three?



- A. gene
B. allele
C. centromere
D. chromosome

Use the following genetic crosses to answer question 26.

I	$Dd \times Dd$
II	$Dd \times dd$
III	$DD \times Dd$
IV	$DD \times dd$

LEGEND
D = dimples
d = no dimples

III

	D	d
D	DD	Dd
d	Dd	dd

50%

IV

	D	D
d	Dd	Dd
d	Dd	Dd

100%

26. The allele for dimples is dominant and the allele for no dimples gene is recessive. Which of the crosses have the same probability of producing heterozygous dimpled individuals?

- A. I, II and III only
B. I, II and IV only
C. II, III and IV only
D. I, II, III and IV

I

	D	d
D	DD	Dd
d	Dd	dd

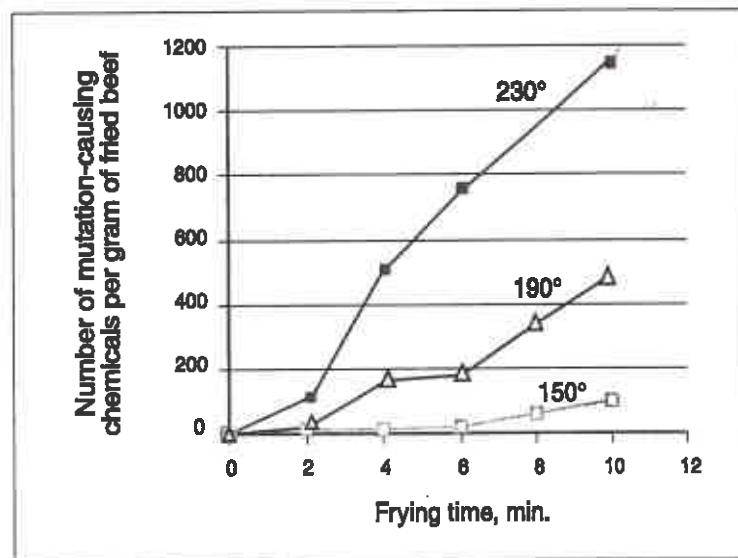
50%

II

	D	d
d	Dd	dd
d	Dd	dd

50%

Use the following graph to answer question 27.



27. True or false? As cooking temperature increases from 150°C to 230°C, the number of mutation-causing chemicals per gram of fried beef increases.

- A. True
B. False

Use the following article to answer question 28.

Scientists say wheat grown near the Chernobyl nuclear power plant (the site of a nuclear accident in 1986) in the Ukraine shows "unusually high" mutation rates. They planted identical crops of wheat, one in a heavily contaminated zone around the Chernobyl plant, and the other at a clean site further away. In one generation, the wheat grown inside the contaminated zone showed a pace of genetic change more than six times higher than the other crop.

Adapted from BBC News.

28. Which of the following appears to have caused the mutations?

- A. sunlight
- ☒ B. radiation
- C. viral disease
- D. chemical pesticides

Use the following article to answer question 29.

Scientists at the UConn Health Center have discovered a mutation in a gene that doubles the average life span of fruit flies. The gene is also found in humans. This discovery opens the way for new therapies that could extend human life.... The quality of life is not sacrificed in these long-lived fruit flies. They also remain physically and sexually active longer.

Adapted from Advance, University of Connecticut.

29. *True or false?* This mutation in fruit flies appears to be positive.

- ☒ A. True
- B. False