HEREDITY SAMPLE TOURNAMENT

PART 1 - BACKGROUND:

1. Heterozygous means _____.
    A. Information about heritable traits
    B. Unique/ different molecular forms of a gene that are possible at a given locus
    C. Having a pair of identical (same) alleles at a gene locus
    D. Crossing over results
    E. Having a pair of non-identical alleles at a gene locus

2. Homozygous means_____.
    A. Information about heritable traits
    B. Unique/ different molecular forms of a gene that are possible at a given locus
    C. Having a pair of identical (same) alleles at a gene locus
    D. Observable (expressed) inherited traits
    E. Having a pair of non-identical alleles at a gene locus

3. An allele is _____.
    A. Observable (expressed) inherited traits
    B. Unique/ different molecular forms of a gene that are possible at a given locus
    C. Particular genes carried by an individual
    D. Crossing over results
    E. Having a pair of non-identical alleles at a gene locus

4. Genotype is _____.
    A. Observable (expressed, can physically see) Inherited traits
    B. Unique/ different molecular forms of a gene that are possible at a given locus
    C. Particular genes carried by an individual
    D. Crossing over results
    E. Having a pair of non-identical alleles at a gene locus

5. Phenotype is _____.
    A. Observable (expressed, can physically see) Inherited traits
    B. Unique/ different molecular forms of a gene that are possible at a given locus
    C. Particular genes carried by an individual
    D. Crossing over results
    E. Having a pair of non-identical alleles at a gene locus

6. A dominant allele _____.
    A. Is represented by a capital letter, such as “A”
    B. Is represented by a lower-case letter, such as “a”
    C. Has the ability to mask other traits
    D. Both a and c
    E. Both b and c

HEREDITY SAMPLE TOURNAMENT

PART 1 - BACKGROUND:

1. Heterozygous means _____.
   A. Information about heritable traits
   B. Unique/ different molecular forms of a gene that are possible at a given locus
   C. Having a pair of identical (same) alleles at a gene locus
   D. Crossing over results
   E. Having a pair of non-identical alleles at a gene locus

2. Homozygous means_____.
   A. Information about heritable traits
   B. Unique/ different molecular forms of a gene that are possible at a given locus
   C. Having a pair of identical (same) alleles at a gene locus
   D. Observable (expressed) Inherited traits
   E. Having a pair of non-identical alleles at a gene locus

3. An allele is _____.
   A. Observable (expressed) Inherited traits
   B. Unique/ different molecular forms of a gene that are possible at a given locus
   C. Particular genes carried by an individual
   D. Crossing over results
   E. Having a pair of non-identical alleles at a gene locus

4. Genotype is _____.
   A. Observable (expressed, can physically see) Inherited traits
   B. Unique/ different molecular forms of a gene that are possible at a given locus
   C. Particular genes carried by an individual
   D. Crossing over results
   E. Having a pair of non-identical alleles at a gene locus

5. Phenotype is _____.
   A. Observable (expressed, can physically see) Inherited traits
   B. Unique/ different molecular forms of a gene that are possible at a given locus
   C. Particular genes carried by an individual
   D. Crossing over results
   E. Having a pair of non-identical alleles at a gene locus

6. A dominant allele _____.
   A. Is represented by a capital letter, such as “A”
   B. Is represented by a lower-case letter, such as “a”
   C. Has the ability to mask other traits
   D. Both a and c
   E. Both b and c

7. A recessive allele _____.
    A. Is represented by a capital letter, such as "A"
    B. Is represented by a lower case letter, such as "a"
    C. Has the ability to mask other traits
    D. Both a and c
    E. Both b and c

8. Hybrid offspring _____.
    A. Is when offspring of genetic crosses inherit a pair of identical alleles for a trait
    B. Is when offspring of genetic crosses inherit a pair of non-identical alleles for a trait.

9. Incomplete dominance _____.
    A. Is the presences of three or more alleles of a gene among individuals of a population
    B. A pair of non-identical alleles specify two phenotypes, which are both expressed at the same time in heterozygotes
    C. One allele of a pair isn't fully dominant over its partner, so a heterozygous phenotype somewhere in between the two homozygous phenotypes emerges

10. Females have _____.
    A. One X sex chromosome and one Y sex chromosome
    B. Two Y sex chromosomes
    C. Two X sex chromosomes
    D. Only one sex chromosome which would be X
    E. Only one sex chromosome which would be Y

11. Males have _____.
    A. One X sex chromosome and one Y sex chromosome
    B. Two Y sex chromosomes
    C. Two X sex chromosomes
    D. Only one sex chromosome which would be X
    E. Only one sex chromosome which would be Y

12. Every organism has two alleles for each gene. During meiosis, however, these two alleles separate from each other into different gametes. What did Mendel call this phenomenon?
    A. Law of independent assortment
    B. Law of separation
    C. Law of causation 1
    D. Law of segregation

13. If a male is color blind, from whom did he receive the recessive allele?
    A. Mother B. Father C. Either mother or father D. Not enough information

14. Human blood type is an example of what type of inheritance pattern?
    A. Incomplete dominance B. Epistasis C. Linked genes D. Multiple alleles

15. What is the location of a sex-linked gene?
    A. The X chromosome. B. The Y chromosome.
    C. Any autosome. D. Either the X or Y chromosome

7. A recessive allele _____.
   A. Is represented by a capital letter, such as "A"
   B. Is represented by a lower case letter, such as "a"
   C. Has the ability to mask other traits
   D. Both a and c
   E. Both b and c

8. Hybrid offspring _____.
   A. Is when offspring of genetic crosses inherit a pair of identical alleles for a trait
   B. Is when offspring of genetic crosses inherit a pair of non-identical alleles for a trait.

9. Incomplete dominance _____.
   A. Is the presences of three or more alleles of a gene among individuals of a population
   B. A pair of non-identical alleles specify two phenotypes, which are both expressed at the same time in heterozygotes
   C. One allele of a pair isn't fully dominant over its partner, so a heterozygous phenotype somewhere in between the two homozygous phenotypes emerges

10. Females have _____.
   A. One X sex chromosome and one Y sex chromosome
   B. Two Y sex chromosomes
   C. Two X sex chromosomes
   D. Only one sex chromosome which would be X
   E. Only one sex chromosome which would be Y

11. Males have _____.
   A. One X sex chromosome and one Y sex chromosome
   B. Two Y sex chromosomes
   C. Two X sex chromosomes
   D. Only one sex chromosome which would be X
   E. Only one sex chromosome which would be Y

12. Every organism has two alleles for each gene. During meiosis, however, these two alleles separate from each other into different gametes. What did Mendel call this phenomenon?
   A. Law of independent assortment
   B. Law of separation
   C. Law of causation 1
   D. Law of segregation

13. If a male is color blind, from whom did he receive the recessive allele?
   A. Mother B. Father C. Either mother or father D. Not enough information

14. Human blood type is an example of what type of inheritance pattern?
   A. Incomplete dominance B. Epistasis C. Linked genes **D. Multiple alleles**

15. What is the location of a sex-linked gene?
   A. The X chromosome. B. The Y chromosome.
   C. Any autosome. D. Either the X or Y chromosome.

PART 2: PROBLEMS

1. In humans, free earlobes (E) are dominant over attached earlobes (e). A heterozygous free earlobed male marries a female with attached earlobes. What will be the possible phenotype and genotype of the offspring?

2. Using the information given in #12, cross a heterozygous free ear lobed parents and give the genotype and the phenotype of their possible offspring.

3. If all the offspring of a particular set of parents has Tt for their genotype, what is the genotype of the parents?

4. In watermelons, solid green (G) color is dominant over striped pattern (g), and short shape (S) is dominant over long shape (s). What is the genotype and phenotype of all the possible offspring if you cross a homozygous green, heterozygous short watermelon with a heterozygous green, long watermelon?

PART 2: PROBLEMS

1. In humans, free earlobes (E) are dominant over attached earlobes (e). A heterozygous free earlobed male marries a female with attached earlobes. What will be the possible phenotype and genotype of the offspring?

. Ee x ee yields **Genotype - ½ Ee, ½ ee**
Phenotype - ½ free, ½ attached
ratio of 1:1

	E	e
e	Ee	ee
e	Ee	ee

2. Using the information given in #1, cross a heterozygous free ear lobed parents and give the genotype and the phenotype of their possible offspring.

. Ee x Ee yields **Genotype- ¼ EE, ½ Ee and ¼ ee**
Phenotype- ¾ free, ¼ attached
Ratio of 1:2:1

	E	e
E	EE	Ee
e	Ee	ee

3. If all the offspring of a particular set of parents has Tt for their genotype, what is the genotype of the parents?

Each parent is homozygous for a trait.
Genotype - TT, tt

4. In watermelons, solid green (G) color is dominant over striped pattern (g), and short shape (S) is dominant over long shape (s). What is the genotype and phenotype of all the possible offspring if you cross a homozygous green, heterozygous short watermelon with a heterozygous green, long watermelon?

GGSs x Ggss yields **Genotype - ¼ GGSs, ¼ GGss, ¼ GgSs, ¼ Ggss**
Phenotype- ½ Green, Short, ½ Green, Long

	GS	Gs	GS	Gs
Gs	GGSs	GGss	GGSs	GGss
Gs	GGSs	GGss	GGSs	GGss
gs	GGSs	GGss	GGSs	GGss
gs	GGSs	GGss	GGSs	GGss

5. Using the same information given in # 15, give the genotype and the phenotype of the offspring for a striped homozygous short watermelon and a green, short watermelon that's heterozygous for both traits.

6. Incomplete dominance may be observed in short-tailed cats (T^NT^L). The absence of the long tail gene results in a manx cat (no tail T^NT^N). The absence of a no tail gene results in a long tail cat (T^LT^L). What would be the genotype and the phenotype of the possible offspring if you cross two short tail cats?

7. In cats the X chromosome carries the gene for coat color. The allele for yellow coat (Y) is dominant over the allele for black coat (y). A cross between a yellow male and a black female produces three male kittens. What color are the kittens? How do you know?

8. A man is colorblind with the genotype X^c Y. The mother is not colorblind but carries a colorblind allele. Give all the possible genotypes and phenotypes.

5. Using the same information given in # 15, give the genotype and the phenotype of the offspring for a striped homozygous short watermelon and a green, short watermelon that's heterozygous for both traits.

ggSS x GgSs yields **Genotype - ¼ GgSS, ¼ GgSs, ¼ ggss, ¼ ggSs**
Phenotype - ½ green, short, ½ striped, short

	gS	gS	gS	gS
GS	GgSS	GgSS	GgSS	GgSS
Gs	GgSs	GgSs	GgSs	GgSs
gS	ggSS	ggSS	ggSS	ggSS
gs	ggSs	ggSs	ggSs	ggSs

T^NT^L x T^NT^L yields **Genotype- ¼ T^NT^N, ½ T^NT^L, ¼ T^LT^L**
Phenotype - ¼ no tail, ½ short tail, ¼ long tail

6. Incomplete dominance may be observed in short-tailed cats (T^NT^L). The absence of the long tail gene results in a manx cat (no tail T^NT^N). The absence of a no tail gene results in a long tail cat (T^LT^L). What would be the genotype and the phenotype of the possible offspring if you cross two short tail cats? **N = no tail, L = long tail**

T^N . T^L

T^N	T^NT^N	T^NT^L
T^L	T^NT^L	T^LT^L

7. In cats the X chromosome carries the gene for coat color. The allele for yellow coat (Y) is dominant over the allele for black coat (y). A cross between a yellow male and a black female produces three male kittens. What color are the kittens? How do you know?

The kittens are all black. The key to the problems is that all the kittens are male XY. Each has only one X chromosome, which were inherited from the mother. Since the mother is black, a trait produces by a recessive allele, any X chromosome from the mother must carry the allele for black coat color. That means the kittens would be X^yY or black in color.

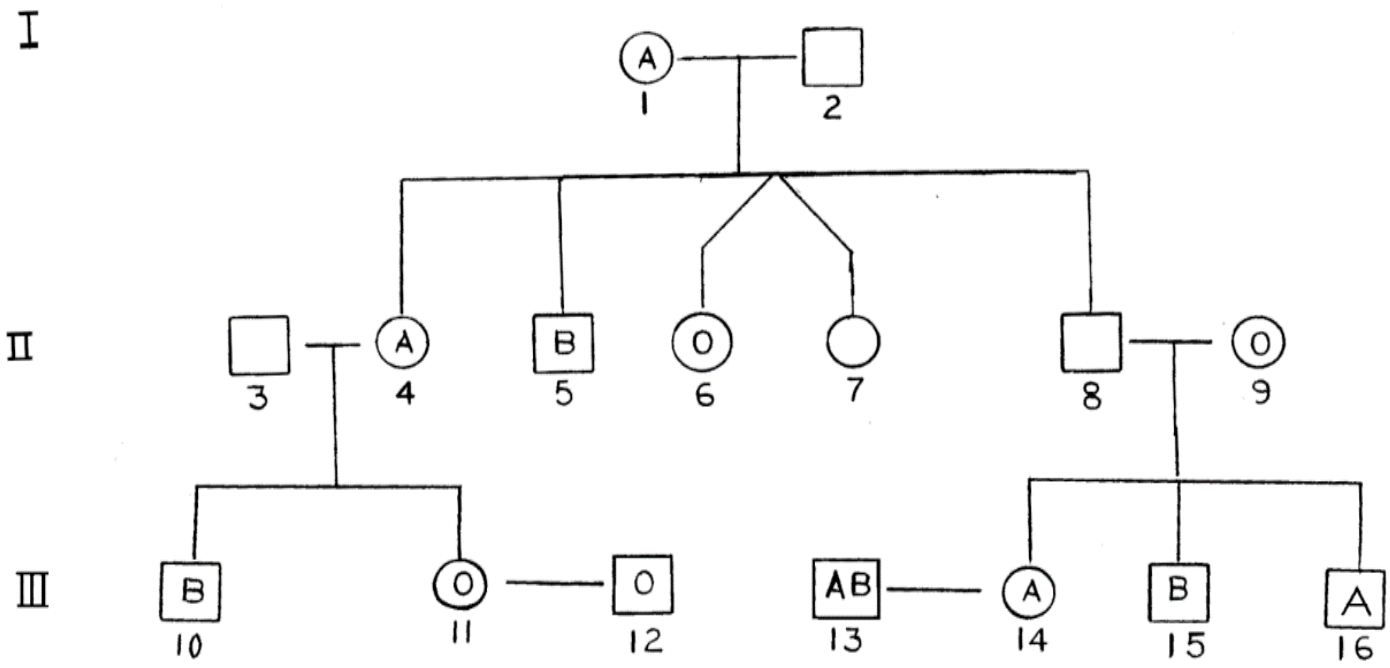
8. A man is colorblind with the genotype X^c Y. The mother is not colorblind but carries a colorblind allele. Give all the possible genotypes and phenotypes.

X^CY x X^NX^C yields **Genotype - ¼ X^CX^N, ¼ X^NY, ¼ X^CX^C, ¼ X^CY**
Phenotype- ¼ normal female, ¼ colorblind female. ¼ normal male, ¼ colorblind male
C = colorblind, N = normal, XX = female, XY = male

	X^C	Y
X^N	X^CX^N	X^NY
X^C	X^CX^C	X^CY

PART 3: PEDIGREE AND KARYTYPE ANALYSIS

Examine the pedigree and answer the following questions. Assume the original parents are married.



What is the relationship of the following individuals?

11. _____# 1 and # 4

12. _____ # 11 and # 12

Give the **possible genotypes** and then the **blood type** for the following individuals.

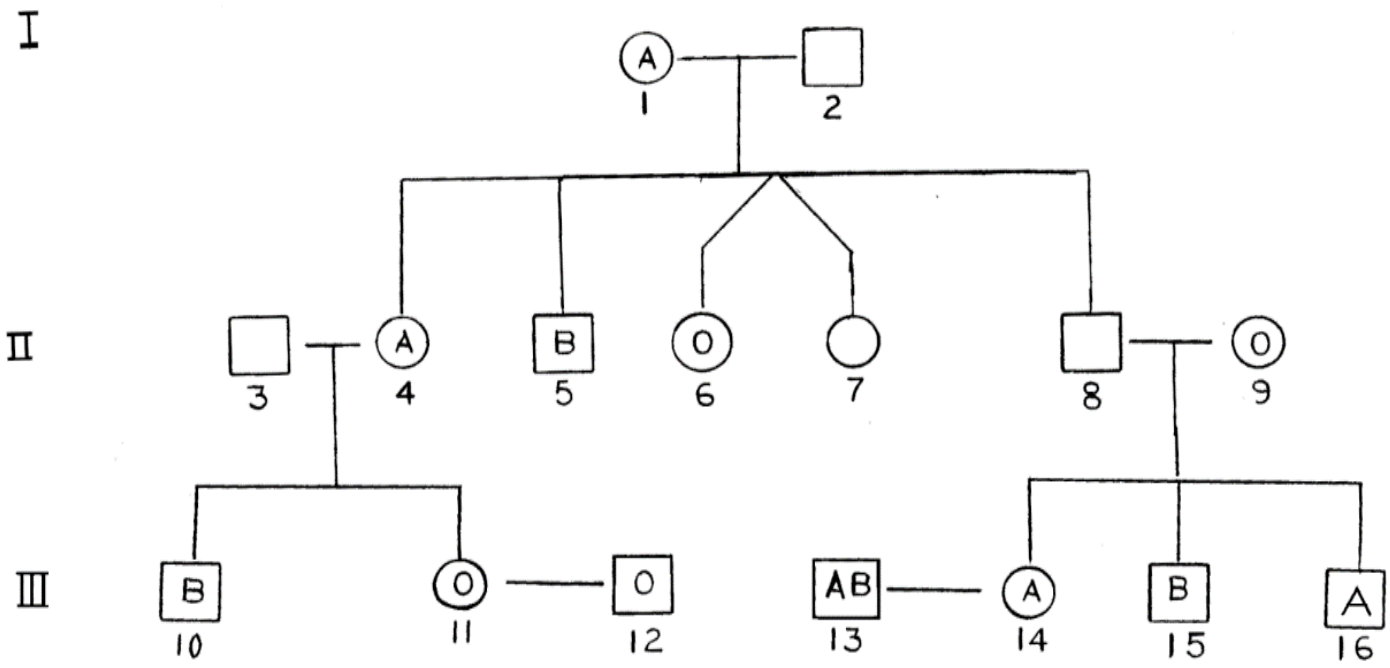
13. _____Individual # 2

14._____ Individual # 3

15._____ Individual # 8

PART 3: PEDIGREE AND KARYTYPE ANALYSIS

Examine the pedigree and answer the following questions. Assume that the original parents are married.



What is the relationship of the following individuals?

11. _**mother and daughter**_# 1 and # 4

12. _**wife and husband**_____ # 11 and # 12

Give the **possible genotypes** and then the **blood type** for the following individuals.

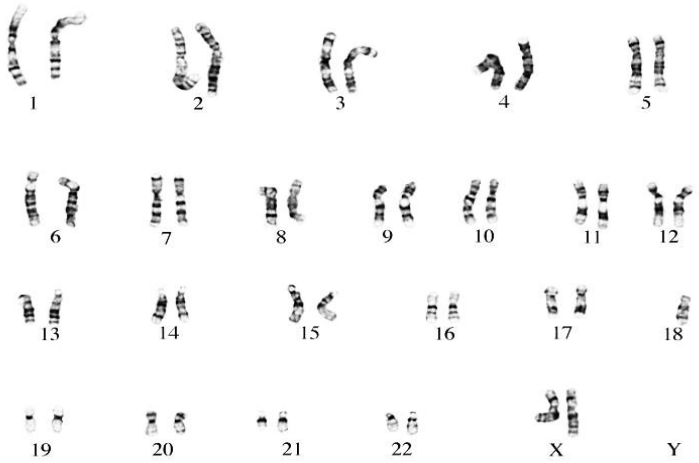
13. _____**I^Bi type B**_____Individual # 2

14._____ **I^Bi type B**_____Individual # 3

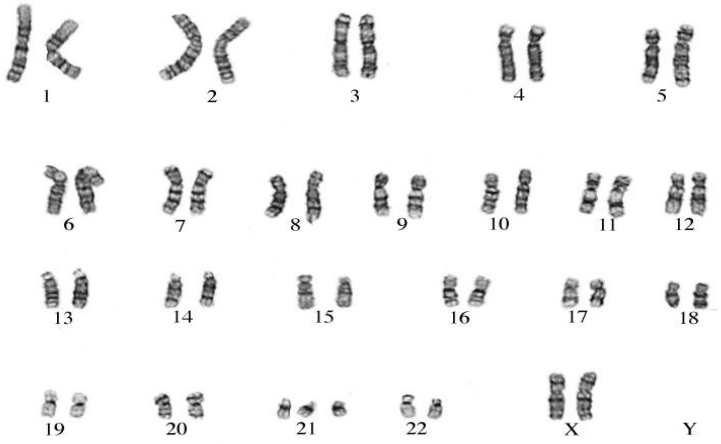
15._____**I^AI^B type AB**_____Individual # 8

Examine the provided karyotypes and answer the following questions.

Individual A



Individual B



16. _____ What is the sex of individual A?

17. _____ What is the sex of individual B?

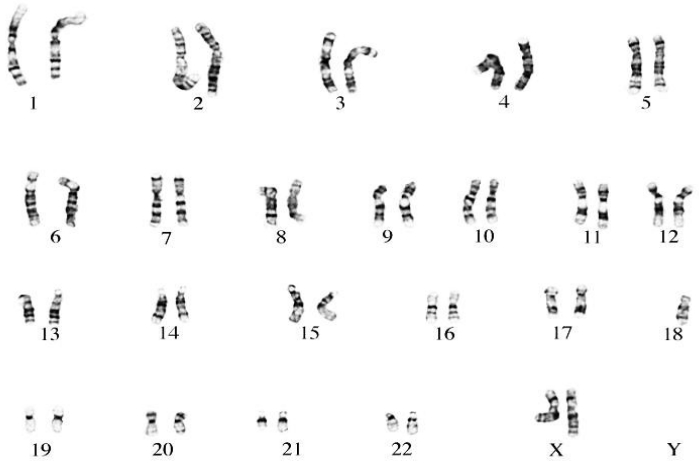
18. _____ What defect does individual A have?

19. _____ What defect does individual B have?

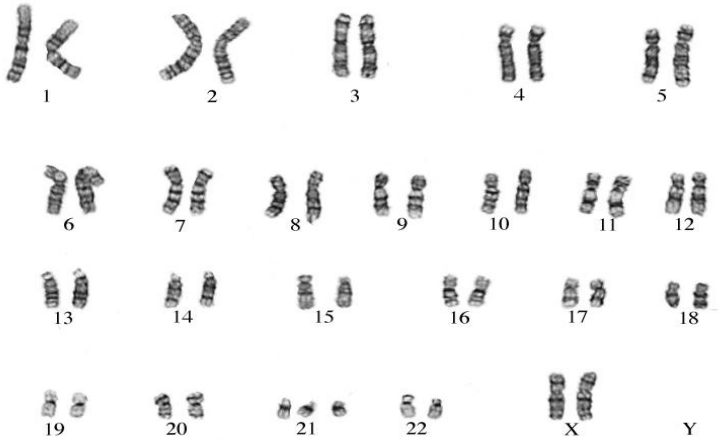
20._____How many chromosomes are in a normal somatic (body) cell of individual A?

Examine the provided karyotypes and answer the following questions.

Individual A



Individual B



16. **female** What is the sex of individual A?

17. fenake What is the sex of individual B?

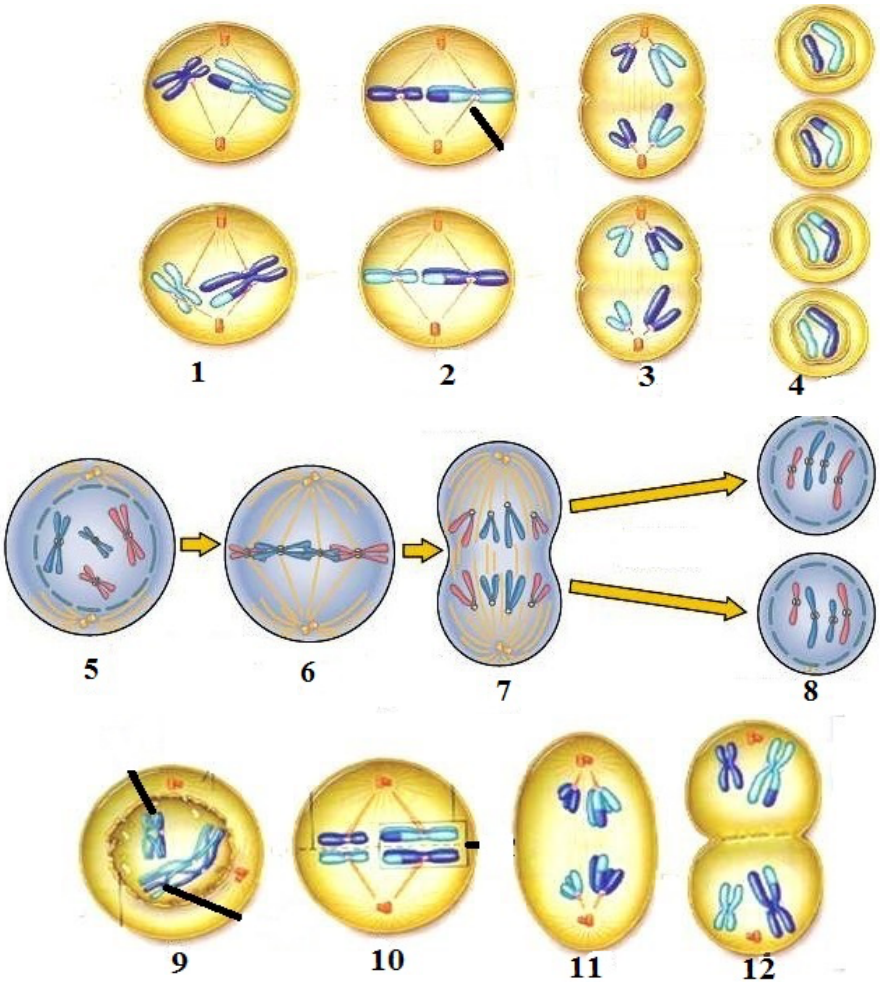
18. **Monosomy 18** What defect does individual A have?

19. **Trisomy 21** What defect does individual B have?
Down Syndrome

20. 45 How many chromosomes are in a normal somatic (body) cell of individual A?

PART 4 – MITOSIS & MEIOSIS

Homologue is
a homologous pair of chromosomes



1. Which set to diagrams (top, middle or bottom) is mitosis?
2. Which set to diagrams (top, middle or bottom) is meiosis I?
3. Which set to diagrams (top, middle or bottom) is meiosis II?

For **Questions 4-9**, give the **number** on the Diagrams represents the following phase.

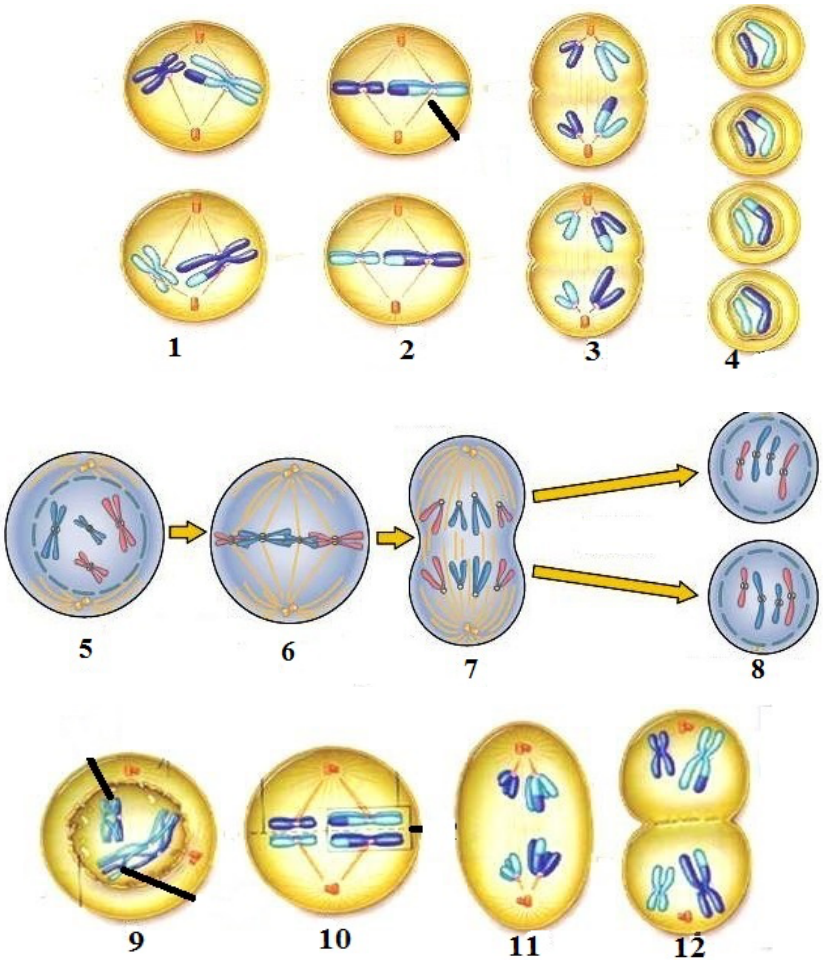
4. Prophase of Mitosis
5. Anaphase of Meiosis II
6. Metaphase of Mitosis
7. Prophase of Meiosis I
8. Telophase of Meiosis II
9. Anaphase of Meiosis I

For **Questions 10-15**, use the **numbers** on the diagram to indicate when the following events. There may be more than one diagram that shows this event, so **list all that apply**.

10. Synapsis occurs
11. Sister chromatids line up at the equatorial plane.
12. Homologues line up at the equatorial plane.
13. Cytokinesis occurs
14. Crossover occurs
15, Homologous chromosome pairs separate but sister chromatids remain together and move toward the poles.

PART 4 – MITOSIS & MEIOSIS

Homologue is
a homologous pair of chromosomes



1. Which set to diagrams (top, **middle** or bottom) is Mitosis?
2. Which set to diagrams (top, middle or **bottom**) is Meiosis I?
3. Which set to diagrams (**top**, middle or bottom) is Meiosis II.

For Questions 4-9, give the **number** on the Diagrams represents the following phase.

4. Prophase of Mitosis **5**
5. Anaphase of Meiosis II **3**
6. Metaphase of Mitosis **6**
7. Prophase of Meiosis I **9**
8. Telophase of Meiosis II **4**
9. Anaphase of Meiosis I **11**

For **Questions 10-15**, use the **numbers** on the diagram to indicate when the following events. There may be more than one diagram that shows this event, so list all that apply.

10. Synapsis occurs **9**
11. Sister chromatids line up at the equatorial plane. **2 6**
12. Homologues line up at the equatorial plane. **10**
13. Cytokinesis occurs **4 8 12**
14. Crossover occurs **9**
15. Homologous chromosome pairs separate but sister chromatids remain together and move toward the poles **11**

PART 5 – DNA STRUCTURE & REPLICATION

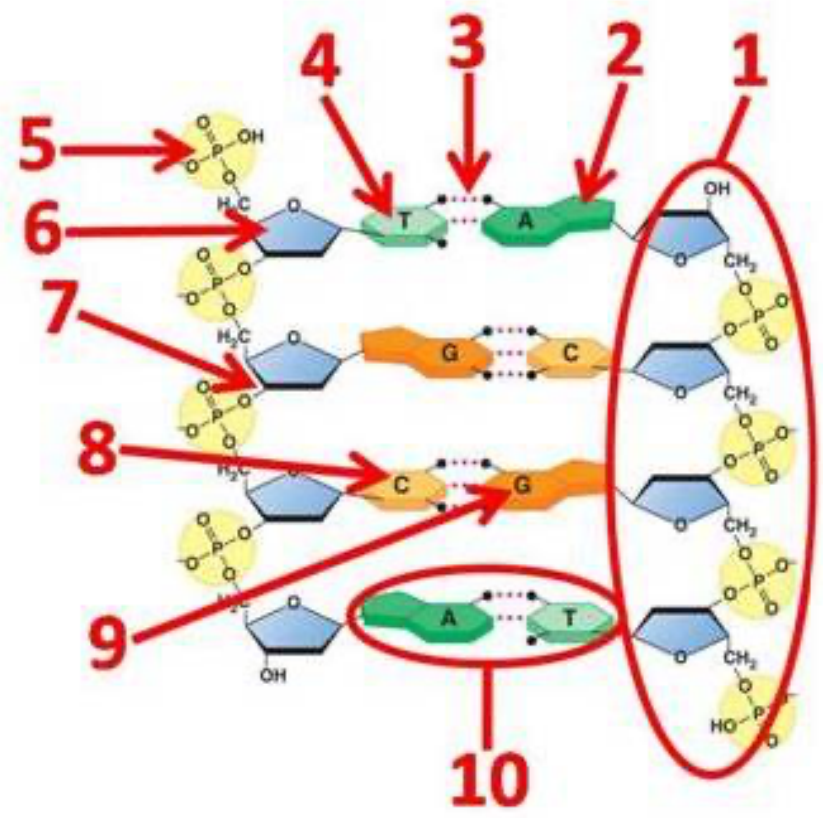


DIAGRAM A

For Questions 1-5, use DIAGRAM A – DNA Structure

1. Which number represents the rungs of the DNA latter and what makes up these rungs?

2. Which base pairs with adenine? Which base pairs with guanine?

3. List the number for phosphate and then the number for deoxyribose.

4. What makes up a nucleotide? How many kinds are there in DNA?

5. List the number which the hydrogen bond that allows two nucleotides to bond together.

PART 5 – DNA STRUCTURE & REPLICATION

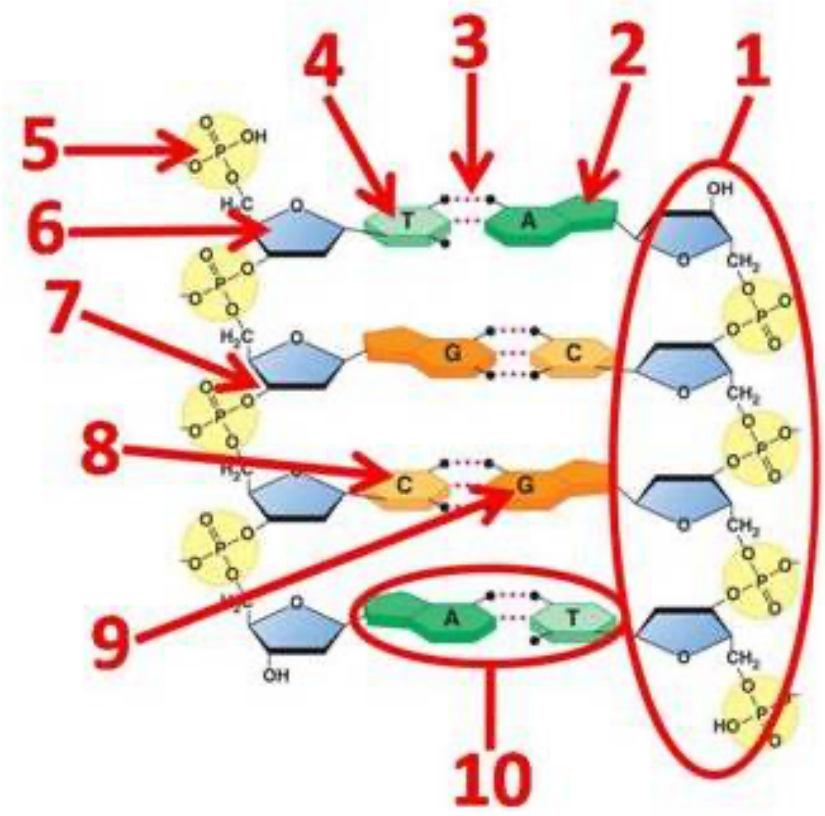


DIAGRAM A

For Questions 1-5, use DIAGRAM A – DNA Structure

1. Which number represents the rungs of the DNA latter and what makes up these rungs?

   10 **nitrogen base pairs**

2. Which base pairs with adenine? Which base pairs with guanine?

   thymine **cytosine**

3. List the number for phosphate and then the number for deoxyribose.

   5 **6**

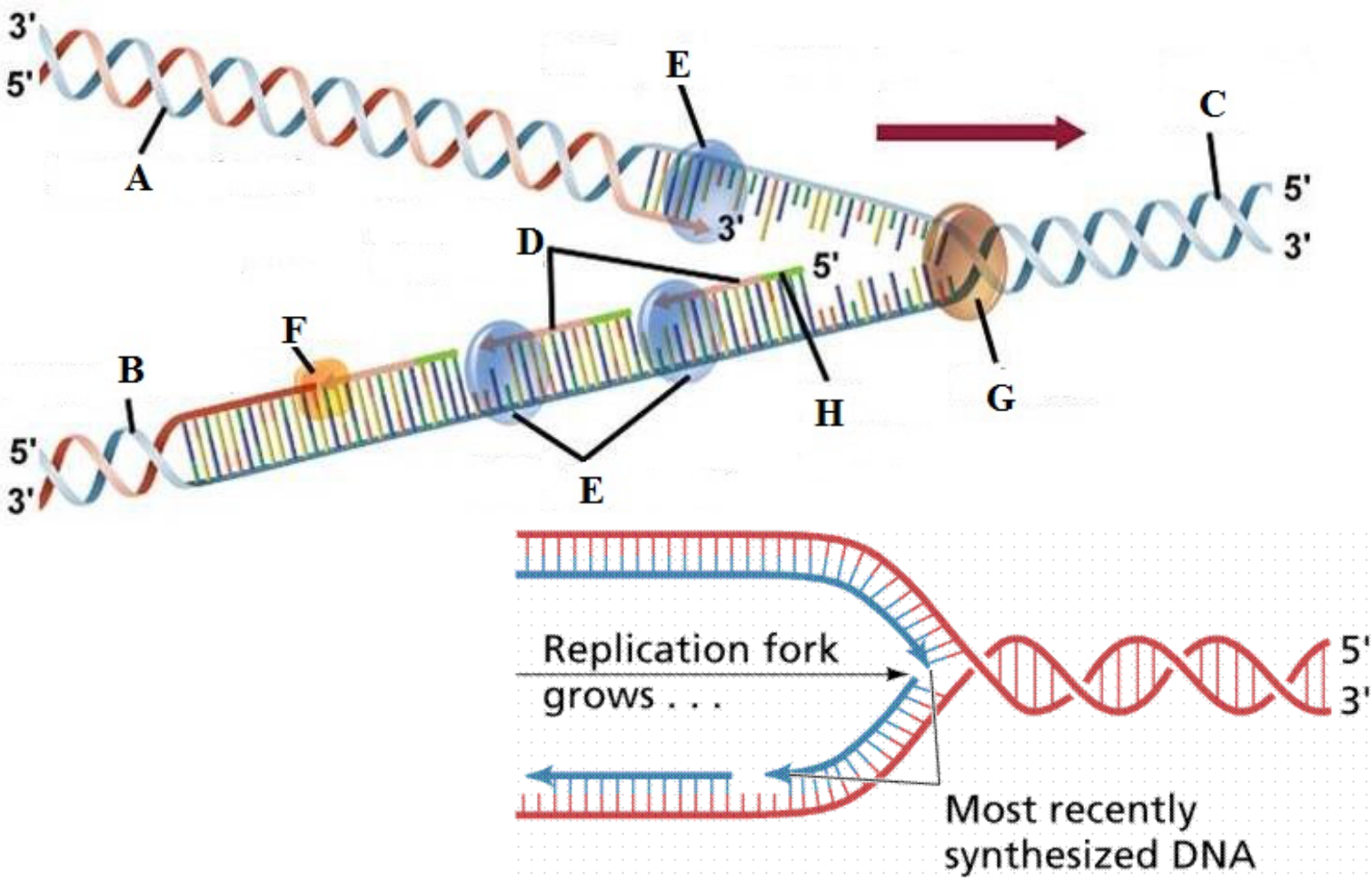
4. What makes up a nucleotide? How many kinds are there in DNA?

   Sugar (deoxyribose), phosphate, and a nitrogen base **4 kinds (because 4 nitrogen bases)**

5. List the number which the hydrogen bond that allows two nucleotides to bond together.

   3

DNA REPLICATION



For Questions 6-10, use the Diagrams for DNA Replication.

6. Give the letter of the parent double-stranded DNA.

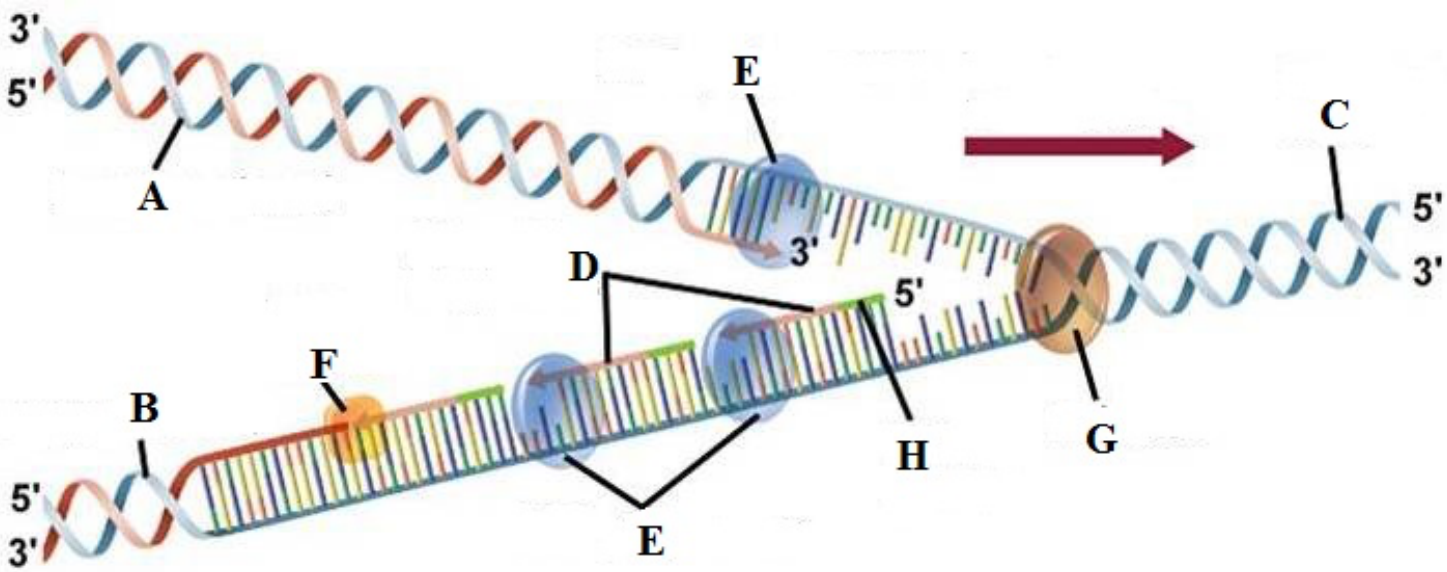
7. Give the letter that represents the Leading Strand with continuous replication.

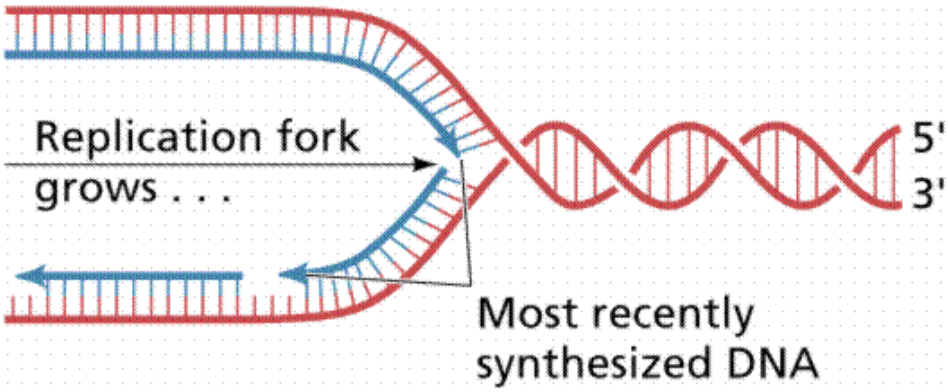
8. Give the letter that represents the Lagging Strand with Okazaki Fragments

9. What direction are the DNA codes read? (3' to 5' or 5' to 3')

10. What direction are the DNA nucleotides added? (3' to 5' or 5' to 3')

DNA REPLICATION





For Questions 6-10, use the Diagrams for DNA Replication.

6. Give the letter of the parent double-stranded DNA. **C**

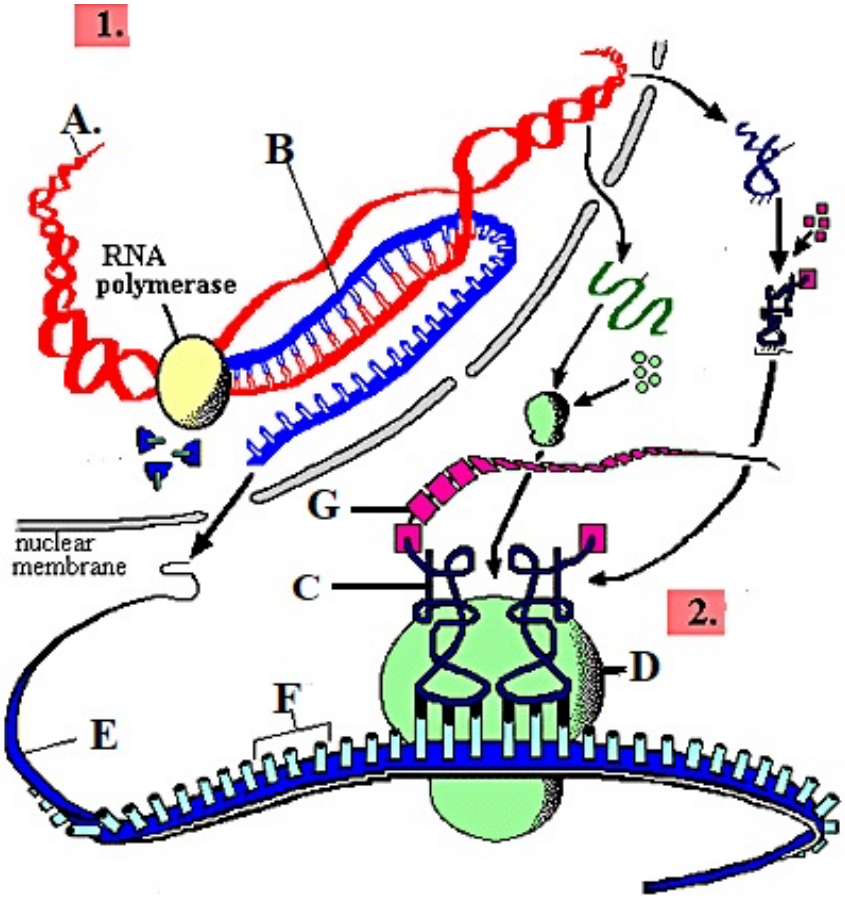
7. Give the letter that represents the Leading Strand with continuous replication. **A**

8. Give the letter that represents the Lagging Strand with Okazaki Fragments. **B**

9. What direction are the DNA codes read? (**3' to 5'** or 5' to 3')

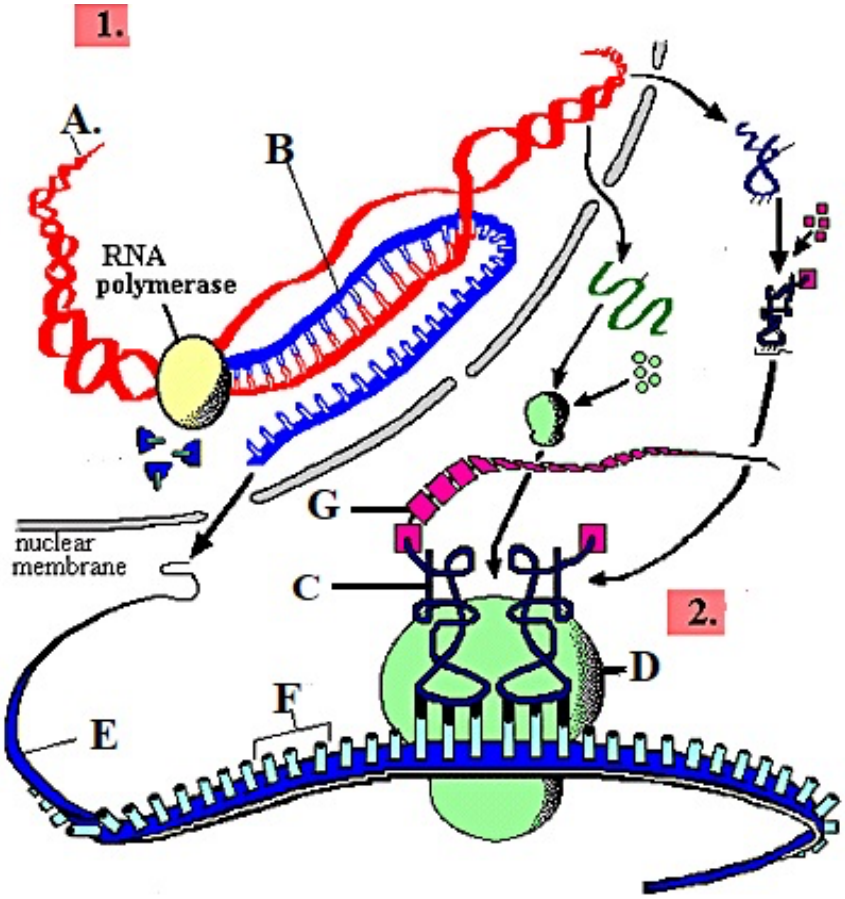
10. What direction are the DNA nucleotides added? (3' to 5' or **5' to 3'**)

PART 6 - GENE EXPRESSION



1. Which process (1 or 2) is translation?
2. Where does translation occur? (nucleus or cytoplasm)
3. What is made during translation? (RNA or protein)
4. Which process (1 or 2) is transcription?
5. Where does transcription occur? (nucleus or cytoplasm)
6. What is made during transcription? (RNA or protein)
7. What letter represents the original strand of DNA?
8. What letter represents the strand of m-RNA being made – before it is modified and introns are removed?
9. What letter represents the mature m-RNA that will be used to produce a protein?
10. What letter represents a codon?
11. What letter represents t-RNA?
12. What letter represents the ribosome?
13. What letter represents the peptide chain that is being made?
14. What must be present for the m-RNA and the t-RNA to attach during protein synthesis?
15. What bring the amino acids that will be bonded to produce the peptide chain of the protein?

PART 6 - GENE EXPRESSION



1. Which process (1 or **2**) is translation?
2. Where does translation occur? (nucleus or **cytoplasm**)
3. What is made during translation? (RNA or **peptide chain-protein**)
4. Which process (**1** or 2) is transcription?
5. Where does transcription occur? (**nucleus** or cytoplasm)
6. What is made during transcription? **(RNA** or peptide chain-protein)
7. What letter represents the original strand of DNA? **A**
8. What letter represents the strand of m-RNA being made before it is modified and introns are removed? **B**
9. What letter represents the mature m-RNA that will be used to produce a protein? **E**
10. What letter represents a codon? **F**
11. What letter represents t-RNA? **C**
12. What letter represents the ribosome? **D**
13. What letter represents the peptide chain that is being made? **G**
14. What must be present for the m-RNA and the t-RNA to attach during protein synthesis? **RIBOSOME**
15. What bring the amino acids that will be bonded to produce the peptide chain of the protein? **tRNA**

PART 7 – INTERPRETING THE GENETIC CODE

First position (5' end)	U	C	A	G	Third position (3' end)
U	UUU Phe UUC UUA Leu UUG	UCU Ser UCC UCA UCG	UAU Tyr UAC UAA Stop UAG Stop	UGU Cys UGC UGA Stop UGG Trp	U C A G
C	CUU Leu CUC CUA CUG	CCU Pro CCC CCA CCG	CAU His CAC CAA Gln CAG	CGU Arg CGC CGA CGG	U C A G
A	AUU Ile AUC AUA AUG	ACU Thr ACC ACA ACG	AAU Asn AAC AAA Lys AAG	AGU Ser AGC AGA Arg AGG	U C A G
G	GUU Val GUC GUA GUG	GCU Ala GCC GCA GCG	GAU Asp GAC GAA Glu GAG	GGU Gly GGC GGA GGG	U C A G

Amino acid names:

Ala = alanine	Gln = glutamine	Leu = leucine	Ser = serine
Arg = arginine	Glu = glutamate	Lys = lysine	Thr = threonine
Asn = asparagine	Gly = glycine	Met = methionine	Trp = tryptophan
Asp = aspartate	His = histidine	Phe = phenylalanine	Tyr = Tyrosine
Cys = cysteine	Ile = Isolevcine	Pro = proline	Val = valine

Use the codon and amino acid chart

The coding sequence of a piece of DNA is 3' **ATAGGCTTAGAGACT** 5'

1. How many codes does this piece of DNA contain?

2. What will be the coding sequence of the M-RNA produced by the piece of DNA?

3. What tRNA anticodon sequence of the tRNA that will attach to the M-RNA?

4. What will be the sequence of amino acids formed? (Use the chart of codons and amino acids to assist you. Use the abbreviations of the amino acids.)

5. What are the mRNA stop codons?

PART 7 – INTERPRETING THE GENETIC CODE

First position (5' end)	U	C	A	G	Third position (3' end)
U	UUU Phe UUC UUA Leu UUG	UCU Ser UCC UCA UCG	UAU Tyr UAC UAA Stop UAG Stop	UGU Cys UGC UGA Stop UGG Trp	U C A G
C	CUU Leu CUC CUA CUG	CCU Pro CCC CCA CCG	CAU His CAC CAA Gln CAG	CGU Arg CGC CGA CGG	U C A G
A	AUU Ile AUC AUA AUG	ACU Thr ACC ACA ACG	AAU Asn AAC AAA Lys AAG	AGU Ser AGC AGA Arg AGG	U C A G
G	GUU Val GUC GUA GUG	GCU Ala GCC GCA GCG	GAU Asp GAC GAA Glu GAG	GGU Gly GGC GGA GGG	U C A G

Amino acid names:

Ala = alanine	Gln = glutamine	Leu = leucine	Ser = serine
Arg = arginine	Glu = glutamate	Lys = lysine	Thr = threonine
Asn = asparagine	Gly = glycine	Met = methionine	Trp = tryptophan
Asp = aspartate	His = histidine	Phe = phenylalanine	Tyr = Tyrosine
Cys = cysteine	Ile = Isolevcine	Pro = proline	Val = valine

Use the codon and amino acid chart

The coding sequence of a piece of DNA is 3' **ATAGGCTTAGAGACT** 5'

1. How many codes does this piece of DNA contain? **5**

2. What will be the coding sequence of the M-RNA produced by the piece of DNA?
   5' UAUCCGAAUCUGUGA 3'

3. What tRNA anticodon sequence of the tRNA that will attach to the M-RNA?
   3' AUA GGC UUA GAG 5' (NOTE: UGA of mRNA was a stop codon)

4. What will be the sequence of amino acids formed? (Use the chart of codons and amino acids to assist you. Use the abbreviations of the amino acids.)
   Tyr Pro Asn Leu

5. What are the mRNA stop codons? **UGA UAG UAA**