BIOCHEMISTRY 2

PAST QUESTIONS

GHABSA PRESIDENT
HOPEFUL
TEAM SELORM "17
TOGETHER WE CAN
BY EDDY

KWAME NKRUMAH UNIVERSITY OF SCIENCE AND TECHNOLOGY
COLLEGE OF SCIENCE
DEPARTMENT OF BIOCHEMISTRY AND BIOTECHNOLOGY

B.Sc (Biochemistry) Mid-semester Examinations, 2014
Second Year

BCHEM 254 METABOLISM IN HEALTH AND DISEASES II

17th March 2014 25 marks Time: 1 HR

Attempt ALL Questions

1. Describe the necessary conditions and activity of pepsin. [2 marks]
2. What is protein turnover and its importance? [2 marks]
3. List the enzymes involved in the tagging of ubiquitin to proteins. [3 marks]
4. Distinguish between proteasomes and proteases. [2 marks]
5. What enzyme is involved in the deamination of threonine? [1 mark]
6. Define glucogenic amino acids and give four (4) examples. [4 marks]
7. What is the underlying cause of the maple syrup urine disease? [2 marks]
8. The urea cycle consists of four steps. Illustrate the main substrates of the pathway. [4 marks]
9. Distinguish between Chylomicrones, LDL and HDL [5 marks]

Size	Largest	medium	smallest
Protein	Low	High	highest
Density	low	High	Highest
		Carries of Plasma Cholesterol	Transporter of Cholesterol to liver

1) ~~optimum pH of 2~~ and
2) operates @ an optimum pH of 2 and catalyzes non specific hydrolysis of peptide bond. It is a proteolytic enzyme

C. LARBIE

2) Protein turnover is the degradation and the synthesis of proteins and it is important in maintaining a constant amount of amino acids that are broken down into oxaloacetate, pyruvate, α-KG, succinyl CoA, fumarate, alanine, glycine, Asparagine, proline

3) E1 - Activating enzyme
E2 - Conjugating enzyme
E3 - Protein Ligase

Ile
Trp Thr
Tyr
Phe

KWAME NKRUMAH UNIVERSITY OF SCIENCE AND TECHNOLOGY, KUMASI.

COLLEGE OF SCIENCE
DEPARTMENT OF BIOCHEMISTRY AND BIOTECHNOLOGY

B.Sc Biochemistry Midsemester Examinations, 2012
Second Year

BCHEM 254 METABOLISM OF NUTRIENTS II 1 HR

March, 2012

ATTEMPT ALL QUESTIONS

1. Explain how pyruvate dehydrogenase complex is regulated through covalent modification. [6 marks]

   b. What is the role of lipoic acid in the pyruvate oxidation reaction? [2 marks]

   c. Explain the toxic action of fluoroacetate. [5 marks]

   d. Name the enzymes and the coenzymes involved in the oxidative decarboxylation of α-ketoglutarate. [5 marks]

2. Distinguish between the process of breakdown of glycogen in the gastrointestinal tract and the breakdown of the same carbohydrate in the muscle cell. [4 marks]

   What is the advantage of each of the process to the organism. [4 marks]

   Explain the presence of glucose-6-phosphatase in the liver cell and the absence of the same enzyme in muscle cells. [5 marks]

3. Write the equation to represent the reaction catalysed by phosphofructokinase. [2 marks]

   What role does phosphofructokinase play in the gylcolytic pathway, and how does it do it? [8 marks]

   Explain how ATP acts as a substrate as well as a modulator in the phosphofructokinase reaction. [4 marks]

   Explain why the enzyme hexokinase is inhibited by its reaction product while glucokinase is not inhibited by its reaction product. [6 marks]

F K N ARTHUR

BCHEM 867
Biophysics
First Semester 2012
Homework Assignment 2

Due Fri. Oct. 12, 2012

Read the article attached
Nishizawa et al. 1988. Determination of molecular weight of native proteins by polyacrylamide gradient gel electrophoresis. *Biochemistry* 9:803-806

Answer the following questions

1. Why is the method used by the researchers described as nondenaturing? because the proteins do not denature after the electrophoresis
2. Explain the advantage of using gradient gel over use of many gels in two sentences
3. What material was used to make the gradient gel?
4. Why did the researchers use standard proteins for this work?
5. What buffers were used? What was the purpose of using different pH of the buffers? This HCl
6. Why was trichloroacetic acid used in the electrophoresis protocol? To fix the proteins
7. Write the equation which governs the mobility of proteins in a nondenaturing gel and explain the parameters $\log R_m = \log Y_0 - K_R T$
8. Why would you have a plot of slope against molecular weight of the proteins?
9. Identify any demerits of this protocol for molecular weight determination
10. What would you do to improve upon this protocol

2. (a) It is linear ~~time~~ ~~after~~ polymerization, the gel length
(b) Negligible contraction and swelling of gel/film

4. To prove the accuracy of this ~~method~~ improved method

6. ~~The~~ This method ensured the determination of slope and MW of enzymatically active ADH

5. ~~Diff~~ pH of buffers were used to give direction to the protein. Thus to ~~help~~ make them migrate toward the anode (pH 8) or cathode pH (9.1)

9. To help researchers to deduce the MWt of unknown proteins by comparing them with the standard proteins whose MWt are adequately and accurately known.

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Name_____ Chapter 9: Photosynthesis: Capturing Energy
Mrs. Laux AP Biology Take home test #6

DUE: MONDAY, NOVEMBER 1, 2010

MULTIPLE CHOICE QUESTIONS

1. Light behaves not only as waves, but also as particles, which are referred to as:

   A. electrons.
   B. protons.
   C. photons.
   D. radiation.
   E. neutrons.

2. An electron absorbs a photon of light energy and becomes energized; the electron shifts from a _____ atomic orbital to a _____ atomic orbital.

   A. high energy; low energy
   B. fluorescing; ground state
   C. ground state; low energy
   D. low energy; high energy
   E. None of the answer choices are correct.

3. Electrons that are excited to a higher energy level may be transferred to an electron acceptor or may return to a ground state. If the latter occurs, energy will be released in a process known as:

   A. photoelectron degradation.
   B. fluorescence.
   C. photoelectron hydrolysis.
   D. porphyrin.
   E. photoelectron deconfiguration.

4. Chlorophyll consists of a porphyrin ring that contains a single atom of:

   A. manganese.
   B. magnesium.
   C. phosphorus.
   D. nitrogen.
   E. iron.

5. Chlorophyll molecules are attached to thylakoid membranes by:

   A. a long hydrophobic tail.
   B. the porphyrin ring.
   C. the methyl group.
   D. a magnesium ion.
   E. a hydroxide group.

6. Chlorophyll and accessory photosynthetic pigments are associated with the:

   A. stroma.
   B. thylakoid membranes.
   C. mesophyll membranes.
   D. light reaction centers of the stroma lamellae.
   E. stroma grana.

Name_____ Chapter 9: Photosynthesis: Capturing Energy
Mrs. Laux AP Biology Take home test #6

DUE: MONDAY, NOVEMBER 1, 2010

7. The most important photosynthetic pigment(s) is(are):

A. carotenoids.
B. xanthophylls.
C. chlorophyll *a*.
D. chlorophyll *b*.
E. All of these are equally important for photosynthesis.

8. The _____ of a chlorophyll molecule is (are) responsible for absorbing light.

A. carbon atoms
B. porphyrin ring
C. methyl group
D. magnesium ion
E. long hydrophobic tail

9. In a chloroplast, there is an outer and an inner membrane. The inner membrane encloses a fluid filled region called the:

A. grana.
B. thylakoid.
C. stroma.
D. pigment.
E. electron acceptor.

10. The thylakoid membrane encloses a space called the:

A. lumen.
B. stroma.
C. granum.
D. mesophyll.
E. porphyrin.

11. Thylakoid membranes are involved in _____ synthesis.

A. glucose
B. NADP
C. ATP
D. RuBP
E. PEP

12. Chlorophyll:

A. reflects red and blue light, and absorbs green light.
B. transmits red and blue light, and absorbs green light.
C. transmits red and blue light, and reflects green light.
D. absorbs red and blue light, and reflects green light.
E. absorbs red, blue, and green light.

13. Accessory photosynthetic pigment that expands the spectrum of light that provides energy for photosynthesis:

A. carotenoids.
B. chlorophyll *a*.
C. chlorophyll *b*.
D. Both caroternois and chlorophyll *a*.
E. Both carotenoids and chlorophyll *b*.

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Name_____ Chapter 9: Photosynthesis: Capturing Energy
Mrs. Laux AP Biology Take home test #6

DUE: MONDAY, NOVEMBER 1, 2010

14. The action spectrum of photosynthesis best matches the absorption spectrum of:

A. NADPH.
B. carotenoids.
C. chlorophyll.
D. xanthophylls.
E. anthocyanin.

15. Chlorophyll absorbs primarily _____ and _____ regions of the visible spectrum.

A. blue; red
B. green; yellow
C. red; green
D. red; yellow
E. blue; yellow

16. Engelmann concluded that chlorophyll in the chloroplasts is responsible for photosynthesis based on the following results:

A. *Spirogyra* cells each contain a long, spiral-shaped, emerald-green chloroplast embedded in the cytoplasm.
B. The action spectrum of photosynthesis matched the maximum production of oxygen by *Spirogyra*, observed by the greatest accumulation of bacteria in the blue and red regions of the spectrum.
C. Bacteria exposed to the action spectrum for photosynthesis showed no preference to any particular color of light.
D. Accessory pigments transfer some of the energy of excitation produced by green light to chlorophyll molecules.
E. None of these answer choices is correct.

17. The overall reactions of photosynthesis are best summarized as:

A. $12\ CO_2 + 6\ H_2O \rightarrow C_6H_{12}O_6 + 12\ O_2 + 6\ H_2O$.
B. $C_6H_{12}O_6 + 6\ O_2 + 6\ H_2O \rightarrow 6\ CO_2 + 12\ H_2O$.
C. $6\ CO_2 + 12\ H_2O \rightarrow C_6H_{12}O_6 + 6\ O_2 + 6\ H_2O$.
D. $6\ CO_2 + 12\ H_2O \rightarrow C_6H_{12}O_6 + 12\ O_2$.
E. $6\ H_2CO_3 + 6\ H_2O \rightarrow C_6H_{12}O_6 + C_6H_{12}O_6 + 6\ H_2O + 6\ O_2$.

18. During the reactions of photosynthesis, _____ is reduced and _____ is oxidized.

A. O_2; $C_6H_{12}O_6$
B. CO_2; $C_6H_{12}O_6$
C. H_2O; $C_6H_{12}O_6$
D. O_2; H_2O
E. CO_2; H_2O

19. In the overall reactions of photosynthesis, it appears that hydrogen atoms are transferred from water to carbon dioxide to form a carbohydrate. This type of reaction is classified as:

A. a redox reaction.
B. an anaerobic reaction.
C. a catabolic reaction.
D. an oxidation reaction.
E. a hydrolytic reaction.

Name_____ Chapter 9: Photosynthesis: Capturing Energy
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DUE: MONDAY, NOVEMBER 1, 2010

20. The reactions of photosynthesis are divided into two categories:

A. light-independent reactions and carbon fixation reactions.
B. carbon fixation reactions and oxygen fixation reactions.
C. light-dependent reactions and carbon fixation reactions.
D. light-dependent reactions and citric acid cycle.
E. chemiosmosis and photochemical reactions.

21. In photosynthesis, ATP and NADPH are produced during:

A. the carbon fixation reactions.
B. the light-dependent phase.
C. the light-independent phase.
D. glycolysis.
E. photolysis.

22. The reactants of the light-dependent reactions are:

A. H_2O, ADP, and $NADP^+$.
B. ~~CO_2, ADP, and $NADP^+$.~~
C. H_2O, ATP, and NADPH.
D. ~~CO_2, ADP, and NADPH.~~
E. ~~H_2O, CO_2, and $NADP^+$.~~

23. The reactants of the Calvin cycle are:

A. H_2O, ATP, and NADPH.
B. CO_2, ADP, and $NADP^+$.
C. CO_2, ATP, and NADPH.
D. H_2O, ATP, and NADPH.
E. CO_2, H_2O, and ATP.

24. Which of the following is *not* associated with the thylakoid membranes?

A. photosystems I and II
B. the Calvin cycle
C. electron transport chain
D. ATP synthase
E. antenna complex

25. $12\ H_2O + 12\ NADP^+ + 18\ ADP + P_i \rightarrow 6\ O_2 + 12\ NADPH + 18\ ATP$ summarizes the _____ reactions of photosynthesis.

A. carbon fixation
B. light-dependent
C. light-independent
D. CAM
E. electron transport

26. The electron transport chain of photosynthesis is located in the:

A. cristae.
B. mitochondria.
C. outer chloroplast membrane.
D. chloroplast stroma.
E. thylakoid membrane.

Name_____ Chapter 9: Photosynthesis: Capturing Energy
Take home test #6
Mrs. Laux AP Biology
DUE: MONDAY, NOVEMBER 1, 2010

27. Reaction center complexes of the light-dependent reactions contain _____ and _____, which receive energy from _____.

A. accessory pigments; chlorophyll; antenna complexes
B. carotenoids; proteins; chlorophyll
C. chlorophyll; antenna complexes; carotenoid
D. proteins; antenna complexes; carotenoid
E. chlorophyll; proteins; antenna complexes

28. How many electrons are needed to reduce one molecule of $NADP^+$ to NADPH?

A. 1
B. 2
C. 3
D. 4
E. 5

29. During the light-dependent reactions of photosynthesis, a constant supply of electrons is provided by:

A. water.
B. oxygen.
C. the sun.
D. chlorophyll.
E. carotenoids.

30. Oxygen produced by photosynthesis comes directly from:

A. light.
B. CO_2.
C. glucose.
D. H_2O.
E. ATP.

31. ATP is formed when _____ _____ the thylakoid lumen.

A. hydrogen ions enter
B. hydrogen ions leave
C. electrons enter
D. electrons leave
E. water is split in

32. The synthesis of ATP as a result of the light-dependent reactions of photosynthesis is an _____ reaction that is coupled to the diffusion of _____ down their concentration gradient.

A. endergonic; protons
B. energy-releasing; hydrogen ions
C. exergonic; electrons
D. energy-acquiring; electrons
E. oxidation; water

33. The synthesis of ATP during photosynthesis or respiration occurs as a result of:

A. phosphorylation of AMP.
B. phosphorylation of ATP.
C. phosphorylation of ADP.
D. phosphorylation of G3P.
E. oxidation of NADPH.

Name_____ Chapter 9: Photosynthesis: Capturing Energy
Mrs. Laux AP Biology Take home test #6

DUE: MONDAY, NOVEMBER 1, 2010

34. The first step in the Calvin cycle is the attachment of carbon dioxide to:

A. Rubisco.
B. glyceraldehyde 3-phosphate (G3P).
C. phosphoglycerate
D. RuBP (ribulose bisphosphate).
E. None of the above.
E. None of these; all are shared by both processes.

35. Which of the following is common to both photosynthesis and aerobic respiration?

A. $NADP^+$ and NADPH
B. glycolysis
C. chemiosmosis
D. CO_2 and O_2 as end products
E. thylakoids

36. Ribulose phosphate is synthesized from:

A. $NADP^+$.
B. pyruvate.
C. G3P.
D. RuBP.
E. CO_2.

37. Which of the following is *not* one of the intermediates or products of the carbon fixation reactions?

A. NADPH
B. phosphoglycerate (PGA)
C. glyceraldehyde 3-phosphate
D. glucose
E. ribulose bisphosphate

38. In C4 plants, reactions that fix CO_2 into four-carbon compounds occur in:

A. guard cells.
B. epidermal cells.
C. bundle sheath cells.
D. mesophyll cells.
E. xylem cells.

39. At night, CAM plants incorporate CO_2 into _____, which is stored in the _____ of their cells.

A. fructose; vacuoles
B. acetyl CoA; mitochondria
C. glucose; starch granules
D. pyruvate; starch granules
E. malate; vacuoles

40. Animals, fungi, and many bacteria that use organic molecules as a source of both energy and carbon are:

A. photoautotrophs.
B. catabolic autotrophs.
C. chemoheterotrophs.
D. photoheterotrophs.
E. chemoautotrophs.

8000 +1/2

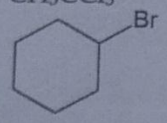
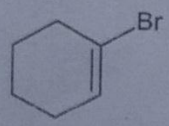
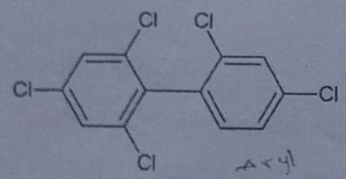
KWAME NKRUMAH UNIVERSITY OF SCIENCE AND TECHNOLOGY
COLLEGE OF SCIENCE
DEPARTMENT OF BIOCHEMISTRY AND BIOTECHNOLOGY

B.Sc (Biochemistry) Mid-semester Examinations, 2014
Second Year

BCHEM 258 ORGANIC CHEMISTRY II

24th April 2014 Time: 1 HR

Attempt ALL Questions

1. Classify each compound as an alkyl halide, a vinyl chloride or an aryl halide;
   A. $CH_3CHCFCH_3$
   B. $(CH_3)_3CBr$
   C. CH_3CCl_3
   D. 
   E. 
   F. 

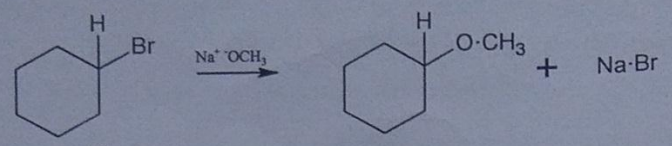
2. For each of the pair of compounds, predict which one has the higher molecular dipole moment and explain your reasoning;
   A. Ethyl chloride or ethyl iodide
   B. 1-Bromopropane or cyclopropane

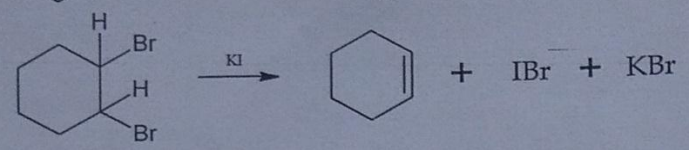
3. When water is shaken with hexane, the two separate into two phases. Which compound is present in the top phase and which is present in the bottom phase? Explain your observation.

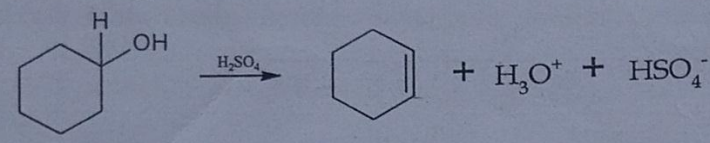
4. Propose a mechanism for the reaction;

$$H_2C{=}CH{-}CH_3 + Br{-}Br \xrightarrow{h\nu} H_2C{=}CH{-}CH_2Br + HBr$$

5. Classify each reaction as a substitution, elimination or neither. Identify the leaving group in each reaction and the nucleophile in substitution.

A. 

B. 

C. 

6. Show how you might use S_N2 reactions to convert 1-chlorobutane into butan-1-ol.

7. Choose the member of each pair that will react faster by the S_N1 mechanism.

   A. 1-Bromopropane or 2-bromopropane

   B. 2-Bromo-2-methylbutane or 2-bromo-3-methylbutane

   C. n-Propylbromide or allyl bromide

   D. 2-Bromo-2-methybutane or ethyl iodide

8. Propose a mechanism for the reaction of acetic anhydride with water.

9. Two amides are obtained from the reaction of acetyl chloride with a mixture of ethylamine and propylamine. Identify the amides.

10. Write the mechanism for the acid-catalyzed transesterification reaction of methyl acetate with ethanol.

C. Larbie

H.E. Lutterodt

KWAME NKRUMAH UNIVERSITY OF SCIENCE AND TECHNOLOGY, KUMASI

COLLEGE OF SCIENCE

DEPARTMENT OF BIOCHEMISTRY

B.Sc (Biochemistry) Second Semester Mid-Semester Examination

BCHEM 260: PHYSICAL CHEMISTRY II

APRIL, 2013 TIME: $1\frac{1}{2}$ HOURS

Attempt ALL questions

1. (a) What is quantum mechanics?

   (b) Explain, very briefly, how Planck's theory of black body radiation (1900), Einstein's theory of the photoelectric effect (1905), Bohr's theory of the hydrogen atom (1913) and de Broglie's hypothesis of particle-wave duality (1924) together led to the demise of the classical mechanics.

2. Calculate the de Broglie wave length associated with a tennis ball of mass 50 g served at 250 km/h. Hence comment on the wave character of macroscopic objects such as a tennis ball.

3. The red color of hemoglobin (and therefore of blood) is a consequence of the strong absorption of this protein of yellow and green light in the wavelength range 500 – 600 nm, and also of the blue light in the wavelength range 400 – 450 nm, leaving only red light transmitted. What is the energy of a quantum of yellow light absorbed by hemoglobin at 550 nm?

4. (a) State and explain the Heisenberg's Uncertainty Principle.

   (b) Distinguish between the Heisenberg's Uncertainty Principle and the Measurement Disturbance Relation and describe how the latter may be violated.

   (c) (i) Suppose the speed of an electron is known to within 1 μms^{-1}. Calculate the minimum uncertainty in its position.

   (ii) Repeat the calculation in (i) above for a tennis ball of mass 58 g.

   (iii) On the basis of (i) and (ii) above, comment on the consequence of the Uncertainty Principle for macroscopic particles.

Physical Chemistry

2. mass = 50g v = 250km/h $v = \frac{250000\,m}{3600\,s} = 69.44\,m/s$

∴ mass = 0.05 kg

$\lambda = \frac{h}{mv}$ ~~from~~ de Broglie wavelength.

$\lambda = \frac{6.626 \times 10^{-34}\,Js}{0.05kg \times 69.44m/s}$ $250 \times \frac{1000}{3600}$ $\frac{50}{1000}$ 0.05kg 69.44m/s

$\lambda = 1.908 \times 10^{-34}\,m$

Macroscopic substances have insignificant wavelength due to its large mass.

3.0x10^8

3. $E = h\nu$

$h = 6.626 \times 10^{-34}\,Js$

$\nu = \frac{c}{\lambda} = \frac{3.0 \times 10^{8}\,m/s}{550 \times 10^{-9}\,m}$

$\nu = 5.455 \times 10^{14}\,Hz$

∴ $E = 6.626 \times 10^{-34}\,Js \times 5.455 \times 10^{14}\,Hz$

$E = 3.614 \times 10^{-19}\,J$

4. Speed of é = $1\,\mu ms^{-1}$.

Minimum uncertainty in its position from Heisenberg's Uncertainty Principle

$\Delta x = h / 4m\pi\,\Delta v_x$

10^{8+9} $10^{17-9-3} \times 10^{-5}$ 17+-3 17-3

15

mass of an electron = 9.1×10^{-31}

40) $\Delta x = \dfrac{6.626 \times 10^{-34}\ Js}{4\pi \times 9.1 \times 10^{-31}\ kg \times 1 \times 10^{-6}\ ms^{-1}}$

$\Delta x = \underline{\underline{57.94\ m}}$

ii) mass of tennis = 58 g = 0.058 kg.

$\Delta x = \dfrac{h}{4\pi m \Delta v_x}$

$\Delta x = \dfrac{6.626 \times 10^{-34}\ Js}{4\pi \times 0.058\ kg \times 10^{-6}\ ms^{-1}}$

$\Delta x = \underline{\underline{9.091 \times 10^{-28}\ m}}$

iii) Macroscopic particles have negligible uncertainty due to its large mass. The more the wavelike character, the higher the uncertainty. As compared to microscopic particles which have a significant uncertainty and wavelike character due to its small mass.

c) Heisenberg's Uncertainty Principle depends on the intrinsic nature of the particle and the wave-particle duality of substance. This duality introduces uncertainty in determining the momentum and position of a electron / macroscopic substance simultaneously while the Measurement Disturbance Relation is due to ~~an~~ errors, introduced ~~into the~~ due to the method of measurement. The act of measurement causes a disturbance in the velocity / momentum of a particle. The measurement of the position of an electron is done using Electromagnetic radiations and this impacts on the electron by changing its momentum depending on the frequency of the radiation used in measurement.

Thus the uncertainty principle refers not to the precision and disturbance of a measurement, but to the uncertainties intrinsic in the quantum state. The Measurement Disturbance Relation can be violated by using weak measurement which reduces drastically the errors / disturbance caused by measurement.

9a. Heisenberg's uncertainty principle states that it is impossible to specify simultaneously, with arbitrary precision, the position and momentum of a particle. The Heisenberg's uncertainty principle is not a result of measurement but originates in the intrinsic uncertainty of all subatomic, quantum systems, due to the fact that particles exist in states of probability, rather than certainty. It is due to the wave-particle duality of substances in ~~of sub~~ quantum mechanic systems. The uncertainty restricts the precision with which complementary

observables may be specified.

$\Delta x \Delta p_x = h/4\pi$

1. Quantum mechanics is a mathematical machine ~~used~~ for predicting and interpreting the behaviours of microscopic and submicroscopic objects ~~based~~ on the idea of an essential discontinuity, the quantum. In Quantum mechanics, the energy of a system is quantized and it also agrees with the wave-particle duality of substances.

Planck's theory of black body

KWAME NKRUMAH UNIVERSITY OF SCIENCE AND TECHNOLOGY, KUMASI

FACULTY OF SOCIAL SCIENCES

DEPARTMENT OF MODERN LANGUAGES

Mid-Semester Exams (30 marks) April 2014 1hr

NAME: [illegible]

INDEX NUMBER: 8000412

DEPARTMENT: Biochemistry 2

8/30

Section A (5 marks)

You are booking a hotel; fill the dialogue

Bonjour Madame

- Bonjour, qu'est ce que je ..... faire pour vous ? (a) pourrait (b) peut (c) pourrais (d) peuvent
- S'il vous plait, je..... Abdullah, (a) m'appelle, (b) m'appelles (c) m'appelles (d) m'a présente
- je ..... réserver deux chambres (a) voudrais (b) veut (c)veulent (d) veux
- C'est ..... la chambre ? (a) combien (b) beaucoup (c) mince (d) combiens
- La chambre..... 40 cedis par nuit (a) cour (b) cours (c) coûte (d) coûtons
- ..... l'argent Madame, 40cedis pour deux chambres
- Merci. (a) Voici (b) c'est (c) combien (d) chers

money

2

Section B (10marks)

Rewrite in the past tense how Richard Aidoo, a photographer, spends his day

Je commence ma journée de travail à 10 heures. Je pars à l'agence de publicité. Je discute avec mes copains. Et je regarde les futures compagnes publicitaires. Les directeurs arrivent à 12

19

heures et les premiers mannequins à 14 heures. A 16 heures, je vais avec mon ami Charles au café. Apres le café nous regardons un peu les titres des journaux au kiosque et ensuite nous retournons à l'agence. A la fin de la journée, je téléphone au bureau de ma petite amie et nous fixons l'heure du diner.

Exemple : Hier, j'ai commencé ma journée de travail à 10 heures

J'ai Commencé ma journée de travail à 10 heures. Je parsement à l'agence de publicité. Je discute discutiment avec mes copains. Et je regardement les futures compagnes publicitaires. Les directeurs arrivent à 12 heures et les premiers mannequins à 14 heures. A 16 heures, je ~~vais avec~~ vas avec mon ami Charles au café. Apres le café nous regardons un peu les titres des journaux au kiosque et ensuite nous retournons à l'agence. A la fin de la journée, je téléphone au bureau de ma petite amie et nous etré fixons l'heure du dinner

1

Section C (10 Marks)

Recount in a chronological order how you started your day, using the following verbs/activities using the linking words. (Tout d'abord, et puis .... etc

se doucher, s'habiller, s'endormir, se déshabiller, se brosser les dents, se raser/se maquiller, se réveiller, se coucher, se coiffer, se leyer

Je me suis réveillé à 7 heures. Tout d'abord je me suis douché et brosse les dents.
Je me suis levé et je me suis deshabillé.
Je me suis couché et puis je me suis rasé.
Je me suis coiffer et.
J'ai habiller

2

20

Section D (5marks)

One day a young man went to Stanchart to open an account. Complete the dialogue that follows using the corrects answers in brackets

Client : Bonjour monsieur

Banquier : ……. (a. Bonsoir, vous êtes gentil b) Bonjour, que pourrais-je fais pour toi , c.) Bonne nuit, à demain d.) bonjour que pourrais-je faire pour vous

Client – je ……ouvrir un …… (a) pourrais, ouvrir un e-mail (b) voudrait un compte bancaire (c) aimerais ouvrir un compte bancaire (d) souhaiterai ouvrir un compte

Comment …….. appelez ? (a) nous (b) nous nous (c) vous vous

Je m'appelle Richard Annan comment …… votre nom (a) épelez (b) épeler (c)s'appeler (d) épelée

Mon nom de famille s'écrit A-N-N-A-N

Quel est votre ……(a) profession b) âge c) gout d) nom

Je suis informaticien.

3

Dickson Pimpong/Richard Okyere

reproduce

21

Futur proche

Preparer

Je preparer ai

Tu preparer as

il/elle/on preparera

Nous preparerons

Vous preparerez

ils/elles/preparerons

Je ferai
Tu feras
il/elle/on fera
Nous ferons
Vous ferez

faire
coudre
ecrire
emmener

midi - Quelle est il

Comment va-t-elle ?

nom:
prénom:
Age:
nationalité:

situation familiale
nombre d'enfants
profession
profession du mari:
gouts:
hobbies

La carte porte le nom officiel Ama Adu. Le nom c'est Ama tandis que le prénom c'est Larbie. Cette dame a 30 ans. D'une nationalité Sénégalaise, Madam Ama est mariée où elle a trois enfants.
Madam Larbie travaille comme secretaire chez l'Ambassade de la France en côte d'Ivoire son epoux, l'ingénieur vit avec sa femme. Les gouts de Madame Larbie ce sont, le sport et la lecture.

YEBDAH FELIX

KWAME NKRUMAH UNIVERSITY OF SCIENCE AND TECHNOLOGY, KUMASI
COLLEGE OF ART AND SOCIAL SCIENCES
FACULTY OF SOCIAL SCIENCES
DEPARTMENT OF MODERN LANGUAGES

Second Semester Examination, April-May, 2010

EC 182 : FRENCH FOR COMMUNICATION PURPOSES II TIME: TWO HOURS

CANDIDATE'S INDEX NUMBER: .....

DEPARTMENT: .....

Attempt all questions

A. Put the verbs in brackets into "*passé compose*". (10 marks)

1. J'/Je *(lire)* ....a....lu..... ton message. a'lu
2. Kwame *(rester)* ..est resté..... à la maison. est resté
3. Les garçons *(venir)* sont venu.. me voir hier. sont venus Elle est
4. Koñi et Marc *(adorer)* ...ont... adoré..... le concert. ont adoré
5. Caroline *(cacher)* a..... caché ses bijoux dans son armoire. est caché
6. Hier, Alice *(tomber)* est tombé..... dans l'escalier. est tombé nous avon vous avez
7. Alice et son frère *(aller)* sont allés..... à l'école. Sont allés
8. Lydia *(partir)* est parti..... à Tamale. est parti
9. Hier soir, on *(manger)* a mangé..... au restaurant. a mangé
10. Qu'est-ce que vous *(faire)* avez fait..... samedi ? avez fait

B. Complete with the correct pronoun :
(je, tu, il, elle, nous, vous, ils, elles) (8 marks)

1. ...Je.... viens à la fête de Paul jeudi ?
2. Qu'est-ce que ...vous..... voulez ? Du café ou du thé ?
3. ...Nous.....avons acheté une nouvelle voiture !
4. ...Elles..... vont arriver à quelle heure, tes amies ?
5. Pierre ? ...Il..... n'est pas là. Reviens à 8 heures.
6. Qu'est-ce que ...vous..... vous sers, madame ?
7. ...Je..... vends ma voiture.
8. ...Elles..... est folie, tarabe

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C. **Complete the sentences with the appropriate demonstrative adjectives:**
(ce, cette, cet, ces) (6 marks)

1. Tu connais ....cet....homme qui vient?
2. Marianne veut acheter ....ce.... vélo.
3. ....cette.... dame est très sympathique.
4. Jean revient avant la fin de ....cet.... année.
5. Sylvia, aide-moi avec ....ce.... paquet, s'il te plaît.
6. Ils sont insupportables ....cette.... enfants.

D. **Complete the following sentences using :** *du / les / de la / de l' / des.* (6 marks)

1. Il nous faut ....de la.... farine.
2. J'ai mangé ....du.... pain au petit déjeuner.
3. Vous avez ....des....œufs?
4. Vas m'acheter ....de l'.... huile.
5. Il y a ....du.... jus d'orange dans le frigo.
6. J'adore ....les.... pommes.

E. **Complete the following text using :** *du / de la / de l' / des / au / un / une* (10 marks)

J'aime manger....un....restaurant. Je prends toujours ....une.... entrée: ....au.... plat et ....du....dessert. En entrée, je choisis toujours ....de la....salade. Ensuite je prends ....de la.... viande ou ....du.... poisson avec ....des.... légumes. Pendant le repas, j'aime boire ....du.... verre de vin rouge. Pour le dessert je commande ....une.... glace.

F. **Complete the following sentences using the appropriate verbs:** *vouloir, pouvoir, aimer or avoir* **in the conditional mode as in the example below.** (10 marks)

0. -Est-ce que tu ***pourrais*** garder les enfants ?
   -D'accord.

1. -Tu n'....aurais.... pas 2 francs?

2. -Est-ce que nous ....pourrons.... aller au cinéma et dîner après ?
   -Ah non, on dîne d'abord et on va au cinéma après.

3. -Qu'est-ce que je/j' .... offrir à Doreen pour son anniversaire ?
   -Un foulard, elle adore les foulards

4. -Je ....veux.... une chambre pour deux personnes.

5. -J' ....aime.... prendre un rendez-vous avec le docteur.

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G. Read the dialogue and answer Right or Wrong to the questions which follow: (10 marks)

Charlotte : Si je comprends bien, vous souhaitez acheter une maison à la campagne.

Sébastien : C'est cela. Ma femme rêve d'avoir un jardin et moi j'adore la nature.

Charlotte : Où est-ce que vous avez prévu de vous installer ?

Sébastien : Ce n'est pas sûr, mais peut-être à Bordeaux. Nous irons y passer quelques jours pour visiter les maisons à vendre.

Charlotte : Moi aussi, je me demande si je ne vais pas chercher une petite maison à la campagne et cultiver mon jardin… Depuis le départ de mes enfants, je m'ennuie ici.

Sarah : Tu veux venir avec nous visiter des maisons, ça te donnera peut-être une idée ?

Charlotte : Pourquoi pas, vous partez quand ?

	VRAI	FAUX
1- Charlotte veut acheter une maison à la campagne.		
2- La femme de Sébastien adore la nature.		
3- Charlotte sait où Sébastien et sa femme veulent s'installer.		
4- Sébastien et sa femme partent s'installer définitivement à Bordeaux.		
5- Sébastien et sa femme ont déjà trouvé une maison.		
6- Charlotte préfère rester en ville.		
7- Les enfants de Charlotte vivent avec elle.		
8- Les enfants de Charlotte s'ennuient à la campagne.		
9- Sarah invite Charlotte à venir habiter chez elle et son mari.		
10- Charlotte n'est pas contre aller visiter des maisons avec Sarah et son mari.		

H. You have received the following invitation cards. You can honour only one. Write a letter to accept one and another letter to refuse the other giving reason for your inability to attend. (10 marks)

M. et Mme Henri DUBOIS

Le colonel et Mme MARTIAL

sont heureux de vous inviter au mariage de leurs enfants

Agnès et Bernard

qui sera célébré le 1er mai 2010 à 10 heures en l'église Saint Pierre à Paris.

R.S.V.P.

INVITATION

Pour fêter la fin des examens

J'organise une fête samedi 1er mai 2010

Rendez-vous à la salle des fêtes à 20 heures.

Merci de confirmer votre présence.

John

Qu'est-ce que c'est

Letter A

.....

.....

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.....

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.....

.....

.....

Letter B

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.....

.....

Dr. Albert Yegblemenawo
Mr. Michael Damoah
Miss Lydia Barneoud
Miss Joëlle Haller
Mr. Dickson Pimpong

26

YEBOAH FELIX

KWAME NKRUMAH UNIVERSITY OF SCIENCE AND TECHNOLOGY, KUMASI

COLLEGE OF ART AND SOCIAL SCIENCES

DEPARTMENT OF MODERN LANGUAGES

End of Second Semester Examination, April-May, 2011

FC 182: FRENCH FOR COMMUNICATION PURPOSES II TIME: TWO HOURS

CANDIDATE'S INDEX NUMBER: .....

DEPARTMENT: .....

Attempt all questions on the QUESTION PAPER

A. Choose the correct answer to complete the following sentences. /10

1. Kofi.....ses amis hier.
   a) est visité b) va visiter c) visite d) a visité

2. Tu nous ..... de l'eau, s'il te plait.
   a) donnons b) donnes c) donne d) donné

3. -Qu'est-ce que tu .....de ce professeur ?
   - Oh, je le trouve très sympa !
   a) as b) penses c) trouves d) es

4. – J'adore .....pays, le Ghana.
   a) cet b) cette c) ces d) ce

ne aime

5. Je n'aime pas ..... la télévision.
   a) regardes b) regardons c) regarder d) regarde

6. Pour commencer, Julie prend un peu..... fromage.
   a) du b) de la c) de d) des

7. - ..... orange coûte dix pesewas.
   a) cet b) ces c) cette d) ce

8. Kofi et son frère, tu .....connais ?
   - Oui, bien sûr.
   a) le b) la c) les d) vous

9. .....chanteuse est très célèbre !
   a) cette b) la c) ce d) une

10. -Qu'est-ce qu'on mange ce soir ?
    -..... poulet.
    a) De la b) Du c) de l' d) de

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B. Complete the following sentences with the correct pronouns from the list below:

Je, tu, il, elle, nous, vous, ils, elles, moi, toi, lui, eux. ..... /10

1. - Tu connais Marc et Sophie ? - Oui je travaille avec ..... .
2. Quand je parle twi avec mes étudiants, ...ne me comprennent pas !
3. - Vous faites quoi ce soir ? - ..... allons à Bantama.
4. .....travaillez tard ce soir ?
5. .....vient me chercher à 17h.
6. - Tu vas chez Rodriguez ? - Non, je n'aime pas aller chez..... .
7. Tu vas au marché ? Je peux venir avec ..... ?
8. Tu as des amis ?
   Oui, ...ai un ami. . ..... est photographe. ..... a 26 ans

C. Put the verbs in brackets in *passé composé*. .../10

1. Mes parents **(aimer)** ont aimé.....du fufu pour la première fois hier !
2. Alex **(dire)**..a dit.....que Sarah était très jolie.
3. Ça y est ! Je **(finir)** ai fini.....mes devoirs !
4. Tu **(voir)** as vu.....le nouveau professeur d'histoire ?
5. L'été dernier, nous **(visiter)**,..avons visité.....Paris.
6. Il **(faire)**..a fait..... très chaud hier !
7. Vous **(travailler)** avez travaillé.....avec monsieur le directeur lundi dernier?
8. Maria et Sarah **(manger)**..ont mangé....beaucoup ....mangé.....à Pâques.
9. Je ne..ai..... pas.....compris..... **(comprendre)**. Vous pouvez répétez ?
10. Hier soir, on **(danser)**..a dansé..... toute la nuit!

D. Use the appropriate verbs from the list to complete the following sentences in the conditional tense: (*pouvoir, vouloir, avoir, aimer*)..../10 *

pourrais voudrais aurais aimerais

1. .....-tu me passer le sucre s'il te plaît ?
2. Si j'étais riche, j'.....une grande maison avec une piscine !
3. Si je ne travaille pas, je n'.....pas mon diplôme.
4. Nous.....aller à ce concert, reste-t-il des places ?
5. Je ne .....pas vous retrouver samedi, j'ai un enterrement.
6. .....nous nous rencontrer à 14h mardi prochain ?
7. .....vous me donner votre numéro de téléphone s'il vous plaît ?
8. Vous n'..... pas des cartes postales ?
9. Tu n'.....pas un stylo à me prêter ? J'ai perdu le mien.
10. .....vous aller au cinéma demain soir avec mes amis

28

E. Change the sentences below from the feminine singular to masculine singular.../10

Eg. cette jeune fille	ce jeune garçon
1. Cette musicienne congolaise danse bien	ce musicien congolais danse bie
2. Ta petite sœur chante très bien.	Ton petit
3. Une physicienne est morte.	
4. Sa grand-mère n'aime pas le rap.	
5. Mon amie française mange beaucoup.	

F. Read carefully the following passage and indicate by ticking if the statements that follow are true or false. .../10

Paris, le 28 mai 2006

Chère Isabelle,

Comment vas-tu ? Ça fait longtemps que je ne t'ai pas écrit. Je suis désolée. Mon mari, Patrick est parti au Sénégal en mars et moi, je suis toujours à Paris. Je suis étudiante à l'Alliance française.

Je vais bientôt partir en vacances. Et toi ?

Je t'embrasse.

Sylvie

Timbres

Isabelle GASCON
13, quai de la Dorade
31000 TOULOUSE

STATEMENTS	Vrai	Faux
1.Ce document représente une carte postale		
2.Sylvie ne connaît pas Isabelle.		
3.Isabelle est mariée.		
4.Sylvie a deux enfants.		
5.Ce message a été écrit en mars 2006.		
6.Isabelle est enseignante à l'Alliance française.		
7.Sylvie ne va pas partir en vacances.		
8.Le destinataire du message est Sylvie.		
9.Patrick est sénégalais.		
10. Isabelle habite à Toulouse.		

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G. (i) Send a message in French to your friend Freda to invite her. Your invitation should include the following: a) Reason for the invitation.

b) Day, time & venue ...../10

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(ii). Freda would not be able to honour the invitation. Write out her reply in French.

.....

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.....

Dickson Pimpong
Albert Yegblemenawo
Michael Damoah
Lydia Barneoud
Joelle Haller

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10/02/14

BCHEM 264
Biophysics
Homework Assignment 1
Grading
Total 15 points
Question 1

- Avery and colleagues provided evidence that transforming substance was not protein but DNA by a combination of macromolecule elimination procedures and determination of the physical properties of the transforming material, while Griffith laid the foundation for identification of DNA as genetic material by demonstrating that present in the bacterial cell was a substance which could cause transformation of the phenotype of another cell. 2 *points*
-

Avery and colleagues: employed two approaches

(A) Used sequential elimination of macromolecules from the infected extract of the diseased mouse and studied effect of extract devoid of the macromolecules on transformation. *2 points*

The following elimination methods were used:

- Removed protein with organic solvents: extract still transformed *1point*
- Removed protein with enzymes: trypsin and chymotrypsin. No effect on transformation*1point*
- Removed RNA with enzyme ribonuclease: no effect on transformation *1point*
- These steps ruled out RNA and protein as transforming material *1point*
- Removed DNA with enzyme DNase: destroyed transforming ability*1point*

(B) Determined the physical properties of the transforming substance by use of four techniques:
5 points

1. Ultracentrifugation sedimented rapidly
   means transforming material has high molecular weight
2. Electrophoresis – showed high mobility (i.e., moved fast down the gel), and therefore has high charge-to-mass ratio
3. UV light absorption spectrum– maximum at 260 nm
4. Elemental chemical analysis – nitrogen to phosphorus ratio of 1.67 (expected for pure DNA)
   Protein is however rich in nitrogen and low in phosphorus and would have a much higher N/P
   ratio

(C) Did not infect any organism with extract from diseased mouse.

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Conclusion: provided evidence that transforming substance was not a protein by means of the UV light absorption spectrum at λ_{260}. Elemental analysis: N/P ratio of 1.67. *1 point*

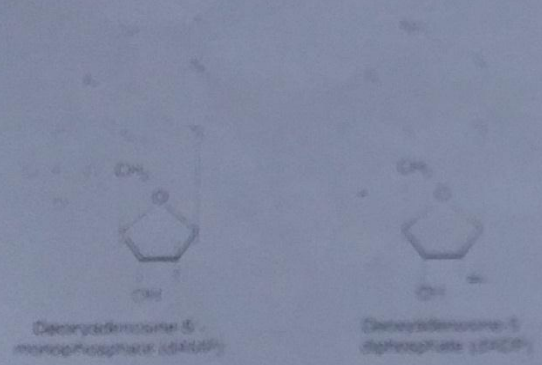
Griffith's experiment

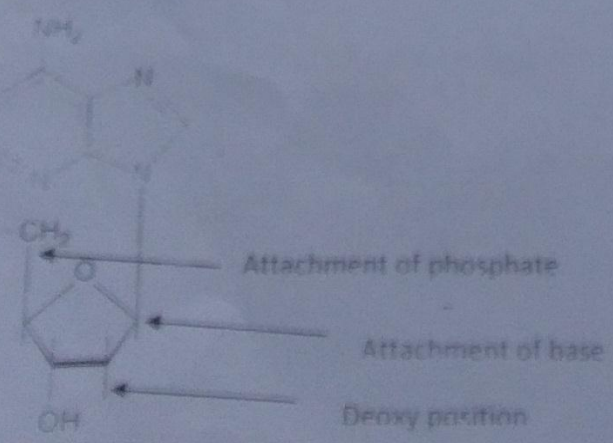
He prepared a culture made of a mixture of heat-killed virulent *S. pneumoniae* with live avirulent strain and infected mouse with it. This resulted in the conversion of the avirulent strain to virulent type because mouse died, when previously, neither the heat-killed virulent strain nor avirulent strain could cause disease. This transformation was shown to be heritable. *3 points*

Concluded that molecules that can carry heritable information are present in the S strain cells, likewise the R strain carried material that could store the heritable material received. *1 point*

Question 2

Structure of a deoxynucleoside monophosphate is presented below with the structure of sugar shown. Position of attachment of the base is 1' carbon of ribose and position of attachment of phosphate is shown by the arrow as 5' carbon. Deoxy position is also shown. *4 points*





Deoxyadenosine-5-monophosphate (dAMP)

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BCHEM 365
Biophysics
Homework Assignment 1
Grading

Total 15 points
Question 1
Avery and colleagues provided evidence that transforming substance was not protein but DNA by a combination of macromolecule elimination procedures and determination of the physical properties of the transforming material, while Hershey and Chase provided evidence that genes were made up of DNA using radiolabel technique. *2 points*
Avery and colleagues: employed two approaches
(A) Used sequential elimination of macromolecules from the infected extract of the diseased mouse
and studied effect of extract devoid of the macromolecules on transformation. The following
elimination methods were used:

- Removed protein with organic solvents: extract still transformed
- Removed protein with enzymes: trypsin and chymotrypsin: No effect on transformation
- Removed RNA with enzyme ribonuclease: no effect on transformation
  - These steps ruled out RNA and protein as transforming material
- Removed DNA with enzyme DNase: destroyed transforming ability

(B) Determined the physical properties of the transforming substance by use of four techniques:
5 points
1. Ultracentrifugation –sedimented rapidly
means transforming material has high molecular weight
2. Electrophoresis – showed high mobility (i.e., moved fast down the gel), and therefore has high charge-to-mass ratio
3. UV light absorption spectrum– maximum at 260 nm
4. Elemental chemical analysis – nitrogen to phosphorus ratio of 1.67 (expected for pure DNA)
Protein is however rich in nitrogen and low in phosphorus and would have a much higher N/P ratio

(C) Did not infect any organism with extract from diseased mouse.

Conclusion: provided evidence that transforming substance was not a protein by means of the UV light absorption spectrum at λ_{260}. Elemental analysis: N/P ratio of 1.67. *1 point*

Hershey and Chase
Used techniques such as radiolabeling of sulfur present in proteins and phosphorus present in nucleic acids. Infected *E. coli* with bacteriophage T2 and examined the contents of the cell for which type of radioactive label it contained.

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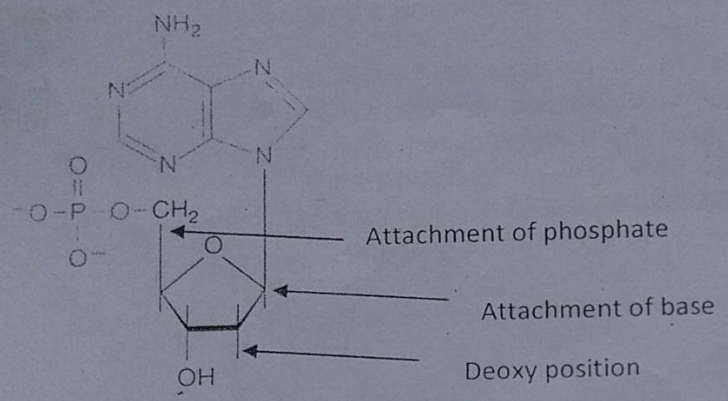
Concluded that because most of the labeled DNA with its ^{32}P entered the infected cells while no ^{35}S was found in the cell, the genes of this phage are made of DNA. *3 points*

Question 2

Structure of a deoxynucleoside monophosphate is presented below with the structure of sugar shown. Position of attachment of the base is 1' carbon of ribose and position of attachment of phosphate is shown by the arrow as 5' carbon. Deoxy position is also shown. *4 points*



Deoxyadenosine-5'-monophosphate (dAMP)

30. Cystitis relates to which of the following?
(A) Protein buildup in the urine
(B) Inflammation of the ureter
(C) Inflammation of the urinary bladder
(D) Inflammation of the urethra

SECTION B

1. Give a brief explanation of mechanism by which the countercurrent multiplier system maintains a high osmolarity in the medulla of the kidney. (5 marks)

Counter Current multiplier system ~~mean~~ is the flow of fluid in opposite direction in the descending limbs of the loop of Henle downwards and the ascending limb of the loop upwards. It maintains a high osmolarity in the medulla of the kidney by the Na^+/K^+ pump ~~with~~ Cl ~~through the~~ into the interstitial fluid

2. What is G.F.R. (Glomerular filtration rate)? (2 marks)

Glomerular filtration rate is the term used to describe the process of filtration in the glomerulus.

3. Trace the pathway of blood through the renal artery to the renal vein through the ..... (4 marks)

Renal artery → glomerulus → proximal convulated tubule → loop of Henle → distal convulated tubule → collecting duct → renal vein.

4. When is aldosterone released during the urine formation and how does it help maintain homeostasis of the blood volume and pressure? (4 marks)

Aldosterone is released during the formation of glycosuria. It helps maintain homeostasis of the blood volume and pressure by regulating the Na^+/Cl^- ions in the interstitial fluid at a normal rate.

5. How is the renal corpuscle specialized to carry out its role? (3 marks)

The renal corpuscle is specialized to carry out its role by the having an elastic covering (elastic muscle) which protects it against trauma.

By being located in the renal capsule which has protects it from trauma & spread of infections.

$E = \frac{V}{d}$

$V = \frac{Eq}{f}$

$\mu = \frac{V}{E}$

KWAME NKRUMAH UNIVERSITY OF SCIENCE AND TECHNOLOGY, KUMASI

B.Sc. Biochemistry and Biotechnology

Class: BCHEM III

Second Semester Examination 2012/2013

BCHEM 264 Biophysics

March 2013

Index number 6112211

Time allowed: 30 min

344

104 - 1

Instructions

Answer all questions

Circle the correct answer on the question sheet

1. Phage T2 has a double stranded DNA with 2.5×10^5 bp. How many full double-helical turns are present in this DNA?

34 → 1 turn

$2.5\times10^5 = \frac{2.5\times10^5 \times 1}{34}$

10bp – 1 turn

$2.5\times10^5 = \frac{2.5\times10^5 \times 1}{10}$

(A) 42,000 turns
(B) 2,625000 turns
(C) 25,000 turns
(D) 19,047 turns
(E) 23,809 turns

2. *Zea mays* has a double stranded DNA with 6.6×10^9 bp. What is the length of the DNA in centimeters?

10bp = 3.4

$6.6\times10^9 = \frac{6.6\times10^9 \times 3.4}{10}$ 2244

(A) 194 cm
(B) 1.94 cm
(C) 224 cm
(D) 19.4 cm
(E) 2.24 cm

3. Homo sapiens has a double stranded DNA with 3.5×10^9 bp. What is the molecular mass of the this DNA?

10bp ⇒ 6600

$3.5\times10^9 \Rightarrow \frac{3.5\times10^9 \times 660}{10}$

(A) 0.23×10^9 kD
(B) 2.31×10^9 kD
(C) 0.188×10^9 kD
(D) 1.88×10^9 kD
(E) None of the above

B

4. Which of these secondary structures represent majority of DNA in nature?
(A) Slightly positive supercoiling in B form
(B) Slightly negative supercoiling in A form
(C) Slightly negative supercoiling in B form
(D) Extensive negative supercoiling in B form
(E) Extensive positive supercoiling in A form

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**Pcu /Cos/m473 -13

5. A researcher is separating a mixture of proteins, A, B and C by polyacrylamide gel electrophoresis. The power pack is producing electricity at 200 volts. The red and black electrodes are separated by a distance of 18 cm. What is the magnitude of the electrical gradient across the electrodes?

(A) 0.90
(B) 0.09
(C) 11.1
(D) 1.11
(E) 36.0

6. Separation of the protein sample in question 5 was carried out for 60 min. Protein A migrated to a distance of 8.4 cm on the gel. What is the magnitude of the mobility of protein A?

(A) 0.01261
(B) 6.1261
(C) 1.2612
(D) 0.12612
(E) 12.6126

7. The disruption of electrophoretic separation caused by electroendosmosis involves which of the following mechanisms?

(A) Dissociation of matrix anions and their movement toward anode while sample migrates to cathode
(B) Dissociation of cations and their movement toward the cathode while sample migrates to anode
(C) Dissociation of matrix anions and their movement toward the anode together with the sample
(D) Dissociation of cations and their movement toward the anode together with the sample
(E) Dissociation of both anions and cations in the matrix with no net movement

8. Which of these gels would you use to separate 100 bp from 150 bp nucleic acid?

(A) Agarose with high –COOH content
(B) Agarose with high SO_4^- content
(C) Polyacrylamid gel or agrose with high SO_4^- and –COOH content
(D) Polyacrylamide gel or agarose with low $-SO_4^-$ content
(E) Only polyacrylamide gel

9. Which of these gels would you use to separate proteins by immunioelectrophoresis?

(A) 12.5%: 5% acrylamide: BIS-acrylamide gel
(B) 7.5% : 5% acrylamide: BIS-acrylamide gel
(C) 3% agarose
(D) 1% agarose
(E) None of the above

10. Which of these reactions occur during polymerization of acrylamide.

(A) Vinyl addition of straight polymer in head-to-tail fashion and copolymerization of acrylamide monomers
(B) Vinyl addition of acrylamide monomers to form crosslinks and copolymerization straight polymers in head-to-tail fashion
(C) Vinyl addition of acrylamide monomers in head-to-tail fashion and copolymerization straight polymers to form crosslinks
(D) Vinyl addition of straight polymer to form crosslinks copolymerization of acrylamide monomers in head-to-tail fashion

E=V/d F=Eq

v=Eq/f

(E) None of the above

11. You want to improve upon the resolution of protein separation on a polyacrylamide gel. Which of these gel systems is the right one to use?
(A) Gradient gel alone
(B) Stacking gel alone
(C) Gradient gel with stacking gel
(D) Gradient gel with resolving gel
(E) Resolving gel alone

12. Which of these gel slabs would you recommend for separating proteins having similar sizes?
(A) 5 cm × 8 cm
(B) 8 cm × 10 cm
(C) 12 cm × 15 cm
(D) 15 cm × 18 cm
(E) 20 cm × 25 cm

13. Which of these gel slabs would you recommend for separating proteins having diverse sizes?

(A) 1.5 cm × 3 cm
(B) 5 cm × 8 cm
(C) 15 cm × 18 cm
(D) 8 cm × 10 cm
(E) 5 cm × 8 cm

14. Electrophoretic stacking of a discontinuous buffer system is achieved via which of the sequence of events?
(A High concentration stacking gel→Cl^- leads glycinate trails→ Kolrausch discontinuity develops→protein stacks
(B) High concentration stacking gel→ glycinate leads→ Cl^- trails→ protein stacks→ Kolrausch discontinuity develops
(C) Low concentration stacking gel→glycinate leads→ Kolrausch discontinuity develop→sCl trails→-protein stacks
(D) Low concentration stacking gel→ Cl^- leads→ glycinate ions trail→Kolrausch discontinuity develops→ protein stacks
(E) High concentration stacking gel→Cl^- leads→ Kolrausch discontinuity develops→ glycinate trails→protein stacks

15.Sodium dodecyl sulfate is ~~of~~ for denaturing of polyacrylamide gel electrophoresis of proteins as _____ and _____ are for denaturing of polyacrylamide gel electrophoresis of DNA
(A)dithiothreitol and NaOH
(B)Urea and formamide
(C)β-mercaptoethanol and urea
(D) β-mercaptoethanol and formamide
(E)uric acid and formaldehyde

16.Three proteins have the same Y intercept on a Ferguson plot. What is the interpretation?
(A)Same charge

(B) Same size
(C) Same mobility
(D) Same isoelectric pH
(E) Both A and B

17. Three proteins have the same slope on a Ferguson plot. What is the interpretation?
(A) same charge
(B) Same molecular mass
(C) Same mobility
(D) Same isoelectric point
(E) Both B and C

18. The equation which governs the mobility of macromolecules in native gel electrophoresis is
(A) Log R_m = log Y_0T -K_RY_0
(B) Log Y_m = log R_0 -K_RT
(C) Log R_m = log Y_0 -K_RT
(D) Log R_m = log R_0 +K_RT
(E) Log Y_m = log R_o + K_RT

19. Following SDS electrophoresis of histones that you have isolated from the nucleus of a eukaryote, you are getting one band per lane and or some lanes show no band at all. What would be the reason for such results?
(I) Anomalous migration of histones due to presence of extra charged groups on the protein
(II) No migration of histones due to absence of charged groups on the protein
(III) Retention of secondary structure due to incomplete denaturation by SDS
(IV) Complete denaturation of the histones to produce amino acids which migrate with no impedance by the gel matrix

(A) Only I
(B) Only II
(C) I and III
(D) II and IV
(E) II and IV

20. Which of these reagents and processes would you select to enhance denaturation of proteins that are difficult to denature by SDS alone?
(A) Triton X-100 + formamide + urea
(B) Triton X-100 + urea + acetic acid
(C) SDS + Triton X-100 + acetic acid with heating
(D) SDS + acetic acid + urea with heating
(E) SDS + Triton X-100 +urea

21. The contents of a good loading buffer for SDS-PAGE of plant tissue would be which of the following?
(I) More SDS, dithiothreitol, high pH
(II) More SDS, and mercaptoethanol, high pH
(III) Less SDS, CHES buffer, dithiothreitol, high pH
(IV) Less SDS, CHES buffer, mercaptoethanol, high pH

TEAM SELORM '17 TOGETHER WE CAN

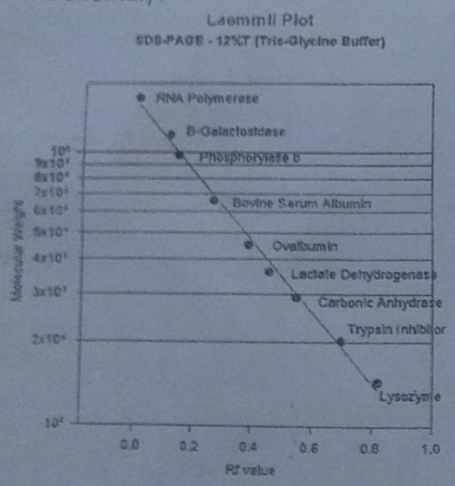
(A) Only I
(B) Only II
(C) I and III
(D) II and IV
(E) I, III, and IV

For Tris glycine
Resolution of smaller proteins is hindered (<10 kD)

22. Four proteins of sizes, 10 kD, 12.5 kD 25 kD and 100 kD were loaded in lanes 1 to 4, respectively, in SDS-PAGE gel and run with Tris-glycine buffer in the tank. Electrophoresis was stopped when bromophenol blue dye front was halfway down the gel. Some lanes did not show any band. What are these lanes?
(A) Lanes 1 and 2
(B) Lanes 1 and 3
(C) All lanes
(D) Only lane 1
(E) Only lane 4

23. The tank buffer in question 22 is changed to Tris-Tricine buffer, samples reloaded and SDS-PAGE run again. Which lanes would show bands?
(A) Lanes 1 and 2
(B) Lanes 2 and 3
(C) All lanes
(D) Only lane 1
(E) Only lane 4

24. Use the standard curve below to answer this question. The R_f value of a standard protein, X, having relative molecular weight 7×10^4 was found to be 0.6 on SDS-PAGE. What explanation can you give for this anomaly?



(I) Protein X may be heterogeneous, such as glycoprotein
(II) Protein X may be heterogeneous, such as phosphorylated protein
(III) Excessive denaturation of protein X by SDS

frictional coefficient - (6πrη)
r = radius
η = viscosity

**Pcu /Cos/m473 -13

41

(A) Only I
(B) Only II
(C) Only III
(D) II and III
(E) I, II and III

25. Which method of electrophoresis would you use to identify multiple proteins from a gene expression study?
(A) Isoelectric focussing
(B) Blue native PAGE
(C) 2-dimensional gel electrophoresis
(D) Cellulose acetate electrophoresis
(E) Quantitative preparative native continuous PAGE

26. You are using isozyme marker to determine victim, suspect, and a pepetrator in a crime scene where a spot of blood was left. Which method of electrophoresis would you use?
(A) Isoelectric focussing
(B) Clear native PAGE
(C) 2-dimensional gel electrophoresis
(D) Cellulose acetate electrophoresis
(E) Quantitative preparative native continuous PAGE

27. Which is the correct sequence of the events listed below, which occur during fixation of proteins on a gel by methanol:water:glacial acetic acid reagent?
(I) Protein complex trapped inside gel
(II) Low pH disrupts hydrogen bonds
(III) Hydrophobic portions of protein exposed by organic solvent
(IV) Uncoiling of peptide chains
(V) Irreversible association between peptide chains

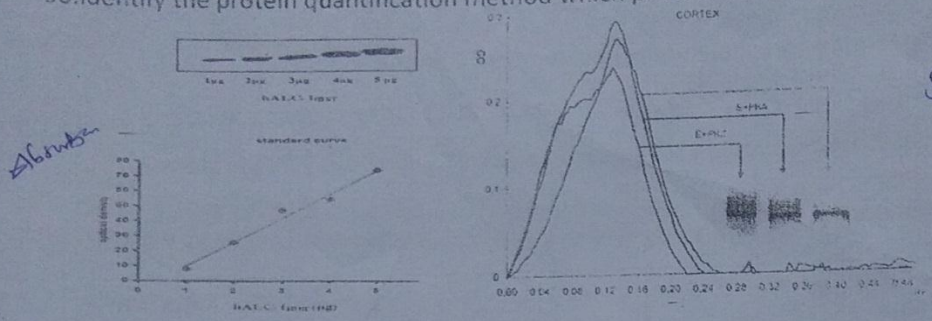
(A) I, III, IV, II, V
(B) I, II, III, IV, V
(C) III, IV, II, I, V
(D) IV, I, V, III, II
(E) II, III, IV, V, I

28. Which stain would you use to detect proteins up to 200 ng concentration on a polyacrylamide gel?
(A) Silver stain 2-5 ng
(B) Fluorescent dye 1-2 ng
(C) Coomassie Brilliant Blue G250 0.1 ug
(D) Coomassie Brilliant Blue R250 0.5 ug
(E) Ethidium bromide 20 ng 25 – 100 ns
glycoprotein

29. You performed electrophoresis on glycoproteins, loaded in two lanes and used horseradish peroxidase as a positive control in the third lane. Only one sample lane showed a band and there was no band in lane 3. Which of these not may be a good reason for your observation?
(A) Samples were contaminated

(B) Lane with no band means sample concentration was below detection limit
(C) The horseradish peroxidase was inactive
(D) The method did not work well
(E) All of the above

30. Identify the protein quantification method which produces images A and B.



A B

(A) Gel documentation and Absorbance of eluted bands
(B) Absorbance of eluted bands and scanning densitometry
(C) scanning densitometry and Absorbance of eluted bands
(D) scanning densitometry and Gel documentation
(E) None of the above

31. Which of these is the correct sequence of immunostaining of western blots. *Note: CSPD is ChloroPhosphoPhenyl Dioxetane; BCIP/NBT is BromoChloroIndoyl Phosphate coupled with Nitro Blue Tetrazolium.*

(A) Blot→ Blocking→Horseradish peroxidase→Antibody→ CSPD→Bue color
(B) Blot →Blocking→Antibody→Horseradish Peroxidase→BCIP/NBT→Blue color
(C) Blot →Antibody→ Blocking→Horseradish Peroxidase→CSPD→ Luminiscence
(D) Blot→antibody→Blocking→Alkaline Phosphatase→BCIP/NBT→Bue color
(E) Blot→ Blocking→Alkaline Phosphatase→Antibody→BCIP/NBT→Luminiscence

32. Which of these do not cause electroendosmosis?
I) Electrophoresis above pH 3
II) A region of charge separation at the capillary wall/electrolyte interface
III) Cations in the electrolyte near the capillary wall migrate towards the cathode
IV) Electrolyte solution pulled toward the anode
V) Electrophoresis below pH 3

(A) I and II
(B) I and IV
(C) I alone
(D) V alone
(E) II and V

33. Select the correct statement in preparation of gels for electrophoresis
(A) Agarose crosslinks are formed by cooling of heated agarose

B) Agarose crosslinks are formed by heating
C) Acrylamide crosslinks are formed by heating
D) Acrylamide crosslinks are formed by copolymerization and vinyl addition
E) None of the above

34. Which of the methods listed below would you choose to resolve up to about 4,000 proteins?
A) Agarose gel electrophoresis
B) cellulose acetate electrophoresis
C) 2D gel electrophoresis
D) Isoelectric focusing
E) SDS-PAGE

35. Two proteins have same relative molecular mass of 12,000. How can you detect this on a Ferguson plot?
A) Same slope
B) Same intercept on Y axis
C) A slope of zero for each protein
D) A Y intercept of zero for each protein
E) None of the above

36. Which method is best for separating acidic water-soluble and membrane proteins?
A) Quantitative Preparative Native Continuous (QPNC) PAGE
B) Isoelectric Focusing
C) Blue Native PAGE
D) SDS-PAGE
E) Clear Native PAGE

37. Arrange the following fixatives in order of denaturation ability
A) Alcohol:acid:water> Glutaraldehyde> Trichloroacetic acid
B) Glutaraldehyde> Trichloroacetic acid> Alcohol:acid:water
C) Alcohol:acid:water> Glutaraldehyde >Trichloroacetic acid
D) Glutaraldehyde> Alcohol:acid:water> Trichloroacetic acid
E) Trichloroacetic acid> Alcohol:acid:water> Glutaraldehyde

38. You have separated a mixture of membrane proteins on SDS-PAGE. Which of these fixatives would you use in your preparation for staining?
A) Isoprpanol:acetic acid:water
B) Formaldehyde
C) Ethanol:acetic acid:water
D) TCA
E) None of the above

KUMASI
COLLEGE OF SCIENCE
FACULTY OF BIOSCIENCES

B. Sc. Biochemistry and Biotechnology First Semester Examination, 2006
Third Year

BCHEM 365: BIOPHYSICS

November, 2006 THREE HOURS

Attempt question 1, and one other question from Section B.
Answer both questions in the answer booklet provided.

Question 1. (50 Marks).

(a) The passage below describes the **Gram staining procedure**. Write the missing word against the corresponding number in your answer booklet

"Gram-staining was first described by Christian Gram in 1884. In essence, the cells are stained with -1- and then treated with -2- solution as a -3-. The intensely stained cells are then washed with -4-. Gram-5- cells retain the stain, whereas gram-6- cells do not. To make the contrast between the two results obvious, the preparation is counterstained with a contrasting red dye (i.e. -7-), So that gram-8- cells are easily seen."

(b) For each statement below numbered **I** to **XX** choose **only one answer** from the list **A** to **T**. Write the letter (**A** to **T**) of the answer against the number (**I** to **XX**) in your answer booklet.

(I) A device for the extraction or elution of proteins after electrophoresis.
(II) A charge detector in which the potential is large enough for the ions to achieve significant kinetic energy and hence create a large number of ion-pairs.
(III) A device in which charged particles are accelerated with multiple exposures to A.C. fields craftily arranged so that each time the particle is exposed to the field it is in the right phase to increase its energy.
(IV) Nuclides having the same atomic number (Z).
(V) A charge detector that responds only to charged particles moving very close to the speed of light.
(VI) A scale positioned on the microscope stage and focused at like a specimen; used to calibrate a microscope.
(VII) Radioisotope most widely used in medicine.
(VIII) Radioisotope used in many palliative medical procedures, usually to relieve pain.
(IX) A lens corrected to yield flat fields rather than curved.

(X) Nuclides having the same number of neutrons (N).

(XI) Isotope recommended to use as a label in new situations and combines the right balance between sensitivity and resolution.

(XII) A charge detector in which the potential is just large enough to attract most of the ions to the electrode before they encounter oppositely charged ions to neutralize themselves against.

(XIII) An interaction of gamma radiation with matter in which a gamma ray uses part of its energy to eject an outer electron and the rest appears as a lower-energy gamma ray.

(XIV) An interaction of gamma radiation with matter in which the gamma ray energy is converted into the mass and energy of an electron and a positron.

(XV) A device used in slicing a specimen into ultra-thin sections required for examination with a microscope.

(XVI) A lens corrected for both flat field and colour aberration.

(XVII) Nuclides having the same atomic weight (A).

(XVIII) Highest quality objective lens with chromatic corrections at three points and spherical corrections at two points; gives the best resolution and fewest optical defects.

(XIX) A type of objective lens that is corrected for chromatic aberration at two points, and spherical aberration at one point; simplest and least expensive.

(XX) Used in autoradiography to reduce exposure times and/or increase the sensitivity in the detection of radiolabeled samples.

Answers

A. Micrometer
B. Compton Effect
C. Strontium-89
D. Pair production
E. Cerenkov detector
F. Proportional Chamber
G. Isobars
H. Isotones
I. Achromat
J. LINAC
K. Isotopes
L. Ionization Chamber
M. Elutrap™
N. ^{33}P
O. Technetium-99
P. Plan lens
Q. Intensifying screen
R. Planachromat
S. Apochromat
T. Ultramicrotome

TURN OVER

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6407

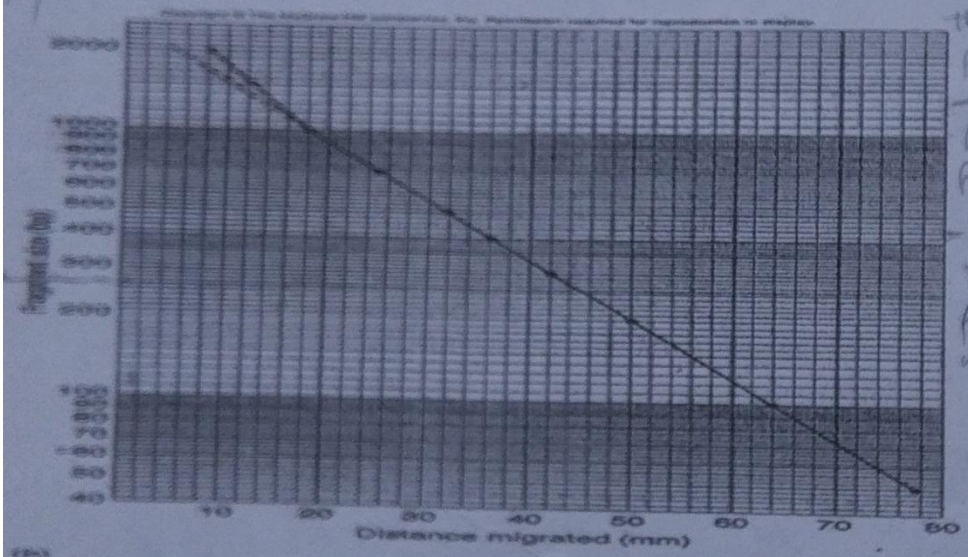
EMISTRY

BCHEM 365
Biophysics
First semester, 2009
Exam #2
Time allowed: 60 minutes

Oct. 16, 2009

1. You have electrophoresed some DNA fragments on an agarose gel. Using the graph below answer the following
   (a) What is the size of fragment that migrated 25 mm? 700bp
   (b) How far did the 250 bp fragment migrate?
   (c) One of the bands on your gel picture shows a 2.3 kb. Can you tell the distance migrated using this diagram? Explain. No
   (d) Name and describe the method used for separating DNA fragments of up to several million bp like chromosomes PFGE

- For a large DNA, the relationship the log of DNA size and the dis from linearity
- Long, double stranded DNA ... graph, curving or properly ... fracture than
- PFGE, uses pulses of current the gel, with longer pulses in forward direction and shorter ... in the opposite sideward



2. Describe a DNA fingerprinting method using a minisatellite probe Southern blot
3. Describe a nonradioactive method for detecting a particular nuclei acid fragment in an electrophoretic gel

Total points: 45
This exam is **15%** of the overall grade for the course

KWAME NKRUMAH UNIVERSITY OF SCIENCE AND TECHNOLOGY
B.Sc. Biochemistry and Biotechnology
Classes: BCHEM III and BIOL III
First Semester Examination #1 2013/2014
BCHEM 365 Biophysics
September 2014

Program: Biochemistry
Year of Program: 3
Name: Baku Emmanuella Nsiah-A. Index number: 38798704
Time allowed: 2 hours

Questions 1-17: Circle the correct answer to the following questions

1. The phenomenon of electrophoresis was observed for the first time by
(A) Oswald Avery in 1807
(B) F. Reuss in 1828
(C) Oswald Avery in 1828
(D) F. Reuss in 1807

F. Reuss

2. Electrophoresis is a technique used for _____ different types of molecules based on their patterns of movement in an electric field.
(A) Separating
(B) Detecting
(C) Quantifying
(D) Only (A) and (B)

3. Which of these statements is true?
(A) Both proteins and nucleic acids possess positive and negative charges at any given pH. Under the influence of electrical field, they will migrate either to the cathode or to the anode
(B) Only proteins possess positive and negative charges at any given pH. Under the influence of electrical field, they will migrate either to the cathode or to the anode
(C) Only nucleic acids possess positive and negative charges at any given pH. Under the influence of electrical field, they will migrate either to the cathode or to the anode
(D) None of the above

4. An electrophoresis unit consists of
(A) A power pack, gel slab, and gel comb
(B) A plastic frame, power pack and buffer
(C) A tank, plastic frame and gel comb
(D) A power pack, tank, plastic frame and gel comb

electrophoresis unit
power pack

5. The force, in newtons that drives a macromolecule with charge q toward an electrode, when placed in an electric field of potential difference E and separated by a distance d, is given by
(A) qE
(B) qd

$F = Eq$

$F = Eq$

$E = \frac{V}{d}$

$V = \frac{Eq}{F}$

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(C) fE
(D) qdF

6. The velocity, v, of the charged macromolecule in Question 5 which encounters frictional resistance, f, is given by the equation
(A) $v = qE/f$
(B) $v = qf/E$
(C) $v = qdE/f$
(D) $v = qfE/d$

7. The electrophoretic mobility, μ, of the charged macromolecule in Question 5 and 6 is given by
(A) v/d
(B) v/Ed
(C) v/Eq
(D) v/E

8. During electrophoresis, the current in the solution between the electrodes is conducted
(A) mainly by the buffer ions, with a small proportion conducted by the sample ions
(B) by buffer ions and sample ions equally
(C) by only buffer ions
(D) mainly by sample ions with a small proportion conducted by the buffer ions

9. The generation of heat in the medium during electrophoresis produces which of the following effects:
(A) A decreased rate of diffusion of sample and buffer ions leading to broadening of the separated samples
(B) The formation of convection currents, which leads to mixing of separated samples
(C) A decrease of buffer viscosity and hence a sharpening of separated bands
(D) All of the above

10. Electroendosmosis is a problem in electrophoresis caused by
(A) heating fluctuations when power supply is not constant
(B) presence of charged groups on the surface of the support medium
(C) conduction of current by the buffer ions
(D) the zone center migrating faster than the edges

11. For a good separation, electrophoresis grade agarose must have
(A) many sulfate groups
(B) few sulfate groups
(C) moderate content of sulfate, carboxyl, and methoxyl groups
(D) none of the above

12. In electroendosomosis the movement of electrolyte ions can be toward the
(A) anode
(B) cathode
(C) zone center
(D) no movement of electrolyte ions

13. Which of these is true?
(A) Agarose is a linear polysaccharide made up of the basic repeating unit agarotriose
(B) Agarose is a branched polysaccharide made up of the basic repeating unit agarobiose
(C) Agarose is a linear polysaccharide made up of the basic repeating unit agarobiose
(D) Agarose is a branched polysaccharide made up of the basic repeating unit agarotriose

14. In what way does agarose support medium overcome convective currents during electrophoresis?
(A) The cross-linked structure
(B) The variable pore size
(C) both (A) and (B)
(D) None of the above

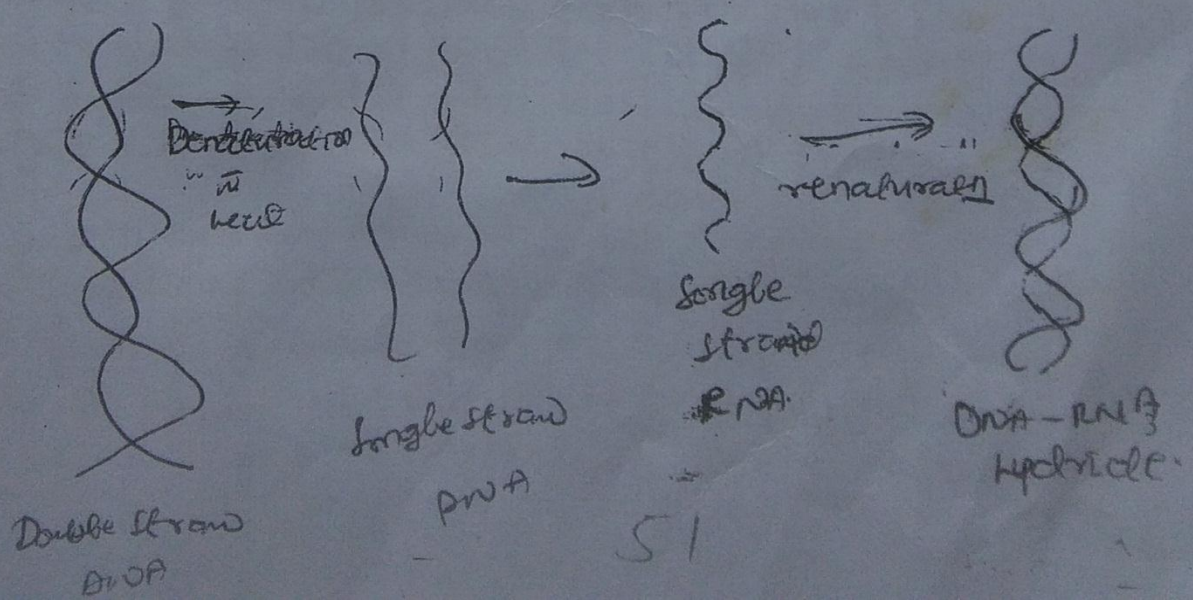
15. Gelling properties of agarose is attributed to
(A) both inter- and intramolecular hydrogen bonding within and between the long agarose chains
(B) cross-linking of agarose chains with sulfate groups
(C) both inter- and intramolecular methylene bridges within and between the long agarose chains
(D) All of the above

16. 1% agarose gel is good for the separation of
(A) only proteins
(B) only nucleic acids
(C) Either proteins or nucleic acids
(D) both proteins and nucleic acids

17. Which of these statements is true? (2 points)
(a) All proteins have a net negative charge
(b) All DNA have a net negative charge
(c) All proteins have net positive charge
(d) All DNA have neutral charge
(e) All of the above

Questions 18-24
Answer the following questions to the best of your knowledge

18. Use a drawing to illustrate the principle of nucleic acid hybridization (4 points)



TEMED -

between DNA strands

Low salt :- Removes the ions that shield the negative charges on the two strands from each other.

19. Name four factors that promote DNA denaturation. Explain how each affects the denaturation process. Use graphs where necessary. (10 points)

(1) High temperature
(2) Organic solvents
(3) High pH
(4) Low salt

: At high temperature is above Tm the double strand DNA molecule begin to unwind leading to the separation of the strand. And Tm is the temperature at which half the DNA strands are ~~melted~~ melted

(2) Organic solvents like DMSO and formamide also denatures DNA

Continuation (3) Ex

20. Name three factors that bring about annealing of denatured DNA. Explain the mechanism of each. (6 points)

(1) Concentration of DNA - the higher the concentration the greater the percentage reannelled.

(2) Temperature - The best temperature for renaturation is about 25°C ie a lower temperature. When temperature is low, it allow for the diffusion of the strands to reanneal

(3) Time - The longer the time allowed for the reannel process, the greater the amount that will anneal

(4) Cot - Cot curves measures the degree of annealing of the DNA

21. Which of these DNA will have a higher melting temperature: AT- DNA and *E. coli* DNA? How do the GC contents vary? (4 points)

E.coli DNA will have a higher melting temperature than AT-DNA. Since the AT-DNA consist of only Adenine and thymine which contains only 2 hydrogen bonds but the E-coli DNA consist of both A-T bonds and G-C bond in 3 hydrogen bonds

22. What is hyperchromic shift? Explain its relevance in DNA denaturation. (4 points)

Hyperchromic shift is a phenomenon in which the DNA strand upon exposure to heat quenches some of the absorption until it reaches the Tm where the double bond begins to break. It gives the Tm of various DNA

-52

23. What do we mean by primary, secondary, tertiary and quaternary structures of proteins? (6 points)

(1) Primary structure of proteins is the basic sequence of amino acids linked together by a peptide bond

(2) Secondary structure of proteins is when the primary structure interacts with each other through hydrogen bonding. This consist of α helix and β pleated sheets

(3) Tertiary structure of proteins is when the individual peptide chains interact with each other through various bonding to form the biological function protein and the folding of the protein results in the quaternary structure

24. *Drosophila melanogaster* has a double-stranded DNA with 1.8×10^8 bp.

(a) How many full double helical turns does this DNA contain? (3 points)

10.5 bp = 1 helical turn

$\therefore 1.8 \times 10^8 \text{ bp} = \frac{1.8 \times 10^8 \text{ bp}}{10.5 \text{ bp}} \times 1 = 1.7 \times 10^7$ helical turns

b) How long is the DNA in microns? (1 micron = 10^4 Å) (3 points)

10.5 bp - 1 h

1 bp - 3.4 Å

Spacing = 3.4 Å = 3.4×10^{-4} u

$\therefore$ length = $1.8 \times 10^8 \times 3.4 \times 10$ =

= 61,200 microns (17)

(c) What is the molecular mass of this DNA? (3 points)

Molecular mass = base pairs × 660 D

$= 1.8 \times 10^8 \text{ bp} \times 660 \text{ D/bp}$

$= 1.188 \times 10^{11}$ D

Total points: 62

This exam is 10% of the overall grade for the course

Antonia Tetteh

53

Question 17

(3) At high pH, in the basic medium the two negative charges repel each other leading to the breaking of the hydrogen bonds

(4) Low salts have low ionic strength and low ionic strength repels the negative charge on the DNA causing the breaking of the bonds.

A graph to illustrate how temperature causes denaturation

Double strand
quenches
absorbance

At Temperatures above 85°c the strand separate and this high temperature denatures the DNA

KWAME NKRUMAH UNIVERSITY OF SCIENCE AND TECHNOLOGY, KUMASI

B.Sc. Biochemistry and Biotechnology

Classes: BCHEM III and BIOL III

First Semester Examination #1 2011/2012

BCHEM 365 Biophysics

September 2011

Sept. 29, 2011

Name: Anita Emmanuella Nsaloh

Name of Program: _____

Index number _____

Time allowed: 2 hours

Questions 1-17: Circle the correct answer to the following questions *1 point each*

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(A) Oswald Avery in 1807
(B) F. Reuss in 1828
(C) Oswald Avery in 1828
(D) F. Reuss in 1807

2. Electrophoresis is a technique used for Separating different types of molecules based on their patterns of movement in an electric field
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4. An electrophoresis unit consists of
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(B) A plastic frame, power pack and buffer
(C) A tank, plastic frame and gel comb
(D) A power pack, tank, plastic frame and gel comb

5. The force, in newtons that drives a macromolecule with charge q toward an electrode, when placed in an electric field of potential difference E and separated by a distance d, is given by
(A) qE

(B) qd
(C) dE
(D) qdE

6. The velocity, v, of the charged macromolecule in Question 5 which encounters frictional resistance is given by the equation
(A) $v = qE/f$
(B) $v = qf/E$
(C) $v = qdE/f$
(D) $v = qfE/d$

7. The electrophoretic mobility, μ, of the charged macromolecule in Question 5 and 6 is given by
(A) v/d
(B) v/Ed
(C) v/Eq
(D) v/E

8. During electrophoresis, the current in the solution between the electrodes is conducted
(A) mainly by the buffer ions, with a small proportion conducted by the sample ions
(B) by buffer ions and sample ions equally
(C) by only buffer ions
(D) mainly by sample ions with a small proportion conducted by the buffer ions

9. The generation of heat in the medium during electrophoresis produces which of the following effects
(A) A decreased rate of diffusion of sample and buffer ions leading to broadening of the separated samples
(B) The formation of convection currents, which leads to mixing of separated samples
(C) A decrease of buffer viscosity and hence a sharpening of separated bands
(D) All of the above

10. Electroendosmosis is a problem in electrophoresis caused by
(A) heating fluctuations when power supply is not constant
(B) presence of charged groups on the surface of the support medium
(C) conduction of current by the buffer ions
(D) the zone center migrating faster than the edges

11. For a good separation, electrophoresis grade agarose must have
(A) many sulfate groups
(B) few sulfate groups
(C) moderate content of sulfate, carboxyl, and methoxyl groups
(D) none of the above

12. In electroendosomosis the movement of electrolyte ions can be toward the
(A) anode
(B) cathode
(C) zone center
(D) no movement of electrolyte ions

56

ich of these is true?
garose is a linear polysaccharide made up of the basic r g unit agarotriose
garose is a branched polysaccharide made up of the bas ating unit agarobiose
Agarose is a linear polysaccharide made up of the basic . g unit agarobiose
) Agarose is a branched polysaccharide made up of the ba ating unit agarotriose

. In what way does agarose support medium overcome co currents during electrophoresis?
) The cross-linked structure
(B) The variable pore size
) both (A) and (B)
) None of the above

. Gelling properties of agarose is attributed to
(A) both inter- and intramolecular hydrogen bonding within a veen the long agarose chains
(B) cross-linking of agarose chains with sulfate groups
C) both inter- and intramolecular methylene bridges within ween the long agarose chains
D) All of the above

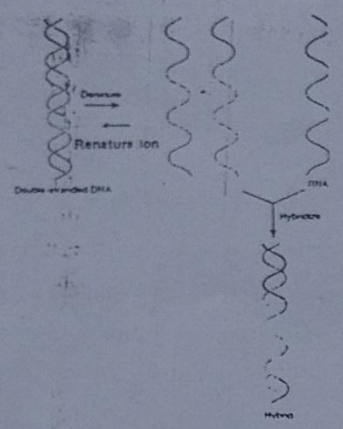
6. 1% agarose gel is good for the separation of
A) only proteins
(B) only nucleic acids
(C) Either proteins or nucleic acids
(D) both proteins and nucleic acids

17. Which of these statements is true? (2 points)
(A) All proteins have a net negative charge
(B) All DNA have a net negative charge
(C) All proteins have net positive charge
(D) All DNA have neutral charge
(E) All of the above

Questions 18-24
Answer the following questions to the best of your knowle

18. Use a drawing to illustrate the principle of nucleic ac ridization (*4 points*)

DNA hybridization



Temp
pH
Low Salt
Organic solvent

19. Name four factors that promote DNA denaturation. Explain how each affects the denaturation process. Use graphs where necessary. (*10 points*)

These conditions promote DNA denaturation

(A) High temperature

Heat DNA solution

the noncovalent forces holding the 2 strands together weaken and break

The two strands come apart in a process known as DNA denaturation/melting

The amount of strand separation or melting is measured by absorbance at 260 nm against temperature

Plot a graph of absorbance against temperature to follow DNA melting

58

(b)How long is the DNA in microns? (1 micron = 10^4 Å) (*3 points*)

The spacing between base pairs is about 3.4 Å or 3.4×10^{-4} µm along the helical axis.

So multiply the number of bp by 3.4×10^{-4} µm

1.8×10^8 bp $\times 3.4 \times 10^{-4}$ µm/bp = 6.12×10^4 µm

(c) What is the molecular mass of this DNA? (*3 points*)

One bp has a molecular mass of about 660 D, so multiply the number of bp by 660 D

1.8×10^8 bp $\times$ 660 D/bp = $1{,}188 \times 10^8$ D

Total points: This exam is 10% of the overall grade for the course

Antoni

$\frac{80}{100} \times 5$

59

E. coli DNA (relatively more complex, has genes of about 10,000) will have higher melting temperature . Relative GC content of 51 from Chargaff's data. AT-DNA (simple, highly repetitive, absence of single copy genes) AT-DNA has no GC content and is expected to have a low melting temperature.

21. What is hyperchromic shift? Explain its relevance in DNA denaturation. (*4 points*)

Nucleic acids absorb light at 260 nm because of the electrical nature of the bases
Close proximity of the bases in the 2 strands (double helix) quenches some of absorbance
When the 2 strands separate upon heating, quenching disappears and the absorbance increases by 30-40%. This is hyperchromic shift
Occurs when nucleic acids go from double stranded to single stranded structure

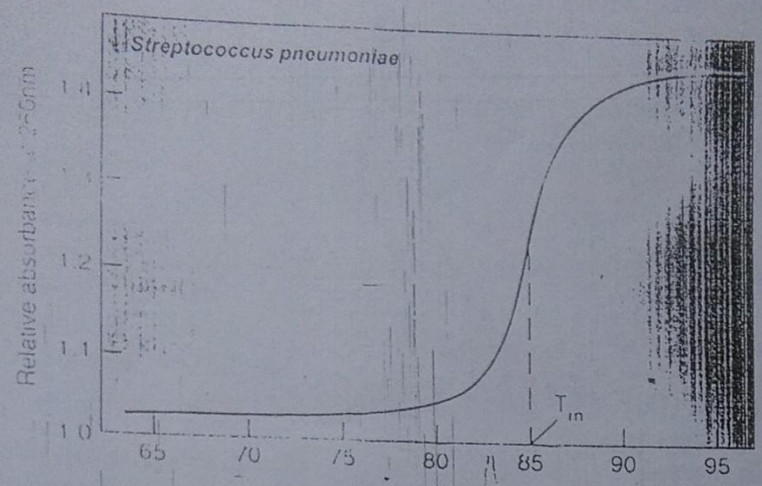
22. What do we mean by primary, secondary, tertiary and quaternary structures of proteins? (6 points)

The amino acid sequence of a protein is the primary structure
Interaction of the amino acids with their neighbors gives rise to secondary structure
α -helix: results from H-bonding among nearby amino acids
B-pleated sheet: extended protein chains packed side by side and interact by H-bonding
The three dimensional shape of a polypeptide is its tertiary structure: involves twisting and folding of the chains to incorporate hydrophobic interactions, S-S linkages, van der Waals and electrostatic interactions. *Give a bonus of 2 points student uses illustrations.*

24. *Drosophila melanogaster* has a double-stranded DNA with 1.8×10^8 bp. *2 points*
(a) How many full double helical turns does this DNA contain? (3 points)
-One turn made of 10.5 bp. So divide the total number of bp by 10.5
$= 1.8 \times 10^8$ bp $\times$ 1 helical turn/10.5 bp $= 1.714 \times 10^7$ helical turns

60

Melting curve of DNA



B) Organic solvents

organic solvents such as dimethyl sulfoxide (DMSO) and formamide : disrupt hydrogen bonds between DNA strands and promote denaturation

C) High pH: disrupt hydrogen bonds between DNA strands and promote denaturation
D) Low salt: removes ions that shield the negative charges on the 2 strands from each other

Name three factors that bring about annealing of denatured DNA. Explain the mechanism of each. (6 points)

Renaturation depends on
(A) Temperature
the best temperature for renaturation is about 25°C below the T_m
This temperature is low enough because
-Does not promote denaturation
This temperature high enough to
- allow rapid diffusion of DNA molecules
- weaken transient bonding between the mismatched sequences and intrastrand base-pairing

Rapid cooling prevents renaturation

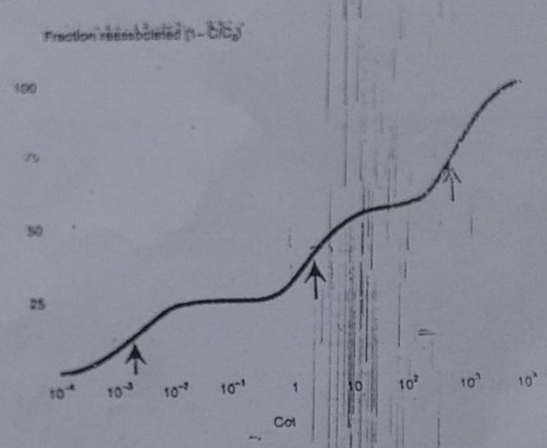
(B) DNA concentration
the higher the concentration, the more likely two complementary strands will encounter each other within a given time
The higher the concentration, the faster the annealing

(C) Time
- the longer the time allowed for annealing, the more annealing will occur

1. Complexity
-Cot curves
Cot = initial DNA concentration (Co)
in moles of nucleotides per liter
x time (t) in seconds

If all other factors are equal, extent of renaturation of complementary strands depends on the Cot. There is a linear relationship between DNA complexity and Cot ½. The more complex DNA is (magnitude of Cot) the longer it takes to reanneal. Magnitude of Cot depends on: length of DNA strand, and distribution of highly repetitive, moderately repetitive and single copy DNA.

Figure 3.6 The reassociation kinetics of eukaryotic DNA show three types of component (indicated by the shaded areas). The arrows identify the $Cot_{1/2}$ values for each component.



	Fast component	Intermediate component	Slow component
Percent of genome	25	30	45
$Cot_{1/2}$	0.0013	1.9	930
Complexity (nt)	340	6.0×10^5	3.0×10^9
Repetition frequency	500 000	350	

62

20. Which of these DNA will have a higher melting temperature, AT- DNA and *E. coli* DNA? How do the GC contents vary? (*4 points*)

Langmann

KWAME NKRUMAH UNIVERSITY OF SCIENCE AND TECHNOLOGY, KUMASI
B.Sc. Biochemistry and Biotechnology
Classes: BCHEM III and BIOL III
First Semester Examination #2 2011/2012
BCHEM 365 Biophysics
October 2011

Oct. 28, 2011

27½ / 48

Program Biochemistry
Year of Program 3
Name Opoku Michael Index number 3884009
Time allowed: 1 hour

Fill in the blank spaces

1. Electrophorectic mobility is the rate of migration of a protein per unit of field strength.
2. cm^2/V-sec is the unit of electrophorectic mobility
3. The intensity of staining and thickness of protein bands are indicative of their concentration × relative abundance
4. The position height of bands measured from the start point within their respective lanes indicates their c × relative sizes
5. Discontinuous gel electrophoresis systems are designed to improve resolution of a mixture of protein sample by the process of stacking
6. Migration of the buffer front as it moves through the gel can be followed by the change in the refractive index between the regions containing the leading and trailing ions.
7. Blue Berry Native PAGE does not provide direct measurement of molecular weight, but can be used to estimate protein charge or subunit composition.
8. SDS makes all proteins have the same charge-to-mass ratio and identical electrophorectic mob
9. Ferguson plot showing same slope but different Y intercept means the native proteins have the same mass (Mr) but different charges
10. Ferguson plot having same Y intercept but different slopes means that the native proteins have the same charge but different masses.
11. SDS PAGE overcomes Native PAGE structure effect on mobility by denaturation of the protein
12. Loading buffer for SDS-PAGE must contain glycerol to permit sample to sink down the well
13. Mercaptoethanol added to the sample buffer reduces any disulfide bridges in the protein that are holding together the protein tertiary structure.
14. By strongly binding to protein, SDS disrupts most non covalent bonds, thereby decreasing protein folding
15. Bromophenol blue is an organic × tracking dye
16. Discontinuous buffer systems use different buffers for gel × and electrode tank and often two buffers within the gel, with a third buffer in the tank.
17. In discontinuous buffer system, the gel with low acrylamide percentage is the stacking gel

63

BCHEM 365
Biophysics
First semester, 2012
Oct. 11, 2012
Quiz 4

Program Biochemistry Name Agbenyegah Sefakor Adzo Index No. 4999810

Match each definition below with its term from the list provided

List

Polyacrylamide gel	Vertical systems	Tris-Acetate-EDTA buffer
Horizontal systems	Copolymerization	Persulfate
Ed	Acrylamide	Eqd
Paper	Convection currents	Agarose
Eq	Ionized silanol groups	Diffusion
Vinyl addition	Tris-EDTA buffer	TEMED
BIS-acrylamide	Starch	Tris-Acetate-Ethanoate buffer

Definitions

1. Gel systems are routinely used for protein separation on acrylamide gels Vertical systems
2. The force that drives a charged molecule toward an electrode Eq
3. The cause of mixing of separated samples during electrophoresis Convection currents
4. This support media gives poor separation of protein and nucleic acids Paper
5. A cause of electroendosmosis Ionized silanol groups
6. Medium for separation of large nucleic acids Agarose
7. Buffer for making agarose gels Tris-Acetate-EDTA buffer
8. A catalyst/initiator for preparing polyacrylamide gel TEMED
9. Polymerization of acrylamide in head-to-tail fashion Vinyl addition
10. This reagent has a molecular formula of $C_7H_{10}N_2O_2$ Bisacrylamide

64

glycinate ion ~~chloride ion~~

18. In discontinuous buffer system, the ion common to both gels is ~~glycine~~ and this is supplied by electrode buffer. Tris - HCl
19. The high pH in the resolving gel of discontinuous buffer systems is for destacking. concentrating glycine
20. Acrylamide solution is allowed to polymerize in a gel well. cassette
21. To ensure a flat interface between the resolving and stacking gels in a discontinuous system we use gradient gel. water / saturated n-butanol
22. Gels of 7.5 15 % polyacrylamide are therefore useful for separating proteins in the molecular weight range of 10,000 to 100,000.
23. A plot of protein molecular eight against R_f value is known as Ferguson plots. Laemmeli plot
24. A single band on SDS-PAGE means the sample is made of ~~single~~ protein or single subunit. equal subunit
25. gradient gel. Ampholytes are used to make the pH gradient in isoelectric focusing.

Thought problems

26. You are all set to run your first SDS polyacrylamide-gel electrophoresis. You have boiled your samples of protein in SDS in the presence of mercaptoethanol and loaded them into the wells of a polyacrylamide gel. You are now ready to attach the electrodes. Does the positive electrode go to the top of the gel, where you loaded your proteins, or at the bottom of the gel?

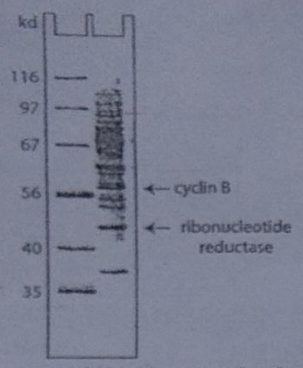
The positive electrode will go to the bottom of the gel. This is to ensure that the negatively proteins sample will move to the anode (positive elec at the bottom. 2

27. For separation of proteins by two-dimensional polyacrylamide-gel electrophoresis, what are the two types of electrophoresis that are used in each dimension? Do you suppose it makes any difference which electrophoretic method is applied first? Why or why not?

1. The first dimension is isoelectric focusing electrophor (I) and the second dimension is SDS - PAGE. 1
It makes difference in the sequence in which the two dimensional polyacrylamide-gel electrophoresis takes place. This is because when the isoelectric focusing ~~ebec~~ gel electrophoresis is done the proteins ~~bec~~ become denatured so that they can in turn bind with the sodium dodecyl sulfate (SDS) to determine their molecular weight. If it is not done this way the desired separation cannot be achieved 2

65

The figure below shows an autoradiograph of an SDS-PAGE separation of radiolabeled proteins in a cell-free extract of sea urchin eggs. Alongside are shown a set of radiolabeled marker proteins of defined molecular mass. Two bands that contain known proteins – the small subunit of ribonucleotide reductase and cyclin B, are indicated.



please ~~turn to~~

please kindly turn back to back page.

(A) Do the standard set of proteins migrate at a rate that is inversely proportional to their molecular masses? That is to say, would you expect a protein of 35 kd for example, to migrate twice as far down the gel as a protein of 70 kd? Do you suppose a plot of log molecular mass versus migration would give a more linear relationship? Hint: Sketch a relevant graph to help you answer this question.

(B) How would you use the standard set of proteins to estimate the molecular masses of ribonucleotide reductase and cyclin B? What would you estimate the molecular masses of these two proteins to be?

(C) The sequences of the genes for these two proteins give molecular masses of 44 kd for ribonucleotide reductase and 46 kd for cyciln B. Can you offer some possible reasons why the SDS-PAGE estimate for the molecular mass of cyclin B is so far off?

66

TEAM SELORM '17 TOGETHER WE CAN

KWAME NKRUMAH UNIVERSITY OF SCIENCE AND TECHNOLOGY, KUMASI

B.Sc. Biochemistry and Biotechnology

Classes: BCHEM III and BIOL III

First Semester Examination #2 2011/2012

BCHEM 365 Biophysics

October 2011

Oct. 28, 2011

27/48

Program BIOCHEMISTRY

Year of Program 3

Name DADSON JEFFERY KWEKU Index number 3880809

Time allowed: 1 hour

Fill in the blank spaces

1. Electrophoretic mobility is the rate of migration of a protein per unit of field strength.
2. $cm^2/V\text{-}sec$ is the unit of (Field strength x) Electrophoretic mobility
3. The intensity of staining and thickness of protein bands are indicative of their concentration (relative abundance)
4. The position height of bands measured from the start point within their respective lanes indicates their mobility (Rf) x (relative sizes)
5. Discontinuous gel electrophoresis systems are designed to improve resolution of a mixture of protein sample by the process of stacking
6. Migration of the buffer front as it moves through the gel can be followed by the change in the refractive index between the regions containing the leading and trailing ions.
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9. Ferguson plot showing same slope but different Y intercept means the native proteins have same sizes (mass) but different charges
10. Ferguson plot having same Y intercept but different slopes means that the native proteins have same charges but different sizes (mass)
11. SDS PAGE overcomes interference effect on mobility by denaturation of the protein
12. Loading buffer for SDS-PAGE must contain (glycerol) glycine x to permit sample to sink down the well
13. Mercaptoethanol added to the sample buffer reduces any disulphide linkages bridges in the protein that are holding together the protein subunits x (tertiary structure)
14. By strongly binding to protein, SDS disrupts most (non) covalent x bonds, thereby decreasing protein denaturation structure x (folding)
15. Bromophenol blue is an acidic (ionizable) tracking dye (tank)
16. Discontinuous buffer systems use different buffers for sample, gel x and (gel) electrode (tank) x, and often two different buffers within the gel, with a third buffer in the tank.
17. In discontinuous buffer system, the gel with low acrylamide percentage is the stacking gel

67

$\frac{cm^2}{V\text{-}sec}$ $\frac{D}{E}$ $\frac{D}{E}$ $\frac{D \times t}{1 \quad E}$ $\frac{Dt}{E}$ $\frac{V}{E}$

Pcu/Cos/m155-11

18. In discontinuous buffer system, the ion common to both gels is _____ and this is supplied by _____.

19. The high pH in the resolving gel of discontinuous buffer systems is for _____.

20. Acrylamide solution is allowed to polymerize in a gel _____.

21. To ensure a flat interface between the resolving and stacking gels in a discontinuous system we use _____.

22. Gels of _____ % polyacrylamide are therefore useful for separating proteins in the molecular weight range of 10,000 to 100,000.

23. A plot of protein molecular weight against R_f value is known as _____.

24. A single band on SDS-PAGE means the sample is made of _____ protein or _____.

25. _____ are used to make the pH gradient in isoelectric focusing.

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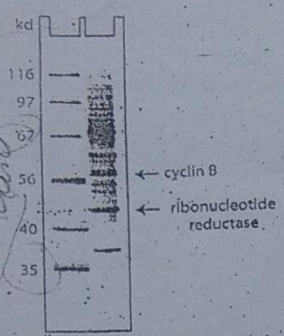

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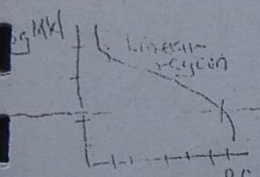

Yes, proteins migrate at a rate that is inversely proportion to their molecular mass shown by the linear region. But curve is sigmoidal because at very high molecular weigh the proteins experience a very large sieving effect and so are to penetrate the gel. On the other hand, when the MW is so small, proteins migrate at rate almost ~~that~~ the same as that of their fr mobility which does not depend on size in SDS - PAGE (Rf — rate of migration)

(B) How would you use the standard set of proteins to estimate the molecular masses of ribonucleotide reductase and cyclin B? What would you estimate the molecular masses of these two proteins to be?

A Calibration curve can be drawn using the Rf and the log MW of the marker proteins. The Rf of ribonucleotide reductase and cyclin B can be m plotted and traced on the graph with the calibration curve to obtain their MW. (Ribonucleotide reductase = 47kd cyclin B = 58kd)

(C) The sequences of the genes for these two proteins give molecular masses of 44 kd for ribonucleotide reductase and 46 kd for cyciln B. Can you offer some possible reasons why the SDS-PAGE estimate for the molecular mass of cyclin B is so far off?

The SDS-PAGE estimate is so far off because the SDS denatures the cyclin into its separate subunits of the protein and so the MW will not be as 3 of the whole intact protein but the reductase is only a subunit.

Post-translational modifications also are not accounted for by de-calculated MW

Features of cyclin B - seq. that affect its migrat

coli DNA (relatively more complex, [illegible] genes of about 10,000) will have a higher melting temperature . Relative GC content of 51 [illegible] in Chargaff's data. AT-DNA (simple, highly repetitive, absence of single copy genes) [illegible] DNA as no GC content and is expected to have a low melting temperature.

21. What is hyperchromic shift? Explain its relevance in DNA denaturation. (*4 points*)

Nucleic acids absorb light at 260 nm because of the electrical nature of the bases
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B-pleated sheet: extended protein chains packed side by side and interact by H-bonding
The three dimensional shape of a polypeptide is its tertiary structure: involves twisting and folding of the chains to incorporate hydrophobic interactions, S-S linkages, van der Waals and electrostatic interactions. *Give a bonus of 2 points student uses illustrations.*

24. *Drosophila melanogaster* has a double-stranded DNA with 1.8×10^8 bp. *2 points*
(a) How many full double helical turns does this DNA contain? (3 points)
-One turn made of 10.5 bp. So divide the total number of bp by 10.5
$= 1.8 \times 10^8$ bp $\times$ 1 helical turn/10.5 bp $= 1.714 \times 10^7$ helical turns

70

6104211
Baffour Awuah

BCHEM 264
Biophysics
First Semester, 2013
Homework Assignment 3

Due Tue. Feb. 19

1. What is the major information that can be obtained from Cot curves?

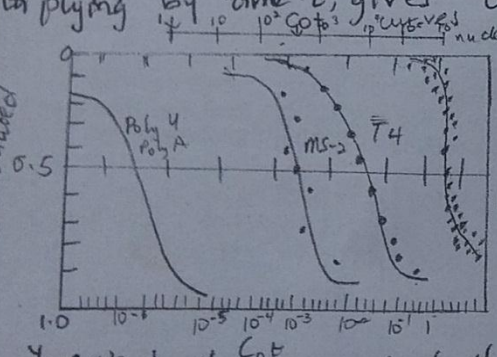
2. Please find attached to your Homework Assignment 3 sheet the article:

   Goldberg, R.B. 2001. From Cot curves to genomics. How gene cloning established new concepts in plant biology. Plant Physiology 125: 4–8.

   Read the article carefully and summarize in two sentences, how the theory of Cot curves contributed to the study of genomics.

Soln//

ot curve is concerned with the measurement of the degre of reannealing of DNA strands. It is a curve drawn with x-axis ving DNA concentration in moles/L wito multiplied by time on a ogarithmic scale. Since the initial concentration is considered as Co, ltiplying by time t, gives "Cot" and the graph is known as Cot curves



From the graph it can be seen that it takes DNA toward the right eg T4 much longer time to reanneal and vice-versa. Each dot represent a varie repeat. It takes repetitive DNA much less time to reanneal. Also DNA with high molecular weight eg. T4 with 10^2 nucleotide pairs reanneal faster than MS-2 with 10 nucleotide pairs.

e Y-axis is the percent of the DNA that remains single stranded. The curve is rather smooth as can be seen and it indicates that reannealing occurs radually over a period of time. The Cot½ is the cot value where half of the NA has reannealed.

The shape of a curve for a given species is a function of two factors: size or complexity of the genome and the amount of repetitive NA within the genome.

As genome size increases a longer time is required for the denatured A to anneal

As genome size increases a higher concentration is required for the atured DNA to anneal.

As mentioned earlier complexity is a function of a species and complexi the distribution of different sequences present in the DNA molecule. complexity of any genome can be determined by the formular

$$\frac{\text{Cot } 1/2 \text{ (DNA of any genome)}}{\text{Cot } 1/2 \text{ (E coli DNA)}} = \text{complexity of any genome}$$

BCHEM 264
Homework 3 Grading

QUESTION 1

Total 18 points

Cot curves are used to follow the pattern of reassociation of denatured DNA. *1 point*

The pattern of reassociation provides information about the complexity of DNA. *1 point*

Complexity refers to the size of DNA as well as the distribution of components in the DNA *1 point*

The higher the $Cot_{1/2}$ value, the larger the size of the DNA, which implies it will take a larger concentration and a longer time to anneal. *1 point*

The kinetics of reassociation shown on the Cot curve provides information about the distribution of various sequences in the DNA. *1 point*

DNA having large number of repetitive sequences tells the researcher that this component will have ribosomal regions and can therefore be used in fingerprinting assays. *1 point*

Repetitive DNA also signifies higher tendency of mismatch and hence lower melting temperature and probably a lower GC content. 2 *points*

DNA with many single copies suggests mainly genes. *1 point*

Bacterial genomes usually have single kinetics on their Cot curves. *1 point*

Bacterial genomes therefore do not have repetitive sequences, hence directly transcribed into mRNA, *(1 point)* while the presence of repetitive sequences in eukaryotic DNA demands processing of intermediate RNA to rid it of the untranslated regions to produce mRNA for translation into protein. *2 points*

QUESTION 2

Cot curves provided information [illegible] and gene regulation *2 points*
Cot curves opened the way for [illegible]
conditions to load into the thermocycler for any DNA amplification, a tool indispensable in genomics
- The melting temperature of a primer was deduced empirically by use of Cot curves to be:

$T_m = 2(A + T) + 4(G+C)$

Where A= adenine
T= thymine
G=guanine
C= cytosine
4 points

72

BCHEM 264
Homework 3 Grading

QUESTION 1

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QUESTION 2

Cot curves provided information on plant genome organization and gene regulation *2 points*
Cot curves opened the way for calculation of primer melting temperature (T_m) and hence PCR conditions to load into the thermocycler for any DNA amplification, a tool indispensable in genomics
- The melting temperature of a primer was deduced empirically by use of Cot curves to be:

$T_m = 2(A + T) + 4(G+C)$

Where A= adenine
T= thymine
G=guanine
C= cytosine
4 points

18
4
14

$T_m = 2(A+T)+4$

73

D) None of the above

7. The Cot1/2 of MS2 is 10^{-1}. Find its complexity given that *E.coli* Cot ½ is 10^{-2} and its sequence is 4.2×10^{6} bp.

$\frac{Cot\,1/2\,(DNA)}{Cot\,1/2\,(Ecoli)} = \frac{\text{complexity of genome}}{4.2 \times 10^{6}\,bp}$ where $Cot\,1/2\,MS2\,DNA = 10^{-1}$, $Cot\,1/2\,Ecoli = 10^{-2}$

$\frac{10^{-1}}{10^{-2}} = \frac{\text{complexity of DNA}}{4.2 \times 10^{6}\,bp}$

complexity of MS2 DNA $= \frac{10^{-1}}{10^{-2}} \times 4.2 \times 10^{6}\,bp = 42 \times 10^{7}\,bp$

8. You want to separate a mixture of proteins. Choose the correct method.
   A) You would use acrylamide and vertical gel systems.
   B) You would use acrylamide and horizontal gel system
   C) You would use agarose and vertical gel system
   D) You would use agarose and horizontal gel system

$\frac{\frac{1}{10}}{\frac{1}{10^{2}}}$ $\frac{1}{10} \times 10^{2}$ 10 $\frac{1}{10} \times \frac{10^{2}}{1}$

9. You want to separate a mixture of small nucleic acids. Choose the correct method.
   A) You would use acrylamide and vertical gel systems
   B) You would use acrylamide and horizontal gel system
   C) You would use agarose and vertical gel system
   D) You would use agarose and horizontal gel system

$\frac{Cot\,1/2\,(DNA\ of\ any\ genome)}{Cot\,1/2\,(Ecoli)} = \frac{\ldots}{4.2 \times}$

10. You want to separate a mixture of large nucleic acids. Choose the correct method.
   A) You would use acrylamide and vertical gel systems
   B) You would use acrylamide and horizontal gel system
   C) You would use agarose and vertical gel system
   D) You would use agarose and horizontal gel system

$\frac{10^{-1}}{10^{-2}} \times 4.2 \times 10^{6}$

Match each definition below with its term from the list provided

List

Polyacrylamide gel	Vertical systems	Tris-Acetate-EDTA buffer
Horizontal systems	Copolymerization	Persulfate
Ed	Acrylamide	Eqd
Paper	Convection currents	Agarose
Eq	Ionized silanol groups	Diffusion
Vinyl addition	Tris-EDTA buffer	TEMED
BIS-acrylamide	Starch	Tris-Acetate-Ethanoate buffer

Definitions

11. Gel systems are routinely used for protein separation on acrylamide gels Vertical system
12. The force that drives a charged molecule toward an electrode Eq
13. The cause of mixing of separated samples during electrophoresis Convection currents
14. This support media gives poor separation of protein and nucleic acids paper
15. A cause of electroendosmosis Ionized silanol groups
16. Medium for separation of large nucleic acids aganosa
17. Buffer for making agarose gels Tris - Acetate - EDTA buffer
18. A catalyst/initiator for preparing polyacrylamide gel TEMED
19. Polymerization of acrylamide in head-to-tail fashion vinyl addition
20. This reagent has a molecular formula of $C_7H_{10}N_2O_2$ Bis-acrylamide.

7 4

TEAM SELORM '17 TOGETHER WE CAN

KWAME NKRUMAH UNIVERSITY OF SCIENCE AND TECHNOLOGY

B.Sc. Biochemistry and Biotechnology

BCHEM 264 Biophysics

Quiz 6

Index number 6109211

Time allowed: 5 min

1. Given $\ln (N_t/N_0) = -\lambda t$ and that the half-life of ^{32}P is 14.2 days, how long would it take a solution containing 42,000 d.p.m. of ^{32}P to decay to 500 d.p.m.?

(A) 100 days
(B) 55 days
(C) 4 days
(D) 21 days
(E) 91 days

2. Which of these is the approximate mass of a proton?

(A) 1.67×10^{-28} kg
(B) 0.67×10^{-27} kg
(C) 1.67×10^{-27} kg
(D) 9.01×10^{-32} kg
(E) 9.10×10^{-31} kg

3. Which of these elements are expected to undergo radioactive decay?

I. $^{x+2}_{x-2}A$ II. $^{x}_{x}A$ III. $^{x+2}_{x}A$ IV. $^{x+2}_{x+2}A$ V. $^{x}_{x-2}A$

(A) I only
(B) II and III only
(C) V only
(D) I, III and V
(E) II and IV

4. Which of these elements are not expected to undergo radioactive decay?

I. $^{x+2}_{x-2}A$ II. $^{x}_{x}A$ III. $^{x+2}_{x}A$ IV. $^{x+2}_{x+2}A$ V. $^{x}_{x-2}A$

(A) I only
(B) II and III only
(C) V only
(D) I, III and V
(E) II and IV

5. A radioactive decay event in which the nucleus loses a neutron but gains a proton is

(A) α emission
(B) β^- emission
(C) β^+ emission
(D) γ radiation
(E) None of the above

75

Pcu /cos/m526-13

Cot ½ indicates the total length of different sequences present - complexity (usually in base pairs)

Cot ½ of any genome is proportional to its complexity

Cot curve reveals a crucial difference between bacterial and eukaryotic genomes Bacterial genome eg. E coli has a single kinetic component whereas Eukaryotic genome eg. Mouse has a much more complex kinetic component.

The various complexity components are; fast component made up of highly repetitive DNA, intermediate component made up of moderately repetitive DNA and slow component made up of a single copy DNA.

	Fast Component	Intermediate Component	Slow Component
Percent of genome	25	30	45
Cot ½	0.0013	1.9	630
Complexity, bp	340	6.0×10^5	3.0×10^8
Repetition of frequency	500,000	350	1

For intermediate component not a single length of DNA but a variety of individual sequences, each shorter whose length together comes to 6×10^5 bp, dispersed throughout the genome and their average repetition is 350. Fast component often forms discrete clusters and is found at centromers and repeats averagely about 500,000 times If repetitive DNA is isolated, heated, and allowed to renature reassociated double strands melt gradually over a wide temperature range It does not consist of exactly paired molecules, some mispairing. Slow component however are not repetitive repetition frequency of one. and are longer hence it takes longer time to reanneal.

DNA sizes is expressed according to the molecular weight, base pairs and bases and as any of these increases reannealing occurs faster

1. It helped to isolate plant genes and this helped to unravel the complexity of plant processes at the genome level by using principles of DNA denaturation and renaturation.

2. Plant genes were located relatively close to each other on plant chromosomes and genes with plant genomes contained repetitive DNA sequences considered to be "eukaryotic-like" similar to animal genome in that respect

KWAME NKRUMAH UNIVERSITY OF SCIENCE AND TECHNOLOGY, KUMASI
B.Sc. Biochemistry and Biotechnology
Classes: BCHEM III and BIOL III
First Semester Examination #1 2011/2012
BCHEM 365 Biophysics
September 2011

Sept. 29, 2011

40½ / 60

Program Biochemistry
Year of Program Third
Name Collins Amoah - Antwi Index number 3877609
Time allowed: 2 hours

Questions 1-17: Circle the correct answer to the following questions

1. The phenomenon of electrophoresis was observed for the first time by
(A) Oswald Avery in 1807
(B) F. Reuss in 1828
(C) Oswald Avery in 1828
(D) F. Reuss in 1807

separating diff types of based on their patterns of movement in an el field

2. Electrophoresis is a technique used for _____ different types of molecules based on their patterns of movement in an electric field.
(A) Separating
(B) Detecting
(C) Quantifying
(D) Only (A) and (B)

3. Which of these statements is true?
(A) Both proteins and nucleic acids possess positive and negative charges at any given pH. Under the influence of electrical field, they will migrate either to the cathode or to the anode
(B) Only proteins possess positive and negative charges at any given pH. Under the influence of electrical field, they will migrate either to the cathode or to the anode
(C) Only nucleic acids possess positive and negative charges at any given pH. Under the influence of electrical field, they will migrate either to the cathode or to the anode
(D) None of the above

4. An electrophoresis unit consists of
(A) A power pack, gel slab, and gel comb
(B) A plastic frame, power pack and buffer
(C) A tank, plastic frame and gel comb
(D) A power pack, tank, plastic frame and gel comb

5. The force, in newtons that drives a macromolecule with charge q toward an electrode, when placed in an electric field of potential difference E and separated by a distance d, is given by
(A) qE
(B) qd

77

(C) dE
(D) qdE

6. The velocity, v, of the charged macromolecule in Question 5 which encounters frictional resistance, f, is given by the equation
(A) $v = qE/f$
(B) $v = qf/E$
(C) $v = qdE/f$
(D) $v = qfE/d$

7. The electrophoretic mobility, μ, of the charged macromolecule in Question 5 and 6 is given by
(A) v/d
(B) v/Ed
(C) v/Eq
(D) v/E

8. During electrophoresis, the current in the solution between the electrodes is conducted
(A) mainly by the buffer ions, with a small proportion conducted by the sample ions
(B) by buffer ions and sample ions equally
(C) by only buffer ions
(D) mainly by sample ions with a small proportion conducted by the buffer ions

9. The generation of heat in the medium during electrophoresis produces which of the following effects?
(A) A decreased rate of diffusion of sample and buffer ions leading to broadening of the separated samples
(B) The formation of convection currents, which leads to mixing of separated samples
(C) A decrease of buffer viscosity and hence a sharpening of separated bands
(D) All of the above

10. Electroendosmosis is a problem in electrophoresis caused by
(A) heating fluctuations when power supply is not constant
(B) presence of charged groups on the surface of the support medium
(C) conduction of current by the buffer ions
(D) the zone center migrating faster than the edges

11. For a good separation, electrophoresis grade agarose must have
(A) many sulfate groups
(B) few sulfate groups
(C) moderate content of sulfate, carboxyl, and methoxyl groups
(D) none of the above

12. In electroendosomosis the movement of electrolyte ions can be toward the
(A) anode
(B) cathode
(C) zone center
(D) no movement of electrolyte ions

13. Which of these is true?
A) Agarose is a linear polysaccharide made up of the basic repeating unit agarotriose
B) Agarose is a branched polysaccharide made up of the basic repeating unit agarobiose
C) Agarose is a linear polysaccharide made up of the basic repeating unit agarobiose
D) Agarose is a branched polysaccharide made up of the basic repeating unit agarotriose

14. In what way does agarose support medium overcome convective currents during electrophoresis?
A) The cross-linked structure
B) The variable pore size
C) both (A) and (B)
D) None of the above

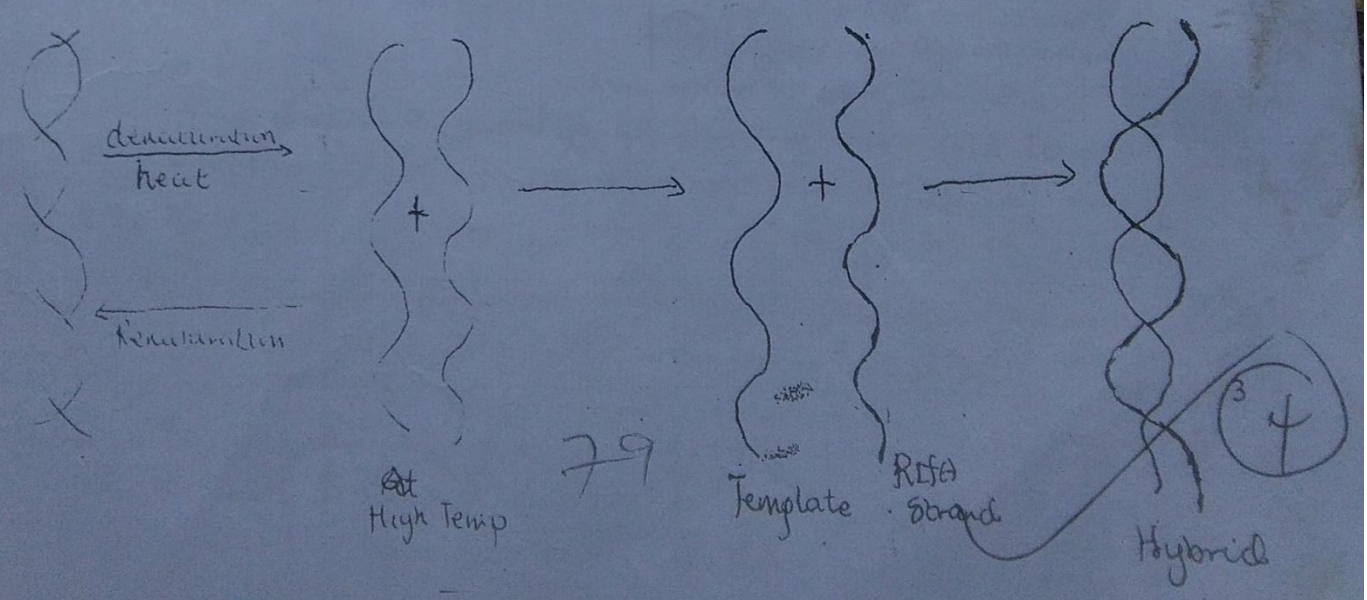
5. Gelling properties of agarose is attributed to
A) both inter- and intramolecular hydrogen bonding within and between the long agarose chains
B) cross-linking of agarose chains with sulfate groups
C) both inter- and intramolecular methylene bridges within and between the long agarose chains
D) All of the above

6. 1% agarose gel is good for the separation of
A) only proteins
B) only nucleic acids
C) Either proteins or nucleic acids
D) both proteins and nucleic acids

7. Which of these statements is true? (2 points)
(a) All proteins have a net negative charge
(b) All DNA have a net negative charge
(c) All proteins have net positive charge
(d) All DNA have neutral charge
(e) All of the above

uestions 18-24
nswer the following questions to the best of your knowledge

18. Use a drawing to illustrate the principle of nucleic acid hybridization (4 points)



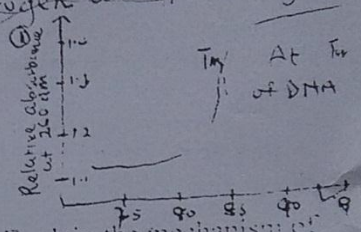
19. Name four factors that promote DNA denaturation. Explain how each affects the denaturation process. Use graphs where necessary. (10 points)

1) High Temperature – Applying heat to a solution of DNA denatures it by breaking / weakening and hydrogen bonds. At a temperature ~~Tm~~ half of the DNA strand melt

2) High pH – High pH also disrupts the hydrogen bonds holding the two DNA strands

3) Low Salt – This also disrupts the ionic distribution of the hydrogen bonds, weaking ~~the~~ causing the strands to separate.

4) Organic Solvents – Organic solvent interupts with the ionic bonding ~~bond~~ holding the two strands together, thereby weaking weakening and causing them to denature.



20. Name three factors that bring about annealing of denatured DNA. Explain the mechanism of each. (6 points)

1) Concentration of DNA – At high concentration of DNA, there will be a high chance for the breaking of mismatched bases and the binding of the correct since there's abundance of each base.

2) Temperature – At a temperature of about 25°C lower than the Melting Temp there temperature is high enough to cause the two strands to join together.

3) Complexity – The complexity of a DNA molecule is determined by the Cot½ from cot curves. The more complex the DNA is, the high the chance to anneal.

21. Which of these DNA will have a higher melting temperature, AT- DNA and E. coli DNA? How do the GC contents vary? (4 points)

E. coli will have a higher melting temperature. E. coli has a higher GC than AT- DNA which is made up ~~of~~ almost dominantly by AT sequences. higher the GC content, the higher the melting temperature.

22. What is hyperchromic shift? Explain its relevance in DNA denaturation. (4 points)

Hyperchromic shift is the increase in absorbance of about 30% - 40% by DNA during denaturation ~~when it is melting~~ at a particular temperature.

Relevance of hyperchromic shift in DNA denaturation is that, the ~~curve~~ shape of the curve gives information about the state of the denatured DNA.

high temp
high pH
ionic solvents

80

23. What do we mean by primary, secondary, tertiary and quaternary structures of proteins? (6 points)

Primary Structure of Proteins is the sequence of amino acids in the protein
secondary Structure is the interaction the proteins have. This yields the α-helix and β-sheet structures. The α-helix structure is determined by the interaction between the amino acids. The β-sheet structure is determined by interaction with other proteins
Tertiary Structure is determined by folding of the protein caused by internal interactions of groups withing the protein
Quaternary structure is determined by multiple polypeptide chains interacting to geth + involves about 2 or more polypeptide units. Eg. the protein haemoglobin.

3

24. *Drosophila melanogaster* has a double-stranded DNA with 1.8×10^8 bp.

(a) How many full double helical turns does this DNA contain? (3 points)

1 turn = 10.5 bp ⇒ No of turns = $\frac{1.8 \times 10^8}{10.5} = 1.71 \times 10^7$ turns

quat: clustering of several indiv polypeptide chain

3

(b) How long is the DNA in microns? (1 micron = 10^4 Å) (3 points)

length =

$1.8 \times 10^8 \times 3.4 \mu \times 10^{-4} = 6.12 \times 10^4 \mu m$

2

(c) What is the molecular mass of this DNA? (3 points)

Molecular mass = $1.8 \times 10^8 \times 660 D$

$= 1.188 \times 10^{11} D$

3

Primary: linear strings of amino acids held together by peptide bonds

Total points: 62
This exam is 10% of the overall grade for the course

Antonia Tetteh

81

BCHEM 365
Biophysics
First Semester, 2012
Homework Assignment 3

Due Fri. Sept. 21

1. What is the major information that can be obtained from Cot curves?

2. Please find attached to your Homework Assignment 3 sheet the article:

   Goldberg, R.B. 2001. From Cot curves to genomics. How gene cloning established new concepts in plant biology. Plant Physiology 125: 4–8.

   Read the article carefully and summarize in two sentences, how the theory of Cot curves contributed to the study of genomics.

KWAME NKRUMAH UNIVERSITY OF SCIENCE AND TECHNOLOGY, KUMASI

B.Sc. Biochemistry and Biotechnology

Classes: BCHEM III and BIOL III

First Semester Examination #1 2012/2013

BCHEM 365 Biophysics

October 2012

Oct. 04, 2012

48

Program BIOCHEMISTRY 3

Index number 5004310

Time allowed: 1½ hours

Questions 1-20: Circle the correct answer.

1. The phenomenon of electrophoresis was observed for the first time by
(A) Oswald Avery in 1807
(B) F. Reuss in 1828
(C) Oswald Avery in 1828
(D) F. Reuss in 1807

2. Electrophoresis is a technique used for _____ different types of molecules based on their patterns of movement in an electric field.
(A) Separating
(B) Detecting
(C) Quantifying
(D) Only (A) and (B)

3. Which of these statements is true?
(A) Both proteins and nucleic acids possess positive and negative charges at any given pH. Under the influence of electrical field, they will migrate either to the cathode or to the anode
(B) Only proteins possess positive and negative charges at any given pH. Under the influence of electrical field, they will migrate either to the cathode or to the anode
(C) Only nucleic acids possess positive and negative charges at any given pH. Under the influence of electrical field, they will migrate either to the cathode or to the anode
(D) None of the above

pa -

I = CV

4. An electrophoresis unit consists of
(A) A power pack, gel slab, and gel comb
(B) A plastic frame, power pack and buffer
(C) A tank, plastic frame and gel comb
(D) A power pack, tank, plastic frame and gel comb

5. The force, in newtons that drives a macromolecule with charge q toward an electrode, when placed in an electric field of potential difference E and separated by a distance d, is given by
(A) qE
(B) qd

83

Q8 : 16

B) Agarose crosslinks are formed by heating
C) Acrylamide crosslinks are formed by heating
D) Acrylamide crosslinks are formed by copolymerization and vinyl addition
E) None of the above

34. Which of the methods listed below would you choose to resolve up to about 4,000 proteins?
A) Agarose gel electrophoresis
B) cellulose acetate electrophoresis
C) 2D gel electrophoresis
D) Isoelectric focusing
E) SDS-PAGE

35.Two proteins have same relative molecular mass of 12,000. How can you detect this on a Ferguson plot?
A) Same slope
B) Same intercept on Y axis
C) A slope of zero for each protein
D) A Y intercept of zero for each protein
E) None of the above

36. Which method is best for separating acidic water-soluble and membrane proteins?
A) Quantitative Preparative Native Continuous (QPNC) PAGE
B) Isoelectric Focusing
C) Blue Native PAGE
D) SDS-PAGE
E) Clear Native PAGE

37.Arrange the following fixatives in order of denaturation ability
A) Alcohol:acid:water> Glutaraldehyde> Trichloroacetic acid
B) Glutaraldehyde> Trichloroacetic acid> Alcohol:acid:water
C) Alcohol:acid:water> Glutaraldehyde >Trichloroacetic acid
D) Glutaraldehyde> Alcohol:acid:water> Trichloroacetic acid
E) Trichloroacetic acid> Alcohol:acid:water> Glutaraldehyde

38. You have separated a mixture of membrane proteins on SDS-PAGE. Which of these fixatives would you use in your preparation for staining?
A) Isoprpanol:acetic acid:water
B) Formaldehyde
C) Ethanol:acetic acid:water
D) TCA
E) None of the above

(C) dE
(D) qdE

6. The velocity, v, of the charged macromolecule in Question 5 which encounters frictional resistance, is given by the equation
(A) $v = qE/f$
(B) $v = qf/E$
(C) $v = qdE/f$
(D) $v = qfE/d$

7. The electrophoretic mobility, μ, of the charged macromolecule in Question 5 and 6 is given by
(A) v/d
(B) v/Ed
(C) v/Eq
(D) v/E

8. During electrophoresis, the current in the solution between the electrodes is conducted
(A) mainly by the buffer ions, with a small proportion conducted by the sample ions
(B) mainly by buffer ions and sample ions equally
(C) mainly by only buffer ions
(D) mainly by sample ions with a small proportion conducted by the buffer ions

9. The generation of heat in the medium during electrophoresis produces which of the following effects
(A) A decreased rate of diffusion of sample and buffer ions leading to broadening of the separated samples
(B) The formation of convection currents, which leads to mixing of separated samples
(C) A decrease of buffer viscosity and hence a sharpening of separated bands
(D) All of the above

10. Electroendosmosis is a problem in electrophoresis caused by
(A) heating fluctuations when power supply is not constant
(B) presence of charged groups on the surface of the support medium
(C) conduction of current by the buffer ions
(D) the zone center migrating faster than the edges

11. For a good separation, electrophoresis grade agarose must have
(A) many sulfate groups
(B) few sulfate groups
(C) moderate content of sulfate, carboxyl, and methoxyl groups
(D) none of the above

12. In electroendosomosis the movement of electrolyte ions can be toward the
(A) anode
(B) cathode
(C) zone center
(D) no movement of electrolyte ions

13. Which of these is true?
(A) Agarose is a linear polysaccharide made up of the basic repeating unit agarotriose
(B) Agarose is a branched polysaccharide made up of the basic repeating unit agarobiose
(C) Agarose is a linear polysaccharide made up of the basic repeating unit agarobiose
(D) Agarose is a branched polysaccharide made up of the basic repeating unit agarose

14. In what way does agarose support medium overcome convective currents during electrophoresis?
(A) The cross-linked structure
(B) The variable pore size
(C) Both (A) and (B)
(D) None of the above

15. Gelling properties of agarose is attributed to
(A) Both inter- and intramolecular hydrogen bonding within and between the long agarose chains
(B) Cross-linking of agarose chains with sulfate groups
(C) Both inter- and intramolecular methylene bridges within and between the long agarose chains
(D) All of the above

16. 1% agarose gel is good for the separation of
(A) Only proteins
(B) Only nucleic acids
(C) Either proteins or nucleic acids
(D) Both proteins and nucleic acids

17. Which of these statements is true? (2 points)
(a) All proteins have a net negative charge
(b) All DNA have a net negative charge
(c) All proteins have net positive charge
(d) All DNA have neutral charge
(e) All of the above

18. Which of the following statements is true?
(A) Agarobiose comprises linear units of galactose and 3,6-anhydrogalactose
(B) Agarobiose comprises crosslinks of galactose units
(C) Agarobiose comprises alternating units of 3,6-anhydrogalactose
(D) Agarobiose comprises alternating units of galactose
(E) Agarobiose comprises alternating units of galactose and 3,6-anhydrogalactose

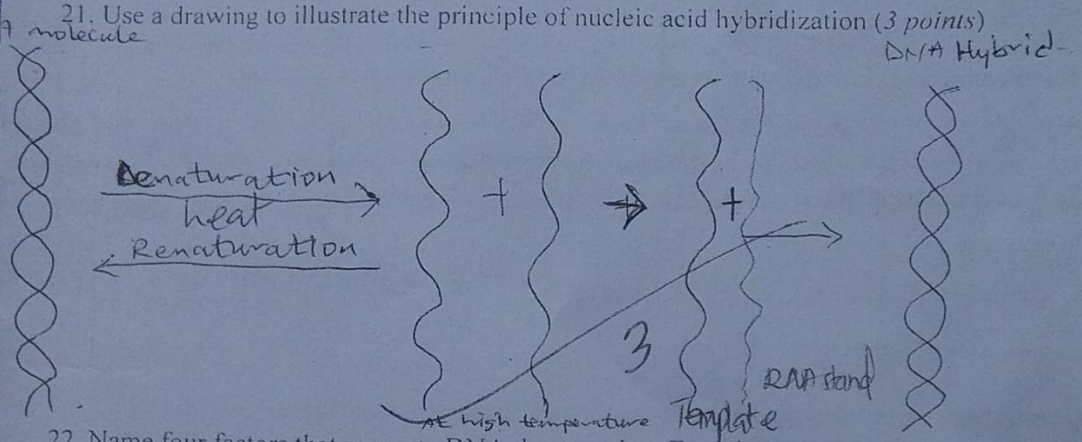
19. Which of the following statements is not true?
(A) Crosslinkages in agarose is initiated by boiling
(B) Crosslinkages in agarose is initiated by alternating units of 3,6-anhydrogalactose
(C) Crosslinkages in agarose is initiated by boiling and cooling
(D) Polymerization of agarose is initiated by boiling
(E) Polymerization of agarose is initiated by boiling and cooling

20. Which of the following statements is true?
(A) Gelling of acrylamide is attributed to inter and intramolecular hydrogen bonding between acrylamide chains

8 6

(B) Gelling of agarose is attributed copolymerization
(C) Gelling of acrylamide is attributed to vinyl addition of acrylamide chains
(D) Gelling of agarose is attributed to hydrogen bonding within and between the long agarose chains
(E) Both C and D

21. Use a drawing to illustrate the principle of nucleic acid hybridization (*3 points*)



22. Name four factors that promote DNA denaturation. Explain how each affects the denaturation process. Use graphs where necessary. (*10 points*)

a) Temperature - High temperature as a result of the heat applied increases DNA denature as it is 25°c more than Tm

b) Salt - The Low salt goes into solution to cleave off the ions on the surface of the strand promoting denaturation

c) Heat - The heat being applied to the DNA sample increases the denaturation even as heat increases.

d) Organic Solvent - Organic solvents ~~to~~ increases DNA denaturation as it goes to react with the phosphodiester bonds & hydrogen bonds to separate the two strands.

23. Name three factors that bring about annealing of denatured DNA. Explain the mechanism of each. (*6 points*)

a) DNA Concentration - The highly concentrated a DNA is, the more rapid the annealing.

b) Temperature - For annealing to occur, the temperature of the reaction should be 25°c below the Tm

c) Time - The longer the time taken, the greater the annealing of denatured DNA. That is, much time facilitates

24. Which of these DNA will have a higher melting temperature, AT- DNA and *E. coli* DNA? How do the GC contents vary? (*4 points*)

E. coli will have a higher melting temperature than AT-DNA. The higher melting temperature (Tm) results from the higher GC contents of the E-Coli than AT-DNA. Thus, the AT-DNA have a lower Tm ~~because~~ than E-Coli because it GC contents are lower than that of E-Coli

3

25. What is hyperchromic shift? Explain its relevance in DNA denaturation. (*4 points*)

Hyperchromic shift is the increase in absorbance of DNA from 30% to 40% when quenching stops and the DNA denatures by the double strands separating into single strands.

Hyperchromic shift shows the extent of the DNA denaturation.

3

26. What do we mean by primary, secondary, tertiary and quaternary structures of proteins? (*6 points*)

Primary structure protein - It has only amino acid sequence of proteins.

Secondary structure protein - It has the interactions of amino acids with neophospho bonds like α-helix

Tertiary structure protein - The three dimesional shape of the polypeptide chain and is formed by twisting and folding.

Quaternary structure protein - This is the integration of protein molecules. e.g. Hemoglobin.

24. *Drosophila melanogaster* has a double-stranded DNA with 1.8×10^8 bp.

(a) How many full double helical turns does this DNA contain? (*3 points*)

$10.5\ bp = 1$ turn $\Rightarrow 10.5\ bp \times x = 1.8 \times 10^8\ bp \Rightarrow x = 17142857.14$

$1.8 \times 10^8\ bp = x$ turns $\Rightarrow \frac{10.5\ bp \times x}{10.5\ bp} = \frac{1.8 \times 10^8\ bp}{10.5\ bp} \Rightarrow x = 1.7 \times 10^7$ turns

3

(b) How long is the DNA in microns? (1 micron = 104 Å) (*3 points*)

$1.8 \times 10^8\ bp \times 3.4\ \mu m$

$\Rightarrow 1.8 \times 10^8\ bp \times 3.4 \times 104\ Å$

$\Rightarrow 1.8 \times 10^8\ bp \times 353.6\ Å$

$\Rightarrow 6.3648 \times 10^{10}\ Å$

$1.8 \times 10^8\ bp \times 3.4\ \mu m$

$= 6.12 \times 10^8\ \mu m$

88

5

Pcu/COS/m41-12

15

KWAME NKRUMAH UNIVERSITY OF SCIENCE AND TECHNOLOGY, KUMASI
B.Sc. Biochemistry and Biotechnology
Class: BCHEM III
Second Semester Examination 2012/2013
BCHEM 264 Biophysics
March 2013

Index number 6109211

Time allowed: 30 min

Instructions
Answer all questions
Circle the correct answer on the question sheet

1. Phage T2 has a double stranded DNA with 2.5×10^5 bp. How many full double-helical turns are present in this DNA?

(A) 42,000 turns
(B) 2,625000 turns
(C) 25,000 turns
(D) 19,047 turns
(E) 23,809 turns

2. *Zea mays* has a double stranded DNA with 6.6×10^9 bp. What is the length of the DNA in centimeters?

(A) 194 cm
(B) 1.94 cm
(C) 224 cm
(D) 19.4 cm
(E) 2.24 cm

3. Homo sapiens has a double stranded DNA with 3.5×10^9 bp. What is the molecular mass of the this DNA?

(A) 0.23×10^6 kD
(B) 2.31×10^9 kD
(C) 0.188×10^9 kD
(D) 1.88×10^9 kD
(E) None of the above

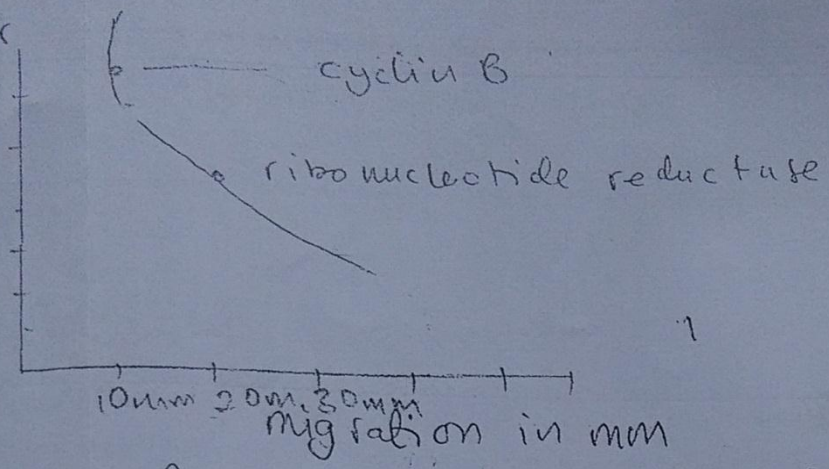
4. Which of these secondary structures represent majority of DNA in nature?
(A) Slightly positive supercoiling in B form
(B) Slightly negative supercoiling in A form
(C) Slightly negative supercoiling in B form
(D) Extensive negative supercoiling in B form
(E) Extensive positive supercoiling in A form

48
15

89

**Pcu /Cos/m473 -13

27a.



(a) It is would give a linear relation for a given range such that the proteins will migrate at distances that is inversely proportional to their molecular mass. However when the sizes ~~inverse~~ of the proteins are so large it would deviate from linearity. (1)

(B) From the graph the sizes of ~~cytin~~ cyclin and ribonucleotide reductase are approximately 58 kd and 45 respectively. Hence we can estimate their masses from interpolating from the graph. (2)

~~(c) It could be that the cyclin B deviated~~

(c) It could be that the cyclin B deviated from the linearity of the graph hence its molecular mass is far off. (1)

5. A researcher is separating a mixture of proteins, A, B and C by polyacrylamide gel electrophoresis. The power pack is producing electricity at 200 volts. The red and black electrodes are separated by a distance of 18 cm. What is the magnitude of the electrical gradient across the electrodes?

(A) 0.90
(B) 0.09
(C) 11.1
(D) 1.11
(E) 36.0

6. Separation of the protein sample in question 48 was carried out for 60 min. Protein A migrated to a distance of 8.4 cm on the gel. What is the magnitude of the mobility of protein A?

(A) 0.01261
(B) 6.1261
(C) 1.2612
(D) 0.12612
(E) 12.6126

7. The disruption of electrophoretic separation caused by electroendosmosis involves which of the following mechanisms?

(A) Dissociation of matrix anions and their movement toward anode while sample migrates to cathode
(B) Dissociation of cations and their movement toward the cathode while sample migrates to anode
(C) Dissociation of matrix anions and their movement toward the anode together with the sample
(D) Dissociation of cations and their movement toward the anode together with the sample
(E) Dissociation of both anions and cations in the matrix with no net movement

8. Which of these gels would you use to separate 100 bp from 150 bp nucleic acid?

(A) Agarose with high –COOH content
(B) Agarose with high SO_4^- content
(C) Polyacrylamid gel or agrose with high SO_4^- and –COOH content
(D) Polyacrylamide gel or agarose with low $-SO_4^-$ content
(E) Only polyacrylamide gel

9. Which of these gels would you use to separate proteins by immunioelectrophoresis?

(A) 12.5%: 5% acrylamide: BIS-acrylamide gel
(B) 7.5%: 5% acrylamide: BIS-acrylamide gel
(C) 3% agarose
(D) 1% agarose
(E) None of the above

10. Which of these reactions occur during polymerization of acrylamide.

(A) Vinyl addition of straight polymer in head-to-tail fashion and copolymerization of acrylamide monomers
(B) Vinyl addition of acrylamide monomers to form crosslinks and copolymerization straight polymers in head-to-tail fashion
(C) Vinyl addition of acrylamide monomers in head-to-tail fashion and copolymerization straight polymers to form crosslinks
(D) Vinyl addition of straight polymer to form crosslinks copolymerization of acrylamide monomers in head-to-tail fashion

**Pcu /Cos/m473 -13

(E) None of the above

11. You want to improve upon the resolution of protein separation on a polyacrylamide gel. Which of these gel systems is the right one to use?
(A) Gradient gel alone
(B) Stacking gel alone
(C) Gradient gel with stacking gel
(D) Gradient gel with resolving gel
(E) Resolving gel alone

12. Which of these gel slabs would you recommend for separating proteins having similar sizes?
(A) 5 cm × 8 cm
(B) 8 cm × 10 cm
(C) 12 cm × 15 cm
(D) 15 cm × 18 cm
(E) 20 cm × 25 cm

13. Which of these gel slabs would you recommend for separating proteins having diverse sizes?

(A) 1.5 cm × 3 cm
(B) 5 cm × 8 cm
(C) 15 cm × 18 cm
(D) 8 cm × 10 cm
(E) 5 cm × 8 cm

14. Electrophoretic stacking of a discontinuous buffer system is achieved via which of the sequence of events?
(A) High concentration stacking gel→Cl^- leads glycinate trails→ Kolrausch discontinuity develops→protein stacks
(B) High concentration stacking gel→ glycinate leads→ Cl^- trails→ protein stacks→ Kolrausch discontinuity develops
(C) Low concentration stacking gel→glycinate leads→ Kolrausch discontinuity develop→sCl^- trails→-protein stacks
(D) Low concentration stacking gel→ Cl^- leads→ glycinate ions trail→Kolrausch discontinuity develops→-protein stacks
(E) High concentration stacking gel→Cl^- leads→ Kolrausch discontinuity develops→ glycinate trails→protein stacks

15.Sodium dodecyl sulfate is ofr denaturing of polyacrylamide gel electrophoresis of proteins as _____ and _____ are for denaturing of polyacrylamide gel electrophoresis of DNA
(A)dithiothreitol and NaOH
(B)Urea and formamide
(C)β-mercaptoethanol and urea
(D) β-mercaptoethanol and formamide
(E)uric acid and formaldehyde

16.Three proteins have the same Y intercept on a Ferguson plot. What is the interpretation?
(A)Same charge

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(B) Same size
(C) Same mobility
(D) Same isoelectric pH
(E) Both A and B

17. Three proteins have the same slope on a Ferguson plot. What is the interpretation?
(A) same charge
(B) Same molecular mass
(C) Same mobility
(D) Same isoelectric point
(E) Both B and C

18. The equation which governs the mobility of macromolecules in native gel electrophoresis is
(A) Log R_m = log Y_0T -K_RY_0
(B) Log Y_m = log R_0 -K_RT
(C) Log R_m = log Y_0 -K_RT
(D) Log R_m = log R_0 +K_RT
(E) Log Y_m = log R_o + K_RT

19. Following SDS electrophoresis of histones that you have isolated from the nucleus of a eukaryote, you are getting one band per lane and or some lanes show no band at all. What would be the reason for such results?
(I) Anomalous migration of histones due to presence of extra charged groups on the protein
(II) No migration of histones due to absence of charged groups on the protein
(III) Retention of secondary structure due to incomplete denaturation by SDS
(IV) Complete denaturation of the histones to produce amino acids which migrate with no impedance by the gel matrix

(A) Only I
(B) Only II
(C) I and III
(D) II and IV
(E) II and IV

20. Which of these reagents and processes would you select to enhance denaturation of proteins that are difficult to denature by SDS alone?
(A) Triton X-100 + formamide + urea
(B) Triton X-100 + urea + acetic acid
(C) SDS + Triton X-100 + acetic acid with heating
(D) SDS + acetic acid + urea with heating
(E) SDS + Triton X-100 +urea

21. The contents of a good loading buffer for SDS-PAGE of plant tissue would be which of the following?
(I) More SDS, dithiothreitol, high pH
(II) More SDS, and mercaptoethanol, high pH
(III) Less SDS, CHES buffer, dithiothreitol, high pH
(IV) Less SDS, CHES buffer, mercaptoethanol, high pH

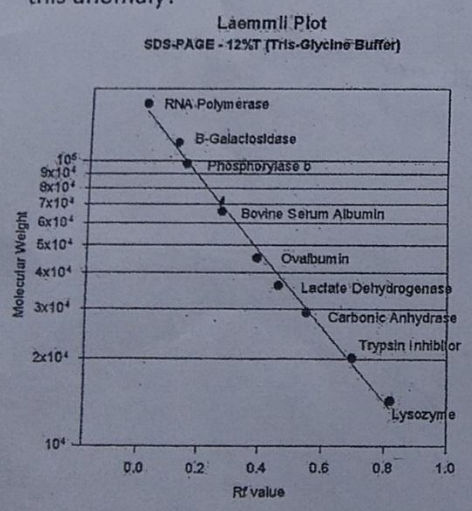
**Pcu /Cos/m473 -13

(A) Only I
(B) Only II
(C) I and III
(D) II and IV
(E) I, III, and IV

22. Four proteins of sizes, 10 KD, 12.5 kD 25 kD and 100 kD were loaded in lanes 1 to 4, respectively, on SDS-PAGE gel and run with Tris-glycine buffer in the tank. Electrophoresis was stopped when bromophenol blue dye front was halfway down the gel. Some lanes did not show any band. What are these lanes?
(A) Lanes 1 and 2
(B) Lanes 1 and 3
(C) All lanes
(D) Only lane 1
(E) Only lane 4

23. The tank buffer in question ~~65~~ 22 is changed to Tris-Tricine buffer, samples reloaded and SDS-PAGE run again. Which lanes would show bands?
(A) Lanes 1 and 2
(B) Lanes 2 and 3
(C) All lanes
(D) Only lane 1
(E) Only lane 4

24. Use the standard curve below to answer this question. The R_f value of a standard protein, X, having relative molecular weight 7×10^4 was found to be 0.6 on SDS-PAGE. What explanation can you give for this anomaly?



(I) Protein X may be heterogeneous, such as glycoprotein
(II) Protein X may be heterogeneous, such as phosphorylated protein
(III) Excessive denaturation of protein X by SDS

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(A)Only I
(B)Only II
(C)Only III
(D) II and III
(E) I, II and III

25.Which method of electrophoresis would you use to identify multiple proteins from a gene expression study?
(A) Isoelectric focussing
(B)Blue native PAGE
(C)2-dimensional gel electrophoresis
(D) Cellulose acetate electrophoresis
(E) Quantitative preparative native continuous PAGE

26.You are using isozyme marker to determine victim, suspect, and a pepetrator in a crime scene where a spot of blood was left. Which method of electrophoresis would you use?
(A) Isoelectric focussing
(B)Clear native PAGE
(C) 2-dimensional gel electrophoresis
(D) Cellulose acetate electrophoresis
(E) Quantitative preparative native continuous PAGE

27. Which is the correct sequence of the events listed below, which occur during fixation of proteins on a gel by methanol:water:glacial acetic acid reagent?
(I) Protein complex trapped inside gel
(II) Low pH disrupts hydrogen bonds
(III) Hydrophobic portions of protein exposed by organic solvent
(IV) Uncoiling of peptide chains
(V) Irreversible association between peptide chains

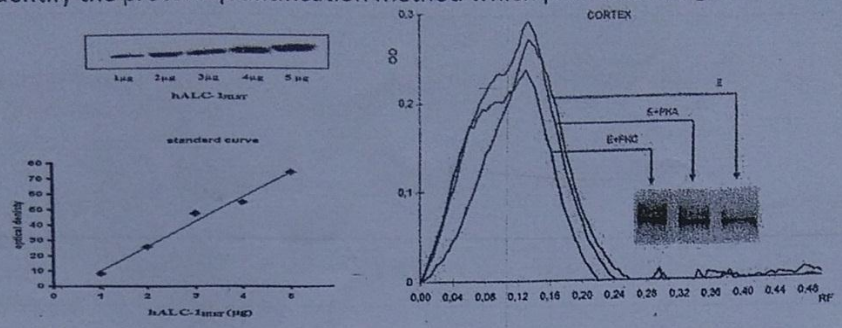
(A) I, III, IV, II, V
(B) I, II, III, IV, V
(C) III, IV, II, I, V
(D) IV, I, V, III, II
(E) II, III, IV, V, I

28. Which stain would you use to detect proteins up to 200 ng concentration on a polyacrylamide gel?
(A) Silver stain
(B) Fluorescent dye
(C) Coomassie Brilliant Blue G250
(D) Coomassie Brilliant Blue R250
(E) Ethidium bromide

29. You performed electrophoresis on glycoproteins, loaded in two lanes and used horseradish peroxidase as a positive control in the third lane. Only one sample lane showed a band and there was no band in lane 3. Which of these not may be a good reason for your observation?
(A)Samples were contaminated

(B) Lane with no band means sample concentration was below detection limit
(C) The horseradish peroxidase was inactive
(D) The method did not work well
(E) All of the above

30. Identify the protein quantification method which produces images A and B.



A B

(A) Gel documentation and Absorbance of eluted bands
(B) Absorbance of eluted bands and scanning densitometry
(C) scanning densitometry and Absorbance of eluted bands
(D) scanning densitometry and Gel documentation
(E) None of the above

31. Which of these is the correct sequence of immunostaining of western blots. *Note: CSPD is ChloroPhosphoPhenyl Dioxetane; BCIP/NBT is BromoChloroIndoyl Phosphate coupled with Nitro Blue Tetrazolium.*
(A) Blot→ Blocking→Horseradish peroxidase→Antibody→ CSPD→Bue color
(B) Blot →Blocking→Antibody→Horseradish Peroxidase→BCIP/NBT→Blue color
(C) Blot →Antibody→ Blocking→Horseradish Peroxidase→CSPD→ Luminiscence
(D) Blot→antibody→Blocking→Alkaline Phosphatase→BCIP/NBT→Bue color
(E) Blot→ Blocking→Alkaline Phosphatase→Antibody→BCIP/NBT→Luminiscence

32. Which of these do not cause electroendosmosis?
I) Electrophoresis above pH 3
II) A region of charge separation at the capillary wall/electrolyte interface
III) Cations in the electrolyte near the capillary wall migrate towards the cathode
IV) Electrolyte solution pulled toward the anode
V) Electrophoresis below pH 3

(A) I and II
(B) I and IV
(C) I alone
(D) V alone
(E) II and V

33. Select the correct statement in preparation of gels for electrophoresis
A) Agarose crosslinks are formed by cooling of heated agarose

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KWAME NKRUMAH UNIVERSITY OF SCIENCE AND TECHNOLOGY, KUMASI

B.Sc. Biochemistry and Biotechnology

Mid-Semester Examination 2012/2013

BCHEM 365 Biophysics

October 2012

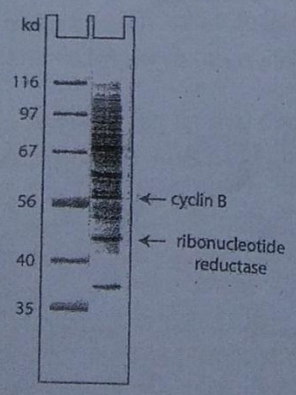
Time: 1 hr

Index No. 4999810 Program BSc Biochemistry

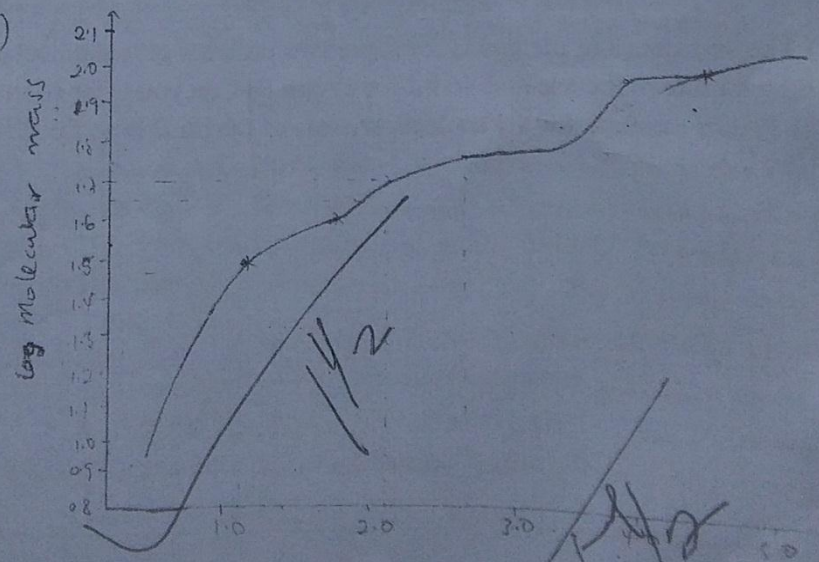
1. For separation of proteins by two-dimensional polyacrylamide-gel electrophoresis, what are the two types of electrophoresis that are used in each dimension? Do you suppose it makes any difference which electrophoretic method is applied first? Why or why not?

The two types of electrophoresis used are SDS-PAGE and Isoelectric focusing with Isoelectric focusing in the first dimension and SDS-PAGE in the second. It does make a difference. In SDS-PAGE, the charges on the proteins are modified by the binding of SDS. It confers a net negative charge on the sample. If it is done first, ~~the samples will not be~~ Isoelectric focusing which is ~~also~~ based on ~~the charge of the samples will not be effective~~ Isoelectric pH of the protein will not be effective.

2. The figure below shows an autoradiograph of an SDS-PAGE separation of radiolabeled proteins in a cell-free extract of sea urchin eggs. Alongside are shown a set of radiolabeled marker proteins of defined molecular mass. Two bands that contain known proteins – the small subunit of ribonucleotide reductase and cyclin B, are indicated.



(A)



(B) estimated Molecular mass for cyclin B – 52kd

estimated Molecular mass for ribonucleotide reductase

(A) Do the standard set of proteins migrate at a rate that is inversely proportional to their molecular masses? That is to say, would you expect a protein of 35 kd for example, to migrate twice as far down the gel as a protein of 70 kd? Do you suppose a plot of log molecular mass versus migration would give a more linear relationship? Hint: plot a relevant graph to help you answer this question.

No. The electrophoretic mobility of proteins is not an inverse function of their molecular mass. That is to say that the distance travelled by these proteins does not inversely relate with their molecular masses. A 70kd protein will not migrate half as far as a 35kd protein though the former is twice the mass of the latter. A graph of log molecular mass versus migration does give a more linear relationship.

3/3

(B) How would you use the standard set of proteins to estimate the molecular masses of ribonucleotide reductase and cyclin B? What would you estimate the molecular masses of these two proteins to be?

There are two ways of doing this. First is to estimate looking at the positions of the standard proteins. However there are two reasons why I wouldn't go for this choice. First because ~~the~~ it is not possible to accurately determine just by looking at positions of the standard proteins. Second because the standard protein may not have run at its electrophoretic mobility.

The second which I think is more accurate is to plot a graph of log molecular mass against ~~their~~ the Rf of the various standard proteins. This will give a somewhat more linear relation. ~~This can be use~~ The Rf of the unknown protein can then be used to find ~~the~~ its mass on the graph. ~~Cyclin B~~

3/3

(C) The sequences of the genes for these two proteins give molecular masses of 44 kd for ribonucleotide reductase and 46 kd for cyciln B. Can you offer some possible reasons why the SDS-PAGE estimate for the molecular mass of cyclin B is so far off?

The mass of ribonucleotide reductase as observed from the electrophoretic run is a calculated from its gene sequence. However that of cyclin B is far off the calculated value. This can be attributed to post transitional modifications of protein which can not be obtained by the electrophoretic run. Also, Cyclin B has large positive charges which may offset the charges conferred on it by SDS giving it a low net negative charge. ~~This will the cause it~~ then causes it to run more slowly. Histones also have large positive charges that even after binding with SDS ~~they~~ run slowly compared to other proteins. If they have a low ~~negative charge~~ net negative charge.

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KWAME NKRUMAH UNIVERSITY OF SCIENCE AND TECHNOLOGY, KUMASI
B.Sc. Biochemistry and Biotechnology
Classes: BCHEM III and BIOL III
Second Semester Examination #1 2012/2013
BCHEM 264 Biophysics
February 2013

Feb. 14, 2013

Program BCHEM 2
Index number 6116111

Time allowed: 15 min

Questions 1-20: Circle the correct answer.

1. The phenomenon of electrophoresis was observed for the first time by
(A) Oswald Avery in 1807
(B) F. Reuss in 1828
(C) Oswald Avery in 1828
(D) F. Reuss in 1807

2. Electrophoresis is a technique used for _____ different types of molecules based on their patterns of movement in an electric field.
(A) Separating
(B) Detecting
(C) Quantifying
(D) Only (A) and (B)

3. Which of these statements is true?
(A) Both proteins and nucleic acids possess positive and negative charges at any given pH. Under the influence of electrical field, they will migrate either to the cathode or to the anode
(B) Only proteins possess positive and negative charges at any given pH. Under the influence of electrical field, they will migrate either to the cathode or to the anode
(C) Only nucleic acids possess positive and negative charges at any given pH. Under the influence of electrical field, they will migrate either to the cathode or to the anode
(D) None of the above

4. An electrophoresis unit consists of
(A) A power pack, gel slab, and gel comb
(B) A plastic frame, power pack and buffer
(C) A tank, plastic frame and gel comb
(D) A power pack, tank, plastic frame and gel comb

5. The force, in newtons that drives a macromolecule with charge q toward an electrode, when placed in an electric field of potential difference E and separated by a distance d, is given by
(A) qE
(B) qd

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(C) dE
(D) qdE

6. The velocity, v, of the charged macromolecule in Question 5 which encounters frictional resistance, f, is given by the equation
(A) $v = qE/f$
(B) $v = qf/E$
(C) $v = qdE/f$
(D) $v = qfE/d$

7. The electrophoretic mobility, μ, of the charged macromolecule in Question 5 and 6 is given by
(A) v/d
(B) v/Ed
(C) v/Eq
(D) v/E

8. During electrophoresis, the current in the solution between the electrodes is conducted
(A) mainly by the buffer ions, with a small proportion conducted by the sample ions
(B) mainly by buffer ions and sample ions equally
(C) mainly by only buffer ions
(D) mainly by sample ions with a small proportion conducted by the buffer ions

9. The generation of heat in the medium during electrophoresis produces which of the following effects:
(A) A decreased rate of diffusion of sample and buffer ions leading to broadening of the separated samples
(B) The formation of convection currents, which leads to mixing of separated samples
(C) A decrease of buffer viscosity and hence a sharpening of separated bands
(D) All of the above

10. Electroendosmosis is a problem in electrophoresis caused by
(A) heating fluctuations when power supply is not constant
(B) presence of charged groups on the surface of the support medium
(C) conduction of current by the buffer ions
(D) the zone center migrating faster than the edges

11. For a good separation, electrophoresis grade agarose must have
(A) many sulfate groups
(B) few sulfate groups
(C) moderate content of sulfate, carboxyl, and methoxyl groups
(D) none of the above

12. In electroendosomosis the movement of electrolyte ions can be toward the
(A) anode
(B) cathode
(C) zone center
(D) no movement of electrolyte ions

**Pcu /cos/m457*

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13. Which of these is true?
(A) Agarose is a linear polysaccharide made up of the basic repeating unit agarotriose
(B) Agarose is a branched polysaccharide made up of the basic repeating unit agarobiose
(C) Agarose is a linear polysaccharide made up of the basic repeating unit agarobiose
(D) Agarose is a branched polysaccharide made up of the basic repeating unit agarose

14. In what way does agarose support medium overcome convective currents during electrophoresis?
(A) The cross-linked structure
(B) The variable pore size
(C) Both (A) and (B)
(D) None of the above

15. Gelling properties of agarose is attributed to
(A) Both inter- and intramolecular hydrogen bonding within and between the long agarose chains
(B) Cross-linking of agarose chains with sulfate groups
(C) Both inter- and intramolecular methylene bridges within and between the long agarose chains
(D) All of the above

16. 1% agarose gel is good for the separation of
(A) Only proteins
(B) Only nucleic acids
(C) Either proteins or nucleic acids
(D) Both proteins and nucleic acids

17. Which of these statements is true? (2 points)
(a) All proteins have a net negative charge
(b) All DNA have a net negative charge
(c) All proteins have net positive charge
(d) All DNA have neutral charge
(e) All of the above

18. Which of the following statements is true?
(A) Agarobiose comprises linear units of galactose and 3,6-anhydrogalactose
(B) Agarobiose comprises crosslinks of galactose units
(C) Agarobiose comprises alternating units of 3,6-anhydrogalactose
(D) Agarobiose comprises alternating units of galactose
(E) Agarobiose comprises alternating units of galactose and 3,6-anhydrogalactose

19. Which of the following statements is not true?
(A) Crosslinkages in agarose is initiated by boiling
(B) Crosslinkages in agarose is initiated by alternating units of 3,6-anhydrogalactose
(C) Crosslinkages in agarose is initiated by boiling and cooling
(D) Polymerization of agarose is initiated by boiling
(E) Polymerization of agarose is initiated by boiling and cooling

20. Which of the following statements is true?
(A) Gelling of acrylamide is attributed to inter and intramolecular hydrogen bonding between acrylamide chains

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(B) Gelling of agarose is attributed to copolymerization
(C) Gelling of acrylamide is attributed to vinyl addition of acrylamide chains
(D) Gelling of agarose is attributed to hydrogen bonding within and between the long agarose chains
(E) Both C and D

21. You want to increase the resolution of a continuous gel electrophoresis. Which of these systems would you use?

(A) Buffer with low ionic strength and highly concentrated sample
(B) Buffer with high ionic strength and low concentration of sample
(C) Load a small sample volume and run electrophoresis at high voltage across the electrodes
(D) Load a large sample volume and run electrophoresis at low voltage across the electrodes
(E) None of the above

22. Continuous gel electrophoresis has the best resolution for
(A) Small molecules at low concentration
(B) Large molecules at low concentration
(C) Small molecules at high concentration
(D) Large molecules at high concentration
(E) All of the above

23. Minimization of spread of bands in continuous and discontinuous gel electrophoresis can be achieved by
(A) Stacking in both
(B) High ionic strength of buffer in both
(C) Low ionic strength of buffer in both
(D) High ionic strength and stacking in either
(E) Low ionic strength and stacking, respectively

A. Tetteh

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KWAME NKRUMAH UNIVERSITY OF SCIENCE AND TECHNOLOGY, KUMASI
B.Sc. Biochemistry and Biotechnology
Classes: BCHEM III and BIOL III
Second Semester Examination #1 2012/2013
BCHEM 264 Biophysics
February 2013

Feb. 14, 2013

Program BIOCHEMISTRY 2
Index number 6109211

19+1

Time allowed: 15 min

Questions 1-20: Circle the correct answer.

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(A) Oswald Avery in 1807
(B) F. Reuss in 1828
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(C) Quantifying
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(D) None of the above

4. An electrophoresis unit consists of
(A) A power pack, gel slab, and gel comb
(B) A plastic frame, power pack and buffer
(C) A tank, plastic frame and gel comb
(D) A power pack, tank, plastic frame and gel comb

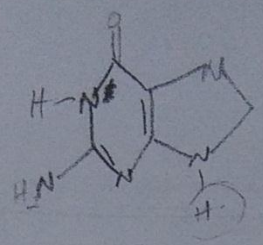
5. The force, in newtons that drives a macromolecule with charge q toward an electrode, when placed in an electric field of potential difference E and separated by a distance d, is given by
(A) qE
(B) qd

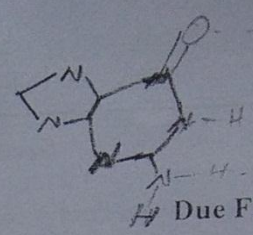
103

105

**Pcu /cos/m457*

BCHEM 365
Biophysics
First semester, 2011
Homework Assignment 2
Fri. Sept. 09, 2011



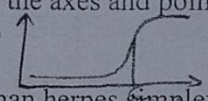


H — N
N
O

Due Fri. Sept. 16

1. Draw the structure of a phodsphodiester bond linking two nucleotides. *6 points*
2. (a) Draw the structure of guanine and show how it forms three hydrogen bonds with its complementary base in a DNA molecule. *2 points*
3. (b) Draw the structure of cytosine and show how it forms two hydrogen bonds with its complementary base in a DNA molecule.. 2 *points*

4. Draw a typical DNA melting curve. Label the axes and point out the melting temperature. *4 points*

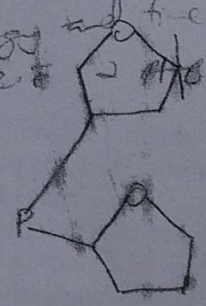


5. The double-stranded DNA genome of human herpes simplex virus 1 has a molecular mass of about 1.0×10^5 kD.
(a) How many base pairs does this virus contain? 3 points
(b) How many full double-helical turns does this DNA contain. *3 points*
(c) How long is this DNA in microns? 3 points

6. Use a graph to illustrate the relationship between the GC content of a DNA and its melting temperature. What is the explanation for this relationship? *6 points*

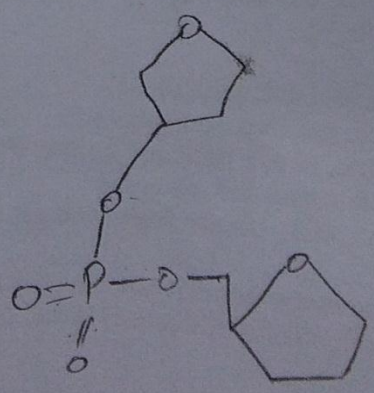
Guanine forms three HBs with Cytosine. While Adenine forms 2 with Thymine. It will require high energy and time to break 3 HBs AT.

$^{2}_{1}H$: $1s^1$ Guanine n Cytosine than 2 breaks



$^{6}_{3}Li$: $1s^2\ 2s^1$

$^{14}_{7}N$: $1s^2\ 2s^2\ 2p_x^1\ 2p_y^1\ 2p_z^1$



$^{12}_{6}C$: $1s^2\ 2s^2\ 2p_x^1\ 2p_y^1\ 2p_z$

$^{16}_{8}O$: $1s^2\ 2s^2\ 2p_x^2\ 2p_y^1\ 2p_z^1$

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(C) dE
(D) qdE

6. The velocity, v, of the charged macromolecule in Question 5 which encounters frictional resistance, f, is given by the equation
(A) $v = qE/f$
(B) $v = qf/E$
(C) $v = qdE/f$
(D) $v = qfE/d$

7. The electrophoretic mobility, μ, of the charged macromolecule in Question 5 and 6 is given by
(A) v/d
(B) v/Ed
(C) v/Eq
(D) v/E

8. During electrophoresis, the current in the solution between the electrodes is conducted
(A) mainly by the buffer ions, with a small proportion conducted by the sample ions
(B) mainly by buffer ions and sample ions equally
(C) mainly by only buffer ions
(D) mainly by sample ions with a small proportion conducted by the buffer ions

9. The generation of heat in the medium during electrophoresis produces which of the following effects:
(A) A decreased rate of diffusion of sample and buffer ions leading to broadening of the separated samples
(B) The formation of convection currents, which leads to mixing of separated samples
(C) A decrease of buffer viscosity and hence a sharpening of separated bands
(D) All of the above

10. Electroendosmosis is a problem in electrophoresis caused by
(A) heating fluctuations when power supply is not constant
(B) presence of charged groups on the surface of the support medium
(C) conduction of current by the buffer ions
(D) the zone center migrating faster than the edges

11. For a good separation, electrophoresis grade agarose must have
(A) many sulfate groups
(B) few sulfate groups
(C) moderate content of sulfate, carboxyl, and methoxyl groups
(D) none of the above

12. In electroendosomosis the movement of electrolyte ions can be toward the
(A) anode
(B) cathode
(C) zone center
(D) no movement of electrolyte ions

**Pcu /cos/m457*

13. Which of these is true?
(A) Agarose is a linear polysaccharide made up of the basic repeating unit agarotriose
(B) Agarose is a branched polysaccharide made up of the basic repeating unit agarobiose
(C) Agarose is a linear polysaccharide made up of the basic repeating unit agarobiose
(D) Agarose is a branched polysaccharide made up of the basic repeating unit agarose

14. In what way does agarose support medium overcome convective currents during electrophoresis?
(A) The cross-linked structure
(B) The variable pore size
(C) Both (A) and (B)
(D) None of the above

15. Gelling properties of agarose is attributed to
(A) Both inter- and intramolecular hydrogen bonding within and between the long agarose chains
(B) Cross-linking of agarose chains with sulfate groups
(C) Both inter- and intramolecular methylene bridges within and between the long agarose chains
(D) All of the above

16. 1% agarose gel is good for the separation of
(A) Only proteins
(B) Only nucleic acids
(C) Either proteins or nucleic acids
(D) Both proteins and nucleic acids

17. Which of these statements is true? (2 points)
(a) All proteins have a net negative charge
(b) All DNA have a net negative charge
(c) All proteins have net positive charge
(d) All DNA have neutral charge
(e) All of the above

18. Which of the following statements is true?
(A) Agarobiose comprises linear units of galactose and 3,6-anhydrogalactose
(B) Agarobiose comprises crosslinks of galactose units
(C) Agarobiose comprises alternating units of 3,6-anhydrogalactose
(D) Agarobiose comprises alternating units of galactose
(E) Agarobiose comprises alternating units of galactose and 3,6-anhydrogalactose

19. Which of the following statements is not true?
(A) Crosslinkages in agarose is initiated by boiling
(B) Crosslinkages in agarose is initiated by alternating units of 3,6-anhydrogalactose
(C) Crosslinkages in agarose is initiated by boiling and cooling
(D) Polymerization of agarose is initiated by boiling
(E) Polymerization of agarose is initiated by boiling and cooling

20. Which of the following statements is true?
(A) Gelling of acrylamide is attributed to inter and intramolecular hydrogen bonding between acrylamide chains

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BCHEM 264
Biophysics
Feb. 21, 2013
Quiz 4

Name BAFFOUR PRISCILLA Index No. 6109211

1. The complexity of *Streptococcus pneumoniae* is 10^2 bp. Which of these will be a good estimate of its Cot½ in a denaturation/annealing experiment?
(A) 10^{-5}
(B) 10^{-2}
(C) 10^{0}
(D) 10^{-1}
(E) 10^{-3}

2. In a denaturation/annealing experiment, Cot½ of bacteriophage λ and *E. coli* were 10^0 and 10^4, respectively. How can you predict the relative distribution of various DNA compositions in the two bacteria?
(A) Equal proportion of highly repetitive sequences in both
(B) Equal proportion of moderately repetitive sequences in both
(C) More moderately repetitive sequences in λ than in *E. coli*
(D) More single copy sequences in *E. coli* than λ
(E) Equal proportion of highly repetitive sequences and single copy sequences in both

3. Given that the Cot½ of *Puccinia polysora* DNA is 3.0×10^2 and that of *E. coli* is 10^4, and that the size of *E. coli* genome is 4.2×10^6 bp, what is the complexity of *P. polysora* DNA?
(A) 1.40×10^3 bp
(B) 1.26×10^3 bp
(C) 1.26×10^2 bp
(D) 1.40×10^2 bp
(E) 0.71×10^3 bp

4. Which of these sequences is translated into protein
A) Single copy
B) Moderately repetitive
C) Highly repetitive
D) Both moderately repetitive and highly repetitive
E) Highly repetitive and single copy

5. Which of these DNA sequences is most likely to have mismatch during reassociation?
A) Moderately repetitive
B) Single copy
C) Highly repetitive
D) All of the above

6. Which of these DNA sequences is most likely to have a lowest T_m?
A) Single copy
B) Highly repetitive
C) Moderately repetitive

**Pcu /cos/m458 -13

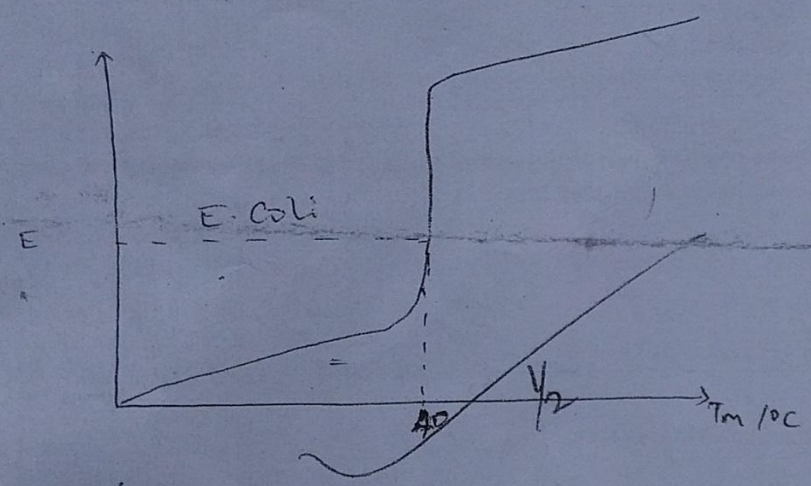
(c) What is the molecular mass of this DNA? (2 *points*)

$1.8 \times 10^8 bp \times 660 \, bp \, D = 1.188 \times 10^{11} D$

2

Total 61 points

22



Antonia Tetteh

2½

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PROGRAM: BIOCHEMISTRY

11

BCHEM 365
Biophysics
Sept. 20, 2012
Quiz 3

repetitive seq'
length
size

1. List the three parameters which describe complexity of DNA
2. Which sequences are found at centromeres
   A) Single copy
   B) Moderately repetitive
   C) Highly repetitive
   D) Both single copy and moderately repetitive
   E) Both moderately repetitive and highly repetitive
3. Which of these sequences is translated into protein
   A) Single copy
   B) Moderately repetitive
   C) Highly repetitive
   D) Both moderately repetitive and highly repetitive
   E) Highly repetitive and single copy

4. Which of these DNA sequences is most likely to have mismatch during reassociation?
   A) Moderately repetitive
   B) Single copy
   C) Highly repetitive
   D) All of the above

5. Which of these DNA sequences is most likely to have a lowest T_m?
   A) Single copy
   B) Highly repetitive
   C) Moderately repetitive
   D) None of the above
6. The Cot1/2 of MS2 is 10^{-1}. Find its complexity given that *E.coli* Cot ½ is 10^{-2} and its sequence is 4.2×10^6 bp
7. You want to separate a mixture of proteins. Choose the correct method.
   A) You would use acrylamide and vertical gel systems
   B) You would use acrylamide and horizontal gel system
   C) You would use agarose and vertical gel system
   D) You would use agarose and horizontal gel system

8. You want to separate a mixture of small nucleic acids. Choose the correct method.
   A) You would use acrylamide and vertical gel systems
   B) You would use acrylamide and horizontal gel system
   C) You would use agarose and vertical gel system
   D) You would use agarose and horizontal gel system

9. You want to separate a mixture of large nucleic acids. Choose the correct method
   A) You would use acrylamide and vertical gel systems
   B) You would use acrylamide and horizontal gel system
   C) You would use agarose and vertical gel system
   D) You would use agarose and horizontal gel system

$$\frac{\text{Cot } 1/2 \text{ of any genome}}{\text{Cot } 1/2 \text{ of E-coli}} = \frac{\text{Complexity of any genome}}{4.2 \times 10^6}$$

$\Rightarrow$ Cot 1/2 of MS2 $= 10^{-1}$; Cot 1/2 of E-coli $= 10^{-2}$.

$$\Rightarrow \text{Complexity of MS2 genome} = \frac{\text{cot } 1/2 \text{ of MS2 genome}}{\text{cot } 1/2 \text{ of E-coli}} \times 4.2 \times 10^6$$

$$= \frac{10^{-1}}{10^{-2}} \times 4.2 \times 10^6$$

$$= 4.2 \times 10^7 \text{ bp}$$

(1) - ~~Size of the genome~~ GC content

- ~~length of the genome~~ Melting temperature

- Number of ~~base pairs (bp)~~ repetitive sequences.

(2)

TWENEBOAH-KODUAH GILBERT
6115611

BCHEM 264
Biophysics
Feb. 07, 2013
Quiz 3

1. List the three parameters which describe complexity of DNA
   No. of repetitive sequence, Size of DNA, Component of DNA
   highly repetitive
   Moderately repetitive
   Single copy DNA
2. Which of these reagents would denature ds DNA to get single strands?
   A) Only high salt
   B) High salt plus low pH
   C) Low salt plus high pH
   D) Only low salt
   E) All of the above

3. Which sequences are found at centromeres
   A) Single copy
   B) Moderately repetitive
   C) Highly repetitive
   D) Both single copy and moderately repetitive
   E) Both moderately repetitive and highly repetitive

4. Which of these statements is false?
   (a) G+C content of DNA is not related to the complexity of an organism
   (b) Melting temperature of bacteriophage T4 is lower than the melting temperature of *E.coli*.
   (c) The G+C content of *B. megaterium* is 38% and its corresponding melting temperature is between 60 and 70°C
   (d) Renaturation of DNA depends on concentration

5. The most extended form of DNA is called
   (a) Z-DNA
   (b) B-DNA
   (c) A-DNA
   (d) none of the above

6. Which of these statements is true?
   (a) When adenine pairs with guanine, thymine will pair with cytosine
   (b) Adenine and guanine are found in the major groove
   (c) Thymine and cytosine are found in the minor groove
   (d) None of the above

7. Which of these statements is true? In DNA, bases pair in a particular fashion:
   (a) adenine with cytosine
   (b) guanine with adenine
   (c) thymine with guanine
   (d) adenine with thymine

8. The G+C content of *M. phlei* is 70%, while that of yeast is 36%. Which of the following inferences can be made from this statement?
   (A) *M. phlei* DNA is expected to show a relatively weaker hyperchromic shift

(B) *M. phlei* DNA is expected to show a relatively stronger hyperchromic shift
(C)The rate of denaturation of *M. phlei* DNA at high pH will not differ from that of yeast
(D) Rate of denaturation at high pH will be faster in *M. phlei* than in yeast DNA

9. In a DNA denaturation experiment, the C/C_0 of *E. coli* strains K12 and RY 13, plus bacteriophage T4 and MS2 were found to be 0.76, 0.54, 0.81 and 0.33, respectively. Which of these DNA samples will demonstrate higher percentage reannealing?
(A) MS2 and K12
(B) Only RY 13
(C) Only MS2
(D) Only T4
(E) K12 and T4

10. The Cot½ of denaturation/annealing experiment on MS2 is 10^{-2}. Which of these is an estimate of its DNA size?
(A) 10^3 to 10^4 bp
(B) 10^7 to 10^8 bp
(C) 10^1 to 10^2 bp
(D) 10^0 to 10^1 bp
(E) 10^5 to 10^6 bp

11. The Cot½ of denaturation/annealing experiment on T4 is 1. Which of these is an estimate of its DNA size?
(A) 10^7 to 10^8 bp
(B) 10^4 to 10^5 bp
(C) 10^2 to 10^3 bp
(D) 10^1 to 10^2 bp
(E) 1 to 10^1 bp

$$\frac{\text{Cot½ of any genome}}{\text{Cot½ of E coli}} = \frac{\text{Complexity of any gene}}{\text{Comp}}$$

$$\frac{10^{-1}}{10^{-2}} = \frac{4.2\times10^6}{x}$$

$$10^{-1}x = 4.2\times10^6$$

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9

Ahuno Samuel Texpe

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BCHEM 264
Biophysics
Feb. 13, 2014
Quiz 2

1. In the Watson-Crick model of DNA the direction of each strand is
   (a) 5'→3'on one strand and 3'→ 5' on the complementary stand
   (b) 3→ 5 on both strands
   (c) 5→ 3 on both strands
   (d) Both (a) and (c)

2. Which of these statements is true? In adenosine structure,
   (a) N3 is bonded to C1 of ribose
   (b) N3 is bonded to C1' of ribose
   (c) N9 is bonded to C1 of ribose
   (d) N9 is bonded to C1' of ribose

3. Which of these statements is true? In uridine structure,
   (a) N3 is bonded to C1 of ribose
   (b) N1 is bonded to C1' of ribose
   (c) N3 is bonded to C1' of ribose
   (d) N9 is bonded to C1' of ribose

4. Which of these statements is false?
   (a) G+C content of DNA is not related to the complexity of an organism
   (b) Melting temperature of bacteriophage T4 is lower than the melting temperature of *E.coli*.
   (c) The G+C content of *B. megaterium* is 38% and its corresponding melting temperature is between 60 and 70°C
   (d) Renaturation of DNA depends on concentration

5. The most extended form of DNA is called
   (a) Z-DNA
   (b) B-DNA
   (c) A-DNA
   (d) None of the above

6. Which of these statements is true?
   (a) When adenine pairs with guanine, thymine will pair with cytosine
   (b) Adenine and guanine are found in the major groove
   (c) Thymine and cytosine are found in the minor groove
   (d) None of the above

7. Who discovered this phenomenon: DNA is a repeating molecule arranged in a cockscrew (helix) structure ?
   (a) Pauling
   (b) Chargaff

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TEAM SELORM '17 TOGETHER WE CAN

(c) Wilkins and Franklin
(d) Franklin and Pauling

8. Which of these best represents base pairing in DNA?
   (a) Adenine with cytosine
   (b) Guanine with adenine
   (c) Thymine with guanine
   (d) Adenine with thymine

9. The G+C content of *M. phlei* is 70%, while that of yeast is 36%. Which of the following inferences can be made from this statement?
   (a) *M. phlei* DNA is expected to show a relatively weaker hyperchromic shift
   (b) *M. phlei* DNA is expected to show a relatively stronger hyperchromic shift
   (c) The rate of denaturation of *M. phlei* DNA at high pH will not differ from that of yeast
   (d) Rate of denaturation at high pH will be faster in *M. phlei* than in yeast DNA

10. Which of these bonds will produce a bulge in DNA structure?
   (a) Cytosine-guanine
   (b) Cytosine -cytosine
   (c) Guanine-guanine
   (d) Thymine-thymine