BIOL 4620 Molecular Biology
Exam 3: April 16, 2010 Name

PLEASE WRITE LEGIBLY. **IF THE GRADER CANNOT READ YOUR ANSWER IT WILL BE MARKED WRONG**.

There are 12 multiple choice questions below. Each question is worth 1 point. **Please write the letter for the correct answer in the appropriate space in the table. 5 points will be deducted for blank table.**

1. D	2. A	3. C	4. D
5. B	6. C	7. A	8. B
9. B	10. C	11. A	12. C

d. specific rRNA methylases

3pts 13 Identify the components of a nucleosome in 30 nm fiber?

DNA ~200nucleotides

Histone core octamer

Linker histone (must specify the presence of linker histone – H1 which is not part of the core octamer)

2pts 14 Identify the components of a typical histone octamer?

2 copies each of H2A, H2B, H3, and H4 (may also say 2 H2A, H2B dimers and 1 H3/H4 tetramer (2 H3/H4 tetramers is incorrect))

2pts 15 Identify ONE major function of the centromere?

Attachment of microtubules OR point where two sister chromatids held together

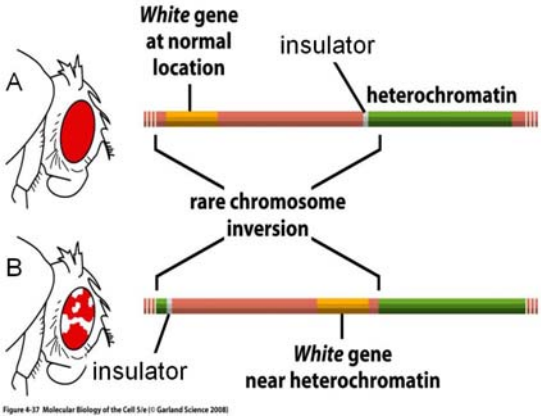
OR region which forms kinetochore

2pts 16 Why is telomere replication important? To prevent shortening of linear chromosomes (since DNA pol only 5'to 3' syn with primer)

2pts 17 How are mammalian centromeres different from yeast centromeres? (for full credit your answer should address both mammalian and yeast centromeres)

Yeast single sequence ~120 bp vs satellite repetitive sequence in mammalian

BIOL 4620 Molecular Biology
Exam 3: April 16, 2010 Name



Expression of the White gene results in red (wild type) eye color in Drosophila. The White gene in fly A and fly B is normal (nonmutant). In fly B, however nonuniform expression of the white gene in fly B ~~is has~~ results in an altered eye color (altered phenotype).

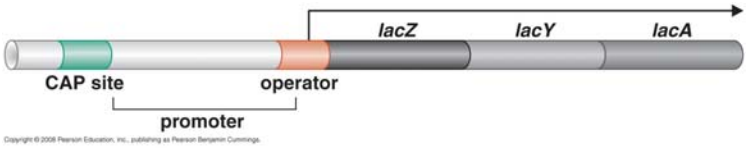
2pts 18The phenomenon is called position effect heterochromatin spreading ½ credit

2pt 19 What role of the insulator in heterochromatin spreading ?
insulator prevents (blocks) the spread of heterochromatin

2 pts 20 Distinguish between constitutive and facultative heterochromatin?
Constitutive heterochom: always condensed – all cells
Facultative heterochom: condensed in some cells and decondensed in others (where genes are expressed)

2pts 21 Why are genes not transcribed in heterochromatin? Genes adjacent to heterochromatin are turned off due to proteins (HP1 for example)binding to histones/ DNA and preventing access (usually methylated histone/methylated DNA)

22-27 .(2pts each) Identify the region of the **lactose operon** that is bound (if any) by each DNA binding protein under the condition indicated. Use figure of the Lac operon for reference. Essentially same question as on Ex2



22. Lac repressor in the absence of lactose? Binds operator

23. RNA polymerase II in the absence of lactose? Does not bind – **eukaryotic RNA pol**

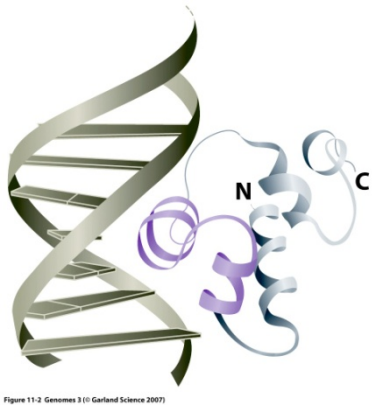
24. RNA polymerase II in the presence of lactose?_ Does not bind – **eukaryotic RNA pol**

25. E coli RNA polymerase in the presence of lactose? Binds promoter

26. Gal 4 in the presence of galactose? Does not bind – **eukaryotic transcription fact**or

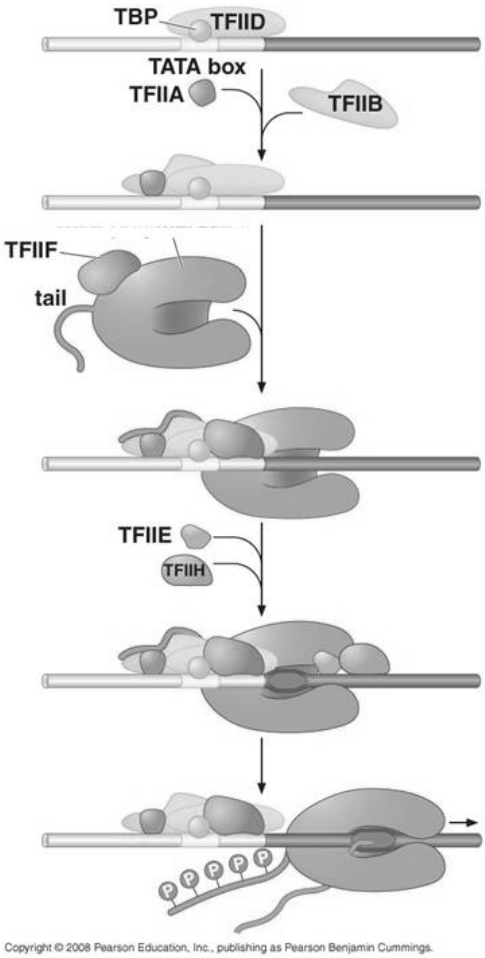
27 CRP in the absence of glucose? Binds CAP site

This figure shows the interaction between the E. coli bacteriophage 434 repressor and the DNA sequence to which it binds.



2pts 28 What kind of DNA binding motif is shown?_____
Helix- turn-helix_____

2pts 29How does the domain interact with DNA_____amino acid side chains in alpha helix interact with bases in the MAJOR GROOVE of the DNA_____



2pts 30Which RNA polymerase initiates transcription in this manner shown in the figure (be specific)? RNA polymerase II

2pts 31What happens when TBP binds DNA?
TBP binds DNA in the minor groove and causes DNA to bend. Then it recruits additional general transcription factors which then recruit RNA polymerase II complex_____

2pts 32TFIIH has several roles in transcription.
Identify one role that TFIIH plays in transcription initiation.
Helicase activity assists in formation of open complex
Kinase is involved in phosphorylation of carboxylterminal domain_____

(2pts) 33 The largest subunit of RNA polymerase II contains a distinct carboxyterminal domain (CTD) which has several roles in RNA transcription and processing.
At initiation the CTD is unmodified. What change occurs in the CTD as the RNA pol II transitions from intiation to elongation? Phosphorylation at specific sites on CTD signals transition to elongation (Serines are phosphorylated- if specific Ser is mentioned must say Ser 5)

(2pts) 34 Which basal transcription factor is required for transcription initiation from all 3 eukaryotic RNA polymerases? TATA binding protein (TBP)

2pts 35What is the role of the basal transcription factor that is involved in transcription initiation from all eukaryotic RNA polymerases? TBP is the positioning factor for RNA polymerases. Transciption factor containing TBP positions RNA polymerase at the promoter. Saying that TBP binding TATA box is only partially correct since TBP also involved in pol I and pol III

2pts 36 How is the promoter for eukaryotic tRNA genes different from promoters for most bacterial genes? Promoter for tRNA genes is internal. Consensus sequences for transcription factor binding are locating within the transcribed region

2pts 37 How is the promoter for eukaryotic Pol II genes similar to bacterial promoters? TATA box has similarity to bacterial -10 sequence. Both sequences are AT rich (melt more easily)

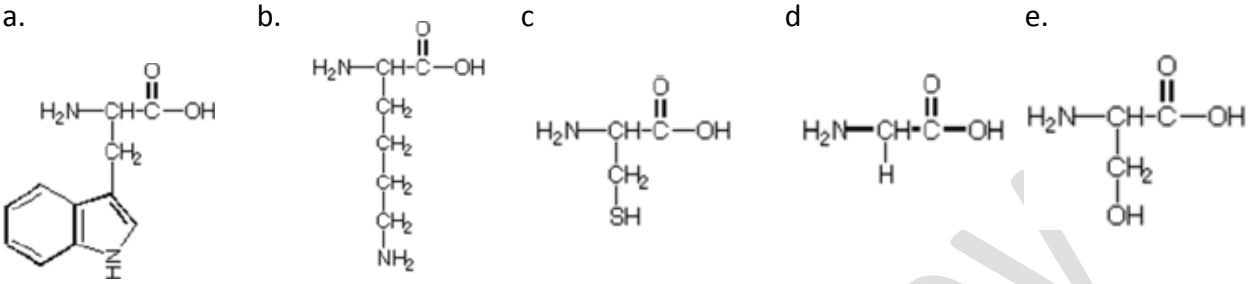
Use the one letter OR the 3 letter code for **your answer to the following**

2pts 38Identifiy one amino acid that is subject to modification via phosphorylation Ser, Thr, Tyr STY

2pts 39Identify one amino acid subject to modification via methylation Arg, Lys,His RKH

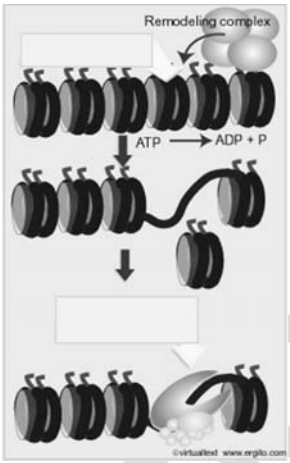
2pts 40Identify one amino acid subject to modification via glycosylation Ser, Thr, Asn STN

a. b. c d e.



2pts 41 Which figure shows the structure of serine? E

2pts 42 Which figure shows the structure of lysine? B



2pts 43 What is nucleosome remodeling? The alteration of the association of DNA and histone (requires energy) (extreme form of remodeling in figure – remove histone but can slide histone to expose sequences)

2pts 44 Nucleosome remodeling complexes such as SWI/SNF and NURF contain ATPases but do not contain proteins that bind DNA in a sequence specific manner. How are they able to alter gene expression of a specific gene?

Nucleosome remodeling complexes are recruited to the region of DNA by sequence specific DNA binding proteins

(2 pts) 45 The Sin3 complex includes two histone deacetylases (HDAC1 and HDAC2) What effect does this complex have on gene expression?

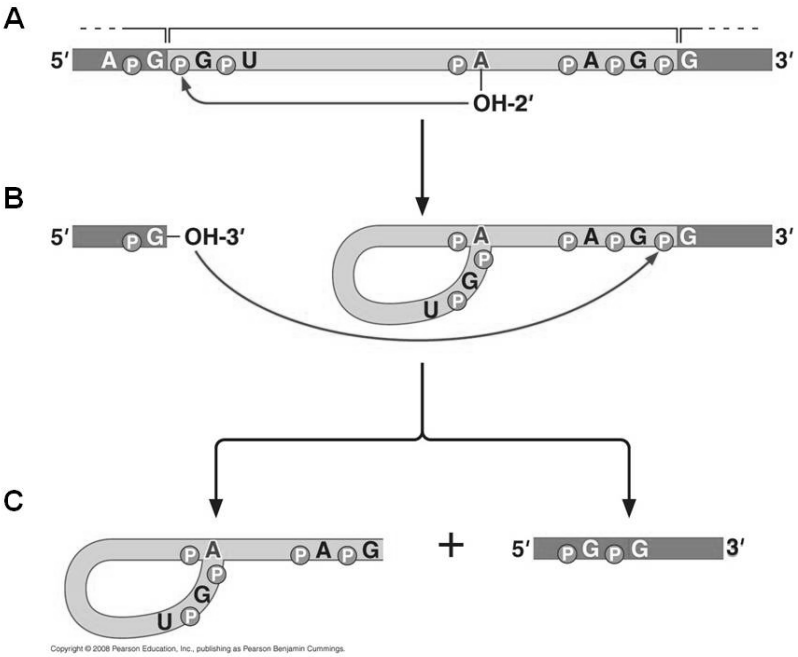
Repress gene expression by removing acetyl groups from histones

2pts 46 A partial sequence of the N terminal end of histone H3 is shown. Which amino acid is modified by histone acetyl transferase? NH_2------Arg_8, Lys_9, Ser_{10},Thr_{11}----------COOH

Lysine 9

2pts 47What affect (if any) does histone acetylation have on gene expression of the nearby gene?

Acetylation of lysine (histone) is associated with turning on of gene expression



3pts 48 Label intron(s) and exon(s) in panel A of the figure.

Dark boxes(ends) – exons

Light box (middle) intron

(1 pt each)

2pts 49 Circle the structure in panel C that remains in the mRNA after the splicing reaction is completed

Structure on right **circled**

2pts 50What component of the spliceosome binds to 5' splice site? U1 snRNP /U1snRNA

2pts 51 What spliceosomal component attaches to branch point? U2 snRNP/(U2 snRNA

2pts 52 How is tRNA splicing different from mRNA splicing?

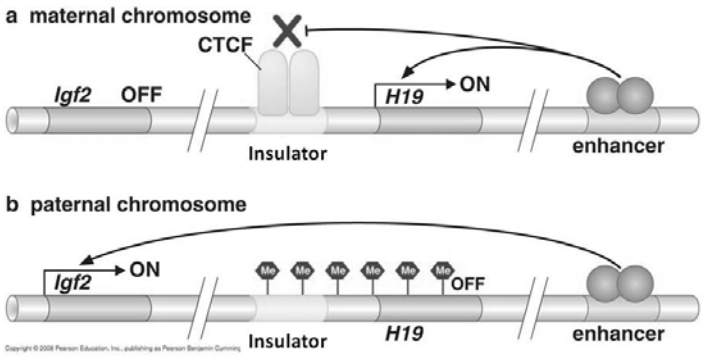
No spliceosome. Nuclease cuts ends of intron (yields unusual 5' and 3' ends) which are then ligated (after phosphodiesterase and kinase)

BIOL 4620 Molecular Biology
Exam 3: April 16, 2010 Name

The sexual development of female Drosophila results from a cascade of alternative splicing events. Functional Tra which produced only in female flies is an SR protein.

2pts 53 What is an SR protein? Serine and arginine rich protein that is involved in splicing. Has RRM (RNA recognition motif) and RS domain (protein-protein interaction)

2pts 57 What epigenetic phenomenon is illustrated in this figure?

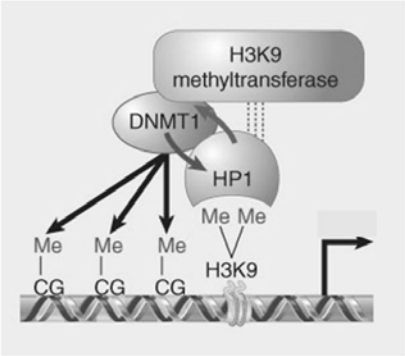


imprinting

2pts 58 Why is the maternal copy of Igf2 not expressed?

Insulator blocks effect of enhancer

2pts 59 Why is the methylated (paternal) copy of H19 not expressed? Methylated DNA is associated with proteins with prevent transcription of the gene (linked with histone methylation and heterochromatin formation)



BONUS questions

2pts B1) Segment identity is determined by homeotic selector genes. Only one homeotic gene is expressed in a given segment. What is the role of ***polycomb*** *in this process? Polycomb* ***maintains the heterochromatin silencing*** *established when homeotic gene expressed*

Bonus2 (1pt) How does DNA and histone methylation this affect the expression of the gene shown in the figure? No expression of gene

If extra info is added it must be correct or no credit!

(Methylated H3K9 and methylated DNA bound by protein which blocks binding of activators/ transcription apparatus)