

**BIOL 115
ESSENTIAL BIOLOGY**

MIDTERM EXAMINATION 2 - 2012

Multiple Choice

1. Which of the following statements about the structure of DNA is FALSE?

- (a) The two DNA strands run parallel (i.e. in the same direction)
- (b) The number $A = T$ and $G = C$ (Chargaff's Rule)
- (c) An analogy for the conformation of DNA is a twisted rope ladder
- (d) The two strands are held together by hydrogen bonding between the bases
- (e) Bases are found in the middle of the double helix

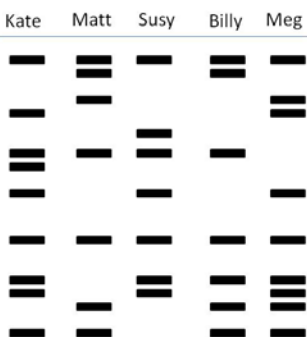
>> answer is 'a'

2. In shorthorn cattle, the genotype RR causes a red coat, the genotype rr causes a white coat, and the genotype Rr causes a roan coat (pale red). This is an example of what type of inheritance?

- (a) Incomplete dominance
- (b) Co-dominance
- (c) Multiple alleles
- (d) Sex-hormone influenced dominance
- (e) Polygenic inheritance

>>answer is 'a'

3. Kate and Matt are in the middle of a bitter divorce. Matt alleges that Kate was unfaithful to him and that their youngest child, Meg, is not his child. DNA profiling was performed to test this allegation with the following results:



What conclusions can be drawn?

- (a) All three children are Matt's
- (b) None of the children are Matt's
- (c) Meg's father is not Matt
- (d) Neither Meg nor Billy are Matt's children
- (e) Susy is not Matt's child

>> answer is 'e'

4. Gene therapy is still experimental, but has been successfully used in a few cases, including which of the following?

- (a) ADA-SCIDs (severe combined immunodeficiency)
- (b) Retinal degeneration in dogs
- (c) CF (cystic fibrosis)
- (d) 'a' and 'b'
- (e) 'a', 'b' and 'c'

>> answer is 'd'

5. Which of the following statements about DNA gel electrophoresis is FALSE?

- (a) It separates DNA samples by their size
- (b) Modern DNA profiling with STRs is now shown as electrophorograms with peaks rather than DNA bands on gels
- (c) A person who is heterozygous for two different STR number alleles will show two bands for that STR on a gel
- (d) It takes advantage of the negative charge on DNA molecules
- (e) Large DNA fragments move more quickly through a gel than small DNA fragments

>> answer is 'e'

6. Which of the following statements about the cell cycle is FALSE?

- (a) Cells can move between G_0 and G_1
- (b) The checkpoint between G_1 and S phases is meant to ensure that the cell is ready to undergo DNA synthesis
- (c) The checkpoint between G_2 and M phases is meant to check that the DNA is properly replicated and the cell is big enough to divide
- (d) The checkpoint between metaphase and anaphase is meant to check that the chromosomes are aligned for proper separation of sister chromatids
- (e) The checkpoint between mitosis and cytokinesis is meant to check that the chromosome properly segregated into the two new daughter nuclei

>> answer is 'e'

7. What RNA would you expect to get from the template DNA sequence 'AGG ACT GTT TCG ACT'?

- (a) TCC TGA CAA AGC TGA
- (b) UCC UGA CAA AGC UGA
- (c) AGG ACU GUU UCG AGU
- (d) AGG ACT GTT TCG ACT
- (e) AGU CGA AAC AGU CCU

>>answer is 'b'

8. The mRNA sequence AUG CGA GAA AUU UGG codes for the polypeptide Met – Arg – Glu – Ile – Trp. What would be the polypeptide sequence be if the mRNA sequence was changed to AUG CGU GAA AUU UGG? (see codon table provided)

- (a) Met – Ala – Glu – Ile – Trp
- (b) Met – Cys – Glu – Ile – Trp
- (c) Met – Thr – Glu – Ile – Trp
- (d) Met – Arg – Glu – Ile – Trp
- (e) Met – Pro – Glu – Ile – Trp

>> answer is 'd' (no change because multiple codons for Arg)

9. Which of the following is/are a characteristic(s) of cancer?

- (a) Cells grow/divide without external growth signals
- (b) Tissue invasion and metastasis
- (c) Evasion of programmed cell death (apoptosis)
- (d) Stimulation of blood vessel growth (angiogenesis)
- (e) 'a', 'b', 'c' and 'd'

>> answer is 'e'

10. What of the following statements about transcription and translation is FALSE?

- (a) mRNA is transcribed by RNA polymerase in the nucleus of eukaryotes
- (b) Ribosomes are made up of a few rRNAs and many proteins
- (c) tRNAs act as translators between mRNA anticodons and amino acids
- (d) The upstream regulatory sequence where RNA polymerase binds is known as the promoter
- (e) The newly made protein is released from the ribosome when a 'Stop' codon is reached

>> answer is 'c' (RNA codons not anticodons)

11. The genetic basis of ABO blood types is:

- (a) Multiple alleles
- (b) Co-dominant alleles
- (c) Three independently assorting genes
- (d) Pleiotropy
- (e) 'a' and 'b'

>> answer is 'e'

12. Which is the correct description of making transgenic plants?

- (a) Isolate gene of interest > ligate into non-infectious virus > use virus to introduce gene into plant genome

- (b) Isolate gene of interest > inject directly into plant embryos
- (c) Isolate gene of interest > ligate into cloning plasmid > transform into E coli bacterium > use E coli to introduce gene into plant genome
- (d) Isolate gene of interest > ligate into Ti plasmid > transform into Agrobacterium > use Agrobacterium to introduce gene into plant genome
- (e) Isolate gene of interest > ligate into cloning plasmid > transform into E coli bacterium > isolate plasmid from E coli > inject plasmid into plant embryos

>> answer is 'd'

13. Which of the following statements about aneuploidies is FALSE?

- (a) The only common autosomal aneuploidy is trisomy 21 (Down syndrome)
- (b) The XYY trisomy must derived from nondisjunction in the child's father
- (c) All gametes from nondisjunction in Meiosis II are abnormal
- (d) Karyotype analysis is the study of the presence and structure of all chromosomes in an individual's cells
- (e) X0 (Turner syndrome) is the only viable monosomy

>> answer is 'c'

14. Which of the following statements about eukaryotic chromosomes is FALSE?

- (a) Eukaryotic chromosomes are compacted at several levels
- (b) Interphase chromosomes are highly compacted
- (c) Chromosomes need to condense for movement during mitosis
- (d) Chromosomes need to be loosely wrapped for transcription and DNA replication
- (e) DNA is wrapped around an octomer of histone proteins known as a nucleosome

>> answer is 'b'

15. In pigeons, the dominant allele C causes a checkered pattern in the feathers; its recessive allele c produces a plain pattern. Feather colouration is controlled by an independently assorting gene; the dominant allele B produces red feathers, and the recessive allele b produces brown feathers. Birds from a true-breeding checkered, red variety are crossed to birds from a true-breeding plain, brown variety. The F1 progeny are then bred back to the true-breeding checkered, red parent. What proportion of the progeny will have the checkered, red phenotype?

- (a) All
- (b) 9/16
- (c) 3/16
- (d) 1/4
- (e) None

>> answer is 'a' - F1 will be Cc Bb x CC BB gives all C_ B_ so answer is 'all'

16. Male pattern baldness is a condition influenced by the presence of the maleness hormone testosterone. If a woman who is heterozygous for male pattern baldness marries a man who is not bald, what proportion of their sons likely would be expected to develop baldness?

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

>> answer is 'c' - woman Bb x man BB → ½ Bb & ½ BB – if consider sons only, ½ will be bald

17. Which of the following is/are tumor suppressors?

- (a) BRCA1
- (b) p53
- (c) Ras
- (d) 'a' and 'b'
- (e) 'a', 'b' and 'c'

>> answer is 'd'

18. Consider the cross between an individual that is AA Bb Cc dd x aa Bb cc Dd. What is the probability of having progeny that are A_ B_ C_ D_?

- (a) 1/16
- (b) 3/4
- (c) 3/8
- (d) 3/16
- (e) 0

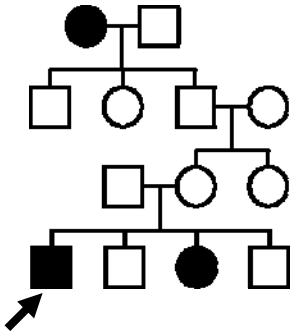
>> answer is 'd' - $1 \times \frac{3}{4} \times \frac{1}{2} \times \frac{1}{2} = 3/16$

19. Which of the following statements about viruses and cancer is/are TRUE?

- (a) Human papilloma virus has been implicated in liver cancer
- (b) Viruses can carry genes encoding for proteins that impair tumor suppressor function
- (c) Insertion of viruses in the genome can never cause cancer
- (d) 'a' and 'b'
- (e) 'a' and 'c'

>> answer is 'b'

20. Consider the pedigree below showing the inheritance of a rare muscle condition. The oldest male in the most recent generation (indicated by an arrow) marries a phenotypically normal woman (assume she is homozygous). What is the probability that their first child will have the muscle condition?



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

>> answer is 'e' – 0% - this is an autosomal recessive condition & if the wife is homozygous normal then all progeny will be Dd & phenotypically normal

21. Which of the following have contributed to reduced cancer in the past century?

- (a) Refrigeration of food
- (b) Cigarette smoking
- (c) PAP smears for women
- (d) 'a' and 'b'
- (e) 'a' and 'c'

>> answer is 'e'

Short Answer & Fill-in-the-Blank

22. DNA replication is performed by and enzyme known as _____.

>> answer is 'DNA polymerase'

23. What two aspects/stages of meiosis are accounted for in the 'my-o-my' part of the meiosis memory aiding phrase 'my-o-my, sex!'?

>> 2 cell divisions & pairing of homologous chromosomes

24. What two general types of chromosomal defects can occur with cancers?

>> chromosomal rearrangements & aneuploidies (altered sets of chromosomes)

25. What is a heterozygote?

>> an individual that has different alleles on their homologous chromosomes at a particular locus

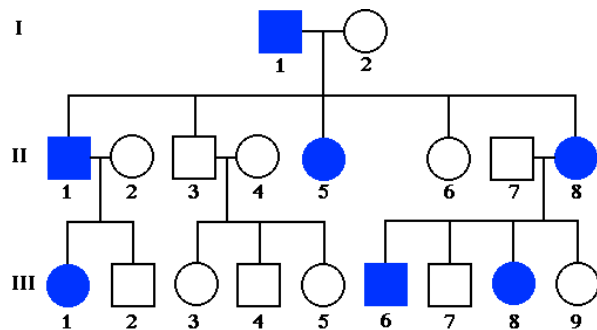
26. What unicellular organisms use mitosis + cell division directly for reproduction?

>> answer is protists

27. In which type of eukaryote is cytokinesis driven by the cytoskeleton pinching the cell in the middle?

>> animal cells

28. What type of inheritance is shown in the following pedigree?



>> answer is autosomal dominant

29. What type of people cannot be differentiated with DNA profiling?

>> answer is 'identical twins'

30. At what two points are prokaryotic genes generally regulated?

>>transcription initiation and protein modification (post translationally)

Second base

		Second base					
		U	C	A	G		
First base	U	UUU	UCU	UAU	UGU	U	
		UUC	UCC	UAC	UGC		C
		UUA	UCA	UAA Stop	UGA Stop		A
		UUG	UCG	UAG Stop	UGG Trp		G
	C	CUU	CCU	CAU	CGU	U	
		CUC	CCC	CAC	CGC		C
		CUA	CCA	CAA	CGA		A
		CUG	CCG	CAG	CGG		G
	A	AUU	ACU	AAU	AGU	U	
		AUC	ACC	AAC	AGC		C
		AUA	ACA	AAA	AGA		A
		AUG Met or start	ACG	AAG	AGG		G
	G	GUU	GCU	GAU	GGU	U	
		GUC	GCC	GAC	GGC		C
		GUA	GCA	GAA	GGA		A
		GUG	GCG	GAG	GGG		G

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