

Name:
Midterm Exam: Elementary Genetics
BIOL 206

ID:

Monday, March 7th, 2016
Instructor: Dr. Aida Abu-Baker

20 Multiple choice questions and 2 short answer questions.

Answers to multiple choice questions must be clearly indicated on the scantron using a pencil.

MULTIPLE CHOICE. Choose only one answer that best completes the statement or answers the question. (5 marks each)

1. Most genes come in alternative forms called:

- A) chromosomes.
- B) gametes.
- C) dominants.
- D) alleles.
- E) recessives.

2. Alisha and Scott have two sons and three daughters. Each son has three daughters. Each daughter has one son. How many of the grandchildren will have Alisha's mitochondria?

- A) 0
- B) 3
- C) 6
- D) 12
- E) This can't be answered with the information provided.

3. Regulatory sequences of DNA that are responsible for the speed at which a gene is transcribed are known as

- A) enhancers
- B) promoters
- C) exons
- D) repressors
- E) 5'capG and 3' poly(A)tail

4. Why aren't all mutations that occur in DNA inherited by our offspring?

- A) Only mutations in DNA contained in sperm and eggs will be inherited.
- B) Each cell has different DNA in it, with only the genes that cell needs.
- C) DNA that is mutated can't be inherited; cells correct it before passing it on.
- D) DNA that is inherited can't have more than one mutation in it.
- E) None of the above

5. Which of the following represents a similarity between RNA and DNA?

- A) Both are double-stranded.
- B) the presence of uracil
- C) the presence of an OH group on the 2' carbon of the sugar
- D) nucleotides consisting of a phosphate, sugar, and nitrogenous base
- E) Both are found exclusively in the nucleus.

6. Which is the largest among the followings?

- A) nucleotide
- B) chromosome

- C) nucleus
- D) gene
- E) phosphate

7. Most genetic diseases result from mutations that cause a gene to produce a non-functioning _____, which in turn blocks the functioning of a metabolic pathway.

- A) enzyme
- B) codon
- C) polysaccharide
- D) tRNA
- E) histone

8. Mrs. Smith (40 years old) and her husband have an amniocentesis for advanced maternal age. They already have four healthy children. They receive results indicating a 47, XXY karyotype. What is the phenotypic sex of the fetus? How many Barr bodies will be found in each somatic cell?

- A) Male, 0
- B) Male, 1
- C) Male, 2
- D) Female, 1
- E) Female, 2

9. The sequence of one strand of DNA is 5' TCGATC 3'. The sequence of the complementary strand would be

- A) 5' AGCTAG 3'
- B) 5' TCGATC 3'
- C) 5' CTAGCT 3'
- D) 5' GCTAGC 3'
- E) 5' GATCGA 3'

10. DNA is a macromolecule that stores information. Which component of DNA is the source of this information?

- A) the sugar
- B) the phosphate group
- C) the base
- D) the histone
- E) the hydrogen bonds

11. Human chorionic gonadotropin (hCG)

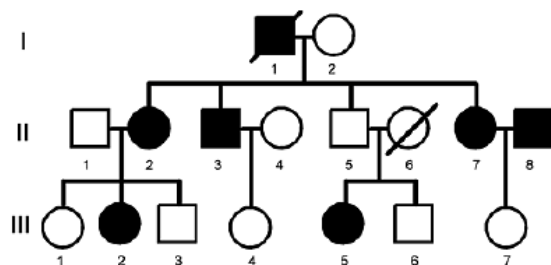
- A) promotes the development of the ovary.
- B) stimulates the formation of the gonads.
- C) is present in undetectable amounts throughout the pregnancy.
- D) prevents the expulsion of the embryo.
- E) is transported to the embryo through the umbilical cord.

12. Regulation of gene expression can be accomplished by controlling:

- A) the rate of translation of mRNA.
- B) the activity of a protein product.
- C) the amount of mRNA that is available.
- D) the rate of mRNA degradation.
- E) All of these.

13. Individual II-5 in the pedigree shown below is:

- A) A male who does not exhibit the trait.
- B) A father.
- C) Has three affected siblings.
- D) Has two children.
- E) All of the above.



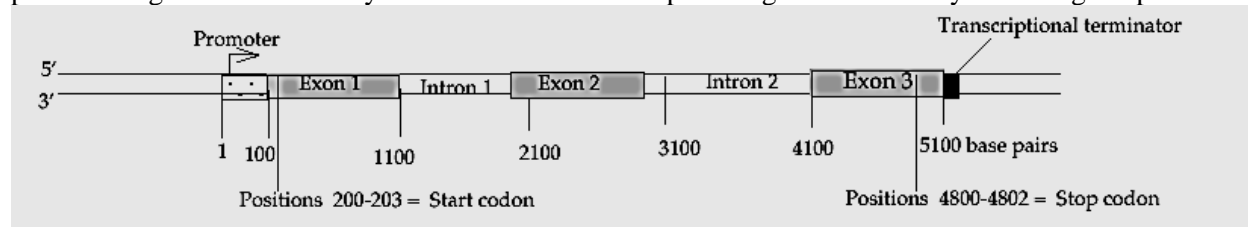
14. The three-dimensional shape of a protein is determined by the

- A) order of amino acids.
- B) temperature of the cells.
- C) amount of protein present.
- D) number of amino acids the organism possesses.
- E) the length of the protein.

15. Which refers to the loss of a complete chromosome?

- A) inversion
- B) translocation
- C) deletion
- D) duplication
- E) monosomy

16. Below is a schematic of gene Hemoglobin beta subunit (HBS), which encodes protein HBS. The promoter region is indicated by the dotted box. Transcription begins immediately following the promoter.



The mature mRNA produced by this gene would be approximately how many nucleotides long?

- A) 100
- B) 200
- C) 3000
- D) 5000
- E) 7000

17. When a triplet of bases in the coding sequence of DNA is GCA, what is the anticodon for the tRNA that would be used in translation?

- A) GCA

- B) GCT
- C) CGT
- D) CGU
- E) CGA

18. A duplicated homologous chromosome pair at the beginning of meiosis contains how many copies of each gene?

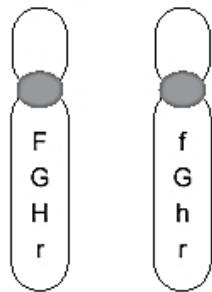
- A) 92
- B) 46
- C) 2
- D) 4
- E) 8

19. Diane has distal symphalangism- her fingers and toes are stiff, with tiny nails. She looks it up and finds it is an autosomal dominant trait. Since her parents do not have it, she reasons she is a new mutation. However, if she has children, each of them, has a(n) ____ probability of inheriting the condition. (assume her partner does not have the condition)

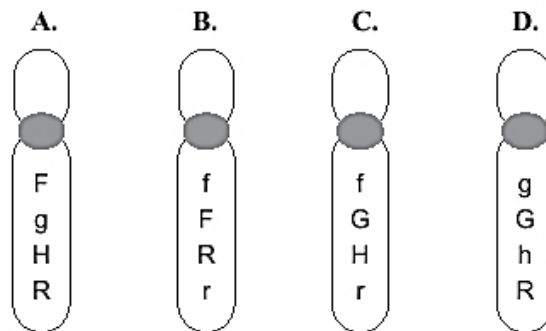
- A) 0
- B) 1/8
- C) 1/4
- D) 1/2
- E) 3/8

20.

A pair of homologous chromosomes involved in normal meiosis in an ovary carries the alleles shown.



Chromosomes detected in eggs produced would include



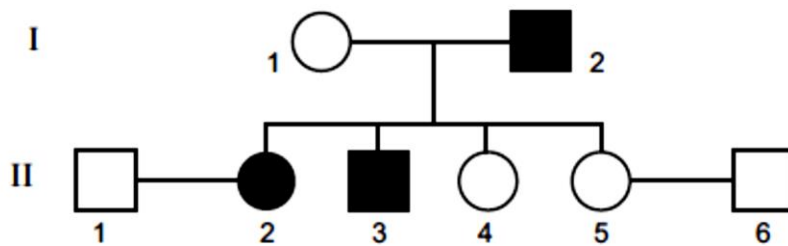
E. All the above.

C. is the correct answer

Short Answer Question 1:

Haemophilia is an X-linked recessive condition. The following pedigree shows a portion of a family in which some members have haemophilia. Those on the pedigree with haemophilia are shaded.

- A) Use appropriate allele symbols from X^H , X^h and Y to indicate the genotype of each of the following two individuals: (5 marks)
- B) The couple II1 and II2 have a son. What is the probability that the child has haemophilia? (5 marks)



- C) A couple comes to a genetic counselor about their chances of having a baby with Tay Sachs disease. The husband had a sibling die of the disease, which is inherited as an autosomal recessive trait. What are the chances that he is a carrier? (5 marks)
- D) How siblings can look so very different? List all genetic answers. (10 marks)

Short Answer Question 2:

The following DNA coding strand represents a segment of beta globin gene (first exon):

5' ATGGCGCAGAACTAA 3' (coding strand)

A) What is the sequence of the complementary DNA strand? (5 marks)

B) Transcribe this segment into mRNA. (5 marks)

C) Use the genetic code table to determine the amino acid sequence of the resulting polypeptide chain. (5 marks)

You do not need to put the stop codon as it does not encode amino acid (I did not reduce any mark if you added it).

But you need to put Met as a first amino acid in this polypeptide chain.

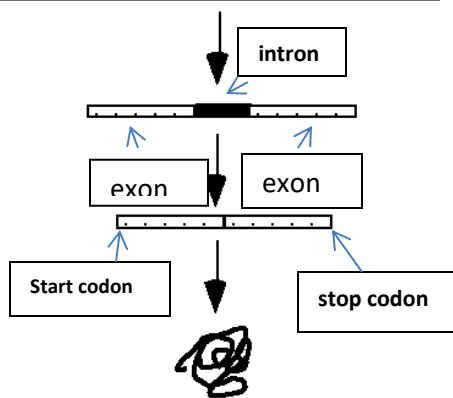
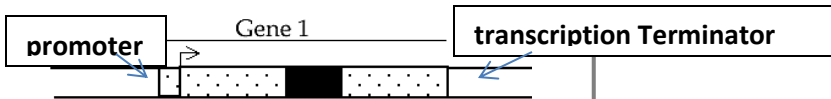
D) Shown below is a schematic of the production of a polypeptide. At the top is the chromosomal arrangement found in the cell; a schematic of the polypeptide is shown below it.

i. Label the process indicated by each arrow. (5 marks)

ii. Indicate on the diagram below where you would expect to find each of the following components: (5 marks)

(Note: the arrow indicates the transcription start site)

- Promoter
- Transcription terminator
- Start codon
- Stop codon
- Introns
- Exons



Transcription

RNA Processing (or post-transcription modifications)

Translation (protein production)

Codon Table

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