

The background of the slide features a complex molecular structure composed of blue spheres (atoms) connected by lines (bonds). The structure is partially obscured by a large, light blue, semi-transparent rectangular box that frames the central text. The overall aesthetic is scientific and modern, with a focus on chemistry and biochemistry.

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# Biochemistry

Past paper

*midterm*

## ❖ Introduction to biochemistry

**1) Water acquires its high specific heat, boiling point, melting point and other physical properties due to:**

- A. It is an amphipathic molecule
- B. High ion product of water
- C. It can dissociate to protons and hydroxyl groups
- D. It can form Hydrogen bonds with each other
- E. It is an amphipathic molecule

**2) Sweating has a cooling effect because of water's high?**

- A. Surface tension
- B. Density
- C. Heat of vaporization
- D. Buffering capacity
- E. Specific heat

**3) Water molecules have \_\_\_\_\_ than molecules of similar size, such as ammonia, reflecting its capacity to absorb large amounts of heat:**

- A. less surface tensions
- B. a higher boiling point
- C. a lower capacity for forming hydrogen bonds
- D. a lower melting point

**4) What do we mean by ion product of water??**

- A. Product of concentrations of hydrogen ions and hydroxyl ions in water or an aqueous solution of an electrolyte
- B. The sum of concentrations of hydrogen ions and hydroxyl ions in water or solution of electrolytes
- C. The product of concentrations of hydrogen ion and hydroxyl ions that are derived only from water molecules in aqueous solution of electrolytes
- D. The number of ionized molecules of H<sub>2</sub>O in one mole of a pure water
- E. The total number of negatively and positively charged ions in one liter of an aqueous solution of electrolytes

**5) Water can form all of these non-covalent interaction, EXCEPT:**

- A. Hydrophobic interactions
- B. Ionic interactions
- C. Hydrogen bonds
- D. Van der Waals
- E. None of the above

**Answers:**

**1) D**

**2) C**

**3) B**

**4) A**

**5) A**

- 6) The ability of water to form hydrogen bonds is attributed to:
- A. The partial positive charge of O
  - B. The partial negative charges of H
  - C. Polar covalent bonds between atoms in water molecules
  - D. None of the above
- 7) Hydrogen bonds can form between electronegative atoms such as oxygen and nitrogen and a hydrogen atom bonded to:
- A. Only oxygen
  - B. Hydrogen
  - C. Only nitrogen
  - D. Any electronegative atom
- 

### ❖ Acids & Bases

- 1) The  $pK_b$  of a base is 3.0, What is the pH of a 1 mM solution of the base?
- A. 9
  - B. 10
  - C. 11
  - D. 12
  - E. 13
- 2) Laboratory tests on the urine of a patient identified the presence of methylmalonate ( $\text{COOCH}(\text{CH}_3)\text{COO}^-$ ), Which of the following statement describes methylmalonate best?
- A. It can't be used to make a buffer solution
  - B. It is 100% dissociated at its  $pK_a$
  - C. It is a major intracellular buffer
  - D. It is a conjugate base of a weak acid
  - E. It is a strong base
- 3) You prepared a sodium phosphate buffer by mixing 100ml of 0.1 M  $\text{Na}_2\text{HPO}_4$  with 100ml of 0.1 M  $\text{NaH}_2\text{PO}_4$ . The pH of the final solution is 7.8 what is the approximate  $pK_a$  of the acid component of the buffer
- A. 7.8
  - B.  $10^{-5.8}$
  - C.  $10^{7.8}$
  - D. 5.8
  - E. 6.8

<b>Answers:</b>	6) C	7) D	1) C	2) D	3) A
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- 4) A patient with an enteropathy (internal disease) produces large amounts of ammonia (NH<sub>3</sub>) from bacterial overgrowth in the intestine. The ammonia was absorbed through the intestine into the portal vein, and entered the circulation. Which of the following is a likely consequence of his ammonia absorption?
- A. Increase expiration of CO<sub>2</sub>
  - B. Hyperventilation
  - C. Conversion of ammonia to ammonium ion in the blood
  - D. Decreased blood pH
- 5) An individual wears a face mask for a long hours without removing it at all the condition that is expected to happen:
- A. Metabolic acidosis
  - B. Metabolic alkalosis
  - C. Respiratory acidosis
  - D. Respiratory alkalosis
  - E. Nothing
- 6) A decrease blood pH from 7.5 to 7 would be accompanied by which of the following changes in ion concentration?
- A. A ten-fold decrease in hydrogen concentration
  - B. An increase in hydrogen ion concentration by a factor of 7.5 / 7
  - C. five fold increase in hydroxyl ion concentration
  - D. shift in concentration of buffer and ions with no change in hydrogen ion concentration
  - E. A 3 fold increase in hydrogen ion concentration
- 7) During a short distance run, the muscles produce a large amount of lactic acid from their glucose stores. Hyperventilation can be used for in this situation because:
- A. Adds H<sup>+</sup> lowering the pH of the blood
  - B. Increase the composition of bicarbonates
  - C. Remove H<sup>+</sup> raising the pH of the blood
  - D. Reduce the capacity of hemoglobin buffer system
  - E. Decreases the production of carbonic acid
- 8) Water is considered:
- A. Amphipathic
  - B. Amphoteric
  - C. Non-polar
  - D. Buffer

**Answers:**

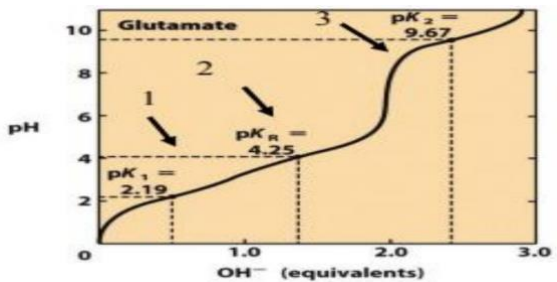
**4) C**

**5) C**

**6) E**

**7) E**

**8) B**

- 9) In a titration curve of a weak acid the point in the plateau region between that inflection point and the equivalence point has the following characteristics
- The concentration of weak acid is higher than the conjugate base
  - All equivalents needed for titration were used up
  - Can act as a buffer
  - The pH of the solution must be 7
  - pH value equals the value of the acid pKa
- 10) you have been observing an insect that defends itself from enemies by secreting a liquid . Analysis of lipid shows it to have a concentration of formic acid ( $K_a = 1.8 \times 10^{-4}$ ) of 1.45M and a concentration of formate ion of 0.015M what is the pH of the secretion ?
- 5.73
  - 1.76
  - 7
  - 3.37
  - 1.91
- 11) The point that represents the Zwitterion (molecule that contains an equal number of positively- and negatively-charged functional groups) is?
- 1
  - 2
  - 3
  - 1 & 2
  - 1 & 2 & 3
- 
- 12) What is the pH if the concentration of the conjugate base ( $A^-$ ) is 0.35M and the concentration of the weak acid ( $HA$ ) is 0.25M after adding 0.05 M of NaOH ? ( $pK_a = 7$ )
- 7.3
  - 6.3
  - 8.6
  - 9
- 13) We have a drug that has  $[HA]$  ionizable acid with  $pK_a$  of 4.5, that enters the cell via the membrane, what is the best pH that enhances the entry of the drug?
- pH = 1
  - pH = 3.9
  - pH = 9
  - pH = 4.8

**Answers:**

9) C

10) B

11) B

12) A

13) A

**14) Which of the following gives a good protein buffer system:**

- A. His
- B. Arg
- C. Asp
- D. Asn
- E. All of the above

**15) If you have x moles of KOH how many moles of an acid must be added to make a buffer solution?**

- A. 2X HCl
- B. X/2 acetic acid
- C. 1.5 X acetic acid
- D. X acetic acid

**16) A patient with panic attacks and hyperventilation is in a respiratory alkalosis. The excess hydroxide ions were able to overcome by which one of the following buffers, which has the greatest buffering capacity in and near to normal blood pH (pKa of dihydrogen phosphate is 6.80. The pKa of carbonic acid is 3.80. pKa of ammonium ion is 9.25, pKa of acetoacetic acid (a ketone body) is 3.62) ?**

- A. Carbonic acid
- B. Dihydrogen phosphate
- C. Ammonium ion
- D. Acetoacetic acid
- E. Ascorbic acid

**17) Which one of the following works as a buffer?**

- A. KOH
- B. NaOH
- C. HCl
- D. H<sub>2</sub>SO<sub>4</sub>
- E. None of the above

**18) Below is the pKa for weak acids, which weak acid will be approximately 9% dissociated at pH 3.88?**

- A. Acetoacetic acid (pKa = 3.6)
- B. Lactic acid (pKa = 3.9)
- C. Propionic acid (pKa = 4.9)
- D. E. imidazolium (pKa = 5.9)

**19) The most effective buffer system in the body at physiological pH:**

- A. Bicarbonate buffer
- B. Phosphate buffer
- C. Protein buffer
- D. All of the above

**Answers:**

**14) A**

**15) C**

**16) B**

**17) C**

**18) A**

20) The pH of 0.1M HCL is 1.0 ,Of 0.1 M Acetic Acid is 2.8. What volume of 0.1N NaOH would be required to titrate 10 mL of each acid solution to their respective End point respectively ?

- A. 10 ml, 10 ml
- B. 16 ml, 10 ml
- C. 10 ml, 16 ml
- D. 100 ml, 16 ml

21) 4.13g OF  $\text{NaC}_2\text{H}_3\text{O}_2$  (M.W = 202.14 g/mol) is added to 250 mL of a 0.150 M  $\text{HC}_2\text{H}_3\text{O}_2$  solution ( $K_a = 2.75 \times 10^{-5}$ ) What is the pH of the buffer system?

- A. 6.54
- B. 5.43
- C. 4.28
- D. 7.42

22) A buffer is made by adding 0.200 M  $\text{HC}_2\text{H}_3\text{O}_2$  and 0.150 M  $\text{NaC}_2\text{H}_3\text{O}_2$ . If 0.005 mol of NaOH is added to 125 mL of this buffer,What is the pH? ( $K_a = 1.8 \times 10^{-5}$ )

- A. 4.82
- B. 4.18
- C. 5.23
- D. 6.47

23) If a person suffered from acidosis (caused, perhaps, by drinking acid):

- A. The respiratory system would hypoventilate, keeping more  $\text{CO}_2$  in the plasma
- B. The lungs would hyperventilate, keeping  $\text{CO}_2$  levels high in plasma
- C. The kidneys would remove  $\text{HCO}_3^-$  from blood plasma and excrete it into the urine
- D. The lungs would hyperventilate, decreasing  $\text{CO}_2$  in the plasma, and the kidneys would save  $\text{HCO}_3^-$  and excrete it into blood plasma
- E. The kidneys would remove  $\text{CO}_2$  and excrete it into blood plasma rather than into urine

24) According to this reaction  $\rightarrow (\text{CO}_2 + \text{H}_2\text{O} \leftrightarrow \text{H}_2\text{CO}_3 \leftrightarrow \text{H}^+ + \text{HCO}_3^-)$

If you dissolve some sodium bicarbonate in water and then add hydrochloric acid, one of the following should be seen (All the components of the reaction are water soluble, but carbon dioxide is a gas)

- A. Carbon dioxide bubbling out
- B. Carbon dioxide dissolving
- C. Nothing, Carbon dioxide is an invisible gas
- D. The solution should turn blue
- E. The solution should turn red

Answers:	20) A	21) C	22) A	23) D	24) A
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**25) What is the concentration of  $\text{H}_2\text{PO}_4$  if we have 0.5 eq in 500ml**

- A. 0.5 M
- B. 0.25 M
- C. 1 M

**26) 0.5 ml of HCl titrated by 0.5 M of NaOH with a volume of 12 ml what is the pH of the acid:**

- A. 0.8
- B. 0.08
- C. 0.6
- D. 0.06

**27) If you have X moles of KOH, how many moles of an acid must be added to have a buffer with equal concentrations of  $\text{A}^-$  and HA?**

- A. X
- B.  $\text{X}/2$
- C. 2X
- D. 1.5X
- E. None of the above

**28) Below is the pKa of some weak acids. Which weak acid will be 91 % undissociated at  $\text{pH}=4.86$ ?**

- A. Acetoacetic acid  $\text{pKa} = 3.6$
- B. Lactic acid  $\text{pKa}=3.9$
- C. beta-hydroxyl butyric acid  $\text{pKa}=4.8$
- D. propionic acid  $\text{pKa}=4.9$
- E. Imidazolium  $\text{pKa}=5.9$

**29) Buffers work the best at all these conditions except:**

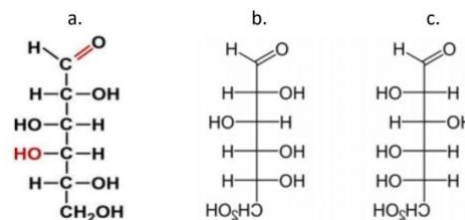
- A. When the pH to be maintained using the buffer has a value close to the pKa of its acid component
- B. When the concentration of the acid component is equal to that of the base component
- C. When the acid component is completely dissociated

<b>Answers:</b>	<b>25) A</b>	<b>26) B</b>	<b>27) C</b>	<b>28) E</b>	<b>29) C</b>
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## ❖ Carbohydrates & Lipids

1) Which of the following is L- Glucose



2) Blood types differ in their:

- A. Sugar content
- B. Lipid content
- C. Protein content
- D. None of the above

3) Which of the following doesn't precipitate Cu in the Benedict test??

- A. Lactose
- B. Sucrose
- C. Galactose
- D. Glucose

4) The myelin sheath is composed of:

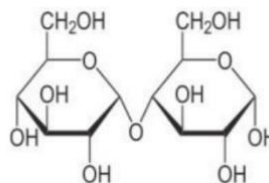
- A. Glycolipids
- B. Phospholipids
- C. GAGs

5) EPA & DHA are omega 6 Fatty acids:

- A. True
- B. False

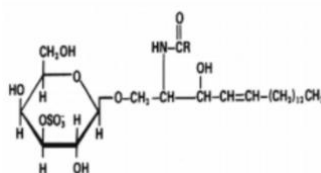
6) Which of the following is not true

- A. The glycosidic bond is Beta (1 – 6)
- B. It can be a part of dextran



7) Which of the following is true:

- A. Sulfatide
- B. Phosphatide
- C. Found in muscle cells Glycerides



8) Which of the following has the least solubility in water:

- A. Palmitate
- B. Oleate
- C. Linoleate
- D. Myristate
- E. Arachidonate

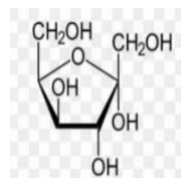
<b>Answers:</b>	<b>1) C</b>	<b>2) A</b>	<b>3) B</b>	<b>4) B</b>	<b>5) B</b>
	<b>6) B</b>	<b>7) A</b>	<b>8) E</b>		

9) Which of the following can't be hydrogenated:

- A. Arachidonic acid
- B. Palmitic acid
- C. Oleic acid
- D. Linoleic acid

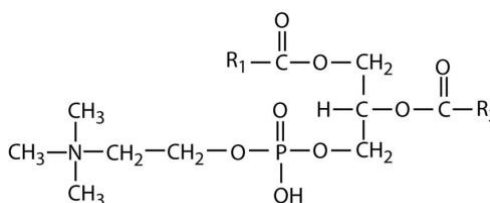
10) The following figure represents D- sorbose.. which of the following statements is wrong ?

- A. It is a furanose
- B. It is an alpha sugar
- C. Carbon no.1 is the anomeric carbon
- D. It is a ketose
- E. It can re-open up into the chain form



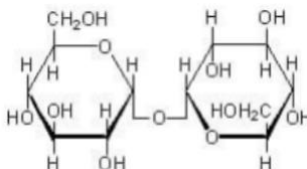
11) This structure is:

- A. Bile acids
- B. Prostaglandins
- C. Monoacylglycerol
- D. Sphingolipid
- E. Phosphatidylcholine



12) This sugar is a reducing sugar:

- A. True
- B. False



13) Which of the following is common in all sphingolipids:

- A. Glycerol
- B. Phosphate
- C. N-acetylgalactosamine
- D. Ceramide

14) Glycoside formation results from:

- A. Reaction of cyclic acetal with alcohol
- B. Reaction of cyclic acetal with another cyclic acetal
- C. Reaction of cyclic hemiacetal with alcohol

15) Which of the following sugars has a beta glycosidic linkage

- A. Chitin
- B. Sucrose
- C. Lactose
- D. None of the above

<b>Answers:</b>	<b>9) B</b>	<b>10) C</b>	<b>11) E</b>	<b>12) B</b>
	<b>13) D</b>	<b>14) C</b>	<b>15) A</b>	

**16) How many chiral carbons are there in deoxyribose**

- A. 1
- B. 2
- C. 3

**17) The following membrane lipid is a major component of the inner mitochondrial membrane:**

- A. Lecithin
- B. Cardiolipins
- C. Cephalins
- D. Phosphatidyl-inositol

**18) Gangliosides contain all the following EXCEPT:**

- A. Fatty acid
- B. Phosphate
- C. Ceramide
- D. Hexose
- E. N-acetyl neuraminic acid (sialic acid)

**19) Arrange the following fatty acids according to their melting point starting from the largest to the smallest (oleic acid, linoleic acid, palmitic acid and palmitoleic acid)**

- A. Oleic acid, palmitic acid, linoleic acid and palmitoleic acid
- B. Palmitic acid, palmitoleic acid, oleic acid and linoleic acid
- C. linoleic acid, palmitoleic acid, palmitic acid and oleic acid
- D. linoleic acid, palmitoleic acid, oleic acid and palmitic acid
- E. oleic acid, linoleic acid, palmitoleic acid, and palmitic acid

**20) Which of the following is not true about glucose:**

- A. Epimer of mannose
- B. Epimer of galactose
- C. Only D-isomer presents in mammals
- D. It mainly exist in as open chain in solution

**21) D-glucose & D-galactose has all of the following except:**

- A. Hexoaldoses
- B. They are Diastereomers
- C. They are anomers
- D. They are reducing sugars

**22) The polysaccharide in which glucose is stored in animal cells:**

- A. Stored in melanocytes & Hepatocytes
- B. Contain Beta linkages
- C. Extremely branched for more efficient energy supply

<b>Answers:</b>	<b>16) B</b>	<b>17) B</b>	<b>18) B</b>	<b>19) A</b>
	<b>20) D</b>	<b>21) C</b>	<b>22) C</b>	

**23) Which of the following is an aldo-pentose:**

- A. Ribose
- B. Glucose
- C. Fructose

**24) An omega-3, 24-carbon Fatty acid has:**

- A. A double bond between carbon 22 & 23
- B. 3 double bonds
- C. A double bond between carbons 21 & 22
- D. A double bond between Carbons 3 & 4

**25) Deoxy sugars produced by:**

- A. Reduction of a monosaccharide
- B. Engaging anomeric carbon in a glycosidic bond
- C. Conversion of a sugar to acid
- D. Hydrolysis of a disaccharide

**26) Omega-9 Fatty acid can do the following:**

- A. Treat asthma
- B. Reduce inflammation
- C. Relieve gastric pain caused by aspirin
- D. Reduce cholesterol
- E. Block formation of eicosanoids

**27) One of the following is true in regard to L-glucose & D-glucose:**

- A. D-glucose is natural, but not L-glucose
- B. They differ in the orientation of only the chiral carbon farther from the most oxidized group
- C. D-glucose is cyclic, but L-glucose is a chain molecule
- D. D-glucose has an anomeric carbon, but L-glucose does not
- E. They are mirror images of each other

**28) Oxidation of carbon number 6 of cyclic glucose:**

- A. Producing fructose
- B. Producing glucuronate
- C. Stabilizing the anomeric carbon
- D. Production of a deoxy-sugar
- E. Opening the ring chain

**29) Creating a cholesterol ester from cholesterol results in:**

- A. Facilitating the transport of cholesterol via lipoproteins
- B. Cholesterol being more hydrophobic
- C. Increasing the density of lipoproteins

<b>Answers:</b>	<b>23) A</b>	<b>24) C</b>	<b>25) A</b>	<b>26) D</b>
	<b>27) E</b>	<b>28) B</b>	<b>29) B</b>	

**30) Liposomes can deliver chemicals into the cells because:**

- A. They can fuse with the plasma membrane
- B. They are small so can diffuse through the plasma membrane
- C. They facilitate chemical transport through the membrane

**31) Which of the following is a sphingolipid:**

- A. Phosphatidylinositol
- B. Cardiolipin
- C. Cephalins
- D. Myelin

**32) Why do some people are lactose-intolerant:**

- A. The lack of lactase enzyme
- B. They can't digest galactose
- C. They didn't drink milk when they were childs

**33) The feature of polysaccharides with beta-glycosidic bond is:**

- A. It forms more H-bonds
- B. Can be branched
- C. More water soluble
- D. Rigid and straight
- E. Can be looped taking less space

<b>Answers:</b>	<b>30) A</b>	<b>31) D</b>	<b>32) A</b>	<b>33) D</b>
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## ❖ Molecular lectures

- 1) The following is a sequence you expect NOT to be recognized by a restriction endonuclease.
- A. ATATAT
  - B. CTTAAG
  - C. AGCT
  - D. GGATCC
  - E. GCAGCA
- 2) You want to purify this hormone, but you do not have an antibody that can help you purify it. You can do this:
- A. Protein tagging
  - B. CRISPR-Cas9 system
  - C. Proteins expression in bacteria
  - D. Immunoprecipitation
  - E. Reporter gene assay
- 3) You want to see the protein move from the stem to the leaves. How can you do that?
- A. Perform a reporter gene assay
  - B. Create a recombinant protein with green fluorescent protein
  - C. Create a recombinant protein with His tag
  - D. Attach Sybr green to the hormone
  - E. Create a recombinant protein with lac-Z gene product (beta-galactosidase)
- 4) The purpose of the Shine-Dalgarno sequence in an expression vector is to:
- A. Translate mRNA
  - B. Transcribe DNA
  - C. Produce cDNA
  - D. Process mRNA
  - E. Replicate DNA
- 5) Vectors like plasmids can multiply into a bacterial cell because:
- A. They can synthesize their own primers when replicating
  - B. They have a DNA insert integrated into them
  - C. They have their own origin of replication
  - D. They have their own antibiotic resistance gene
  - E. They can synthesize their DNA polymerase

<b>Answers:</b>	<b>1) E</b>	<b>2) A</b>	<b>3) B</b>	<b>4) A</b>	<b>5) C</b>
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**6) The advantage of creating cDNA from human samples is:**

- A. Lack of transcription sites
- B. Lack of stop codons
- C. Lack of introns
- D. Lack of untranslated regions

**7) In order to express a human gene in bacteria, you need one of the following:**

- A. Co-expression of a human chaperone protein
- B. The original termination transcription sequence of the human gene
- C. The whole transcribed region of the human gene after RNA processing
- D. The human gene to be controlled by an efficient human promoter
- E. A human gene that produces a protein without cysteines.

**8) You suspect that the hormone binds to large number of proteins. How can you identify the interacting proteins?**

- A. Reporter gene assay
- B. Yeast-two hybrid system
- C. Next-generation sequencing
- D. CRISPR-Cas9 system
- E. Protein tagging

**9) You want to study the regulatory sequences of the hormone gene including promoter, promoter proximal element, enhancer, and silencer. You perform a reporter gene assay. One of the following is True**

- A. You need the coding region of the hormone without introns
- B. You need to use the lac-Z gene as a reporter gene
- C. You need to make a cDNA from the hormone mRNA
- D. You need to create an expression vector that contains different regions of the regulatory sequences
- E. You need to create a recombinant hormone with luciferase

**10) In DNA microarray , clustering of patient samples by Bio informatics is based on :**

- A. molecular fingerprinting
- B. the clinical characteristics of samples
- C. treatment response
- D. gene expression profiling

**11) The following the following is needed for next generation**

- A. DNA adapter
- B. Taq polymerase
- C. Dideoxynucleotide
- D. Multiple pairs of gene-specific primers

<b>Answers:</b>	<b>6) C</b>	<b>7) C</b>	<b>8) B</b>
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9) D

10) D

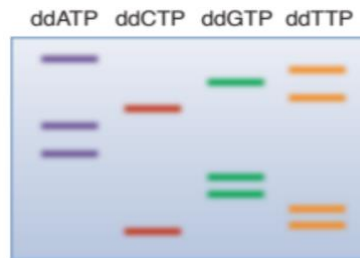
11) A

**12) This technique allows you to identify the change of expression of hundreds to thousands of genes, known and unknown ones, with their alternatively spliced variants:**

- A. Real -time PCR of cDNA
- B. Reporter gene assay
- C. Next generation DNA sequencing
- D. DNA microarray
- E. RNA sequencing

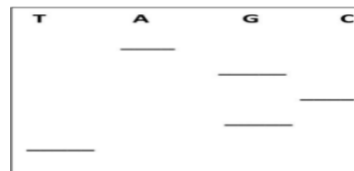
**13) The sequence of the original strand is:**

- A. CTTGGAAGTGA
- B. TACAGTTCCAAG
- C. None of the above



**14) What is the DNA sequence when we perform premature termination of DNA synthesis by dideoxynucleotide shown here?**

- A. 5' AGCGT 3'
- B. 5' TGCGA 3'
- C. 3' TGCGA 5'



**15) This technique allows you to investigate the change of expression several thousands of known genes, all at the same time , among plants that express the hormone versus those that do not?**

- A. Quantitative real-time PCR of CDNA
- B. Reporter gene assay
- C. DNA microarray
- D. Yeast-two hybrid system
- E. Quantitative PCR

**16) )One of the following is not true in regards to the CRISPR:**

- A. Contains DNA fragments of bacteriophage DNA
- B. It is a part of bacterial genome
- C. It encodes to CAS9 protein
- D. It contains a palindromic repeated sequences

**17) The following is a sequence you expect NOT to be recognized by a restriction endonuclease**

- A. CTTAAG
- B. AGCT
- C. GCAGCA
- D. GGATCC



<b>Answers:</b>	<b>12) E</b>	<b>13) B</b>	<b>14) B</b>
	<b>15) C</b>	<b>16) C</b>	<b>17) C</b>

**18) Restriction fragment length polymorphisms may be produced by mutations in the sites for restriction endonucleases. For instance, a single base change in the site for the nuclear Sall produces the sequence GTGGAC, which can no longer be recognized by the enzyme. What was the original sequence recognized by Sall?**

- A. GTAGAC
- B. GCGGAC
- C. CTGGAC
- D. GTCGAC
- E. GTGTAC

**19) DNA sequencing refers to a technique used to determine the:**

- A. Sugar sequence in DNA
- B. Phosphate sequence in DNA
- C. Bases sequence in DNA
- D. All of the above

**20) Which of the following is not true about the CRISPR/CAS9 system?**

- A. Cas9 is guided by an RNA molecule
- B. Breaking double stranded DNA can be repaired by the system
- C. Breaking double stranded DNA can cause a mutation
- D. CRISPR is a bacterial genetic that constitutes the immune system of
- E. bacteria against phages

**21) Which of the following can't be detected by RNA-sequencing**

- A. RNA stability
- B. Amount of transcripts
- C. Significant transcripts

**22) Why do we use adapter in the next generation sequencing:**

- A. To anneal with the primer
- B. To stabilize DNA strands
- C. To detect DNA

**23) Each spot of microarray represent:**

- A. A known DNA sequence
- B. A protein with high affinity to DNA sequence
- C. A known RNA sequence
- D. A heterozygous population of DNA fragments

<b>Answers:</b>	<b>18) D</b>	<b>19) C</b>	<b>20) B</b>
	<b>21) A</b>	<b>22) A</b>	<b>23) A</b>

**24) Which of the following is not required in expression vectors:**

- A. Cloning site
- B. Promoter sequence
- C. Shine dalgarno sequence
- D. Tagging sequence

**25) Taq enzyme is used specifically in PCR due to its:**

- A. Accuracy
- B. High efficiency
- C. Low price
- D. Stability at high temperatures

**26) Luciferase reporter gene is used to:**

- A. Identify transcription site
- B. Identify introns and exons
- C. Identify genes
- D. Identify the regulatory region

**27) Blue colony generated in yeast two-hybrid system, indicates:**

- A. The enzyme beta-galactosidase is inactive
- B. The recombinant plasmid are successfully inserted into yeast
- C. No expression of LacZ gene
- D. A confirmation of protein -protein interaction
- E. Lactose is metabolized

**28) All of the following are advantages of using fluorescence-based sequencing over radioactivity-based sequencing except:**

- A. It detects heterozygosity
- B. It is automated
- C. It is safe and cheap
- D. It is fast

**29) Proteins are tagged in order to:**

- A. Purify them
- B. Detect them
- C. Retain their function
- D. A + B

<b>Answers:</b>	<b>24) D</b>	<b>25) D</b>	<b>26) D</b>
	<b>27) D</b>	<b>28) A</b>	<b>29) D</b>

**30) you aim to create mutations in the hormone gene. you can do this by:**

- A. activation of non-homologous end joining following introduction of CRISPER-Cas9 system
- B. Target the gene with specific primers
- C. Activation of homologous recombination following introduction of CRISPER-Cas9 system
- D. Allow cells to express specific restriction endonucleases
- E. Create a recombinant DNA with glutathione -S-transferase gene conjugated to the hormone gene

**31) your performed fluorescence based DNA sequencing of the coding region of the hormone gene in two plants ; one has a functioning hormone and other does not. you found identical homology except for one position where the peak totally changed colors. This indicates:**

- A. one heterozygous single point to mutation
- B. Polymorphism
- C. Base insertion
- D. two homozygous single point mutation
- E. Frameshift mutation due to the deletion

**32) you expressed the hormone in every plant cell, but the hormone does not function you want to identify the gene that has a mutation , but their plant genome is composed of 5000 genes . you don't know what the gene is . you can perform this technique and compare the results to the database of the normal genome:**

- A. Quantitative PCR
- B. real time PCR
- C. RNA sequencing
- D. next generation sequencing
- E. fluorescent based sequencing

**33) Why cannot we detect any signal in the first few cycles of quantitative PCR?**

- A. SYBR green is not yet activated
- B. The taq polymerase is not active
- C. Limitation in the sensitivity of the instrument
- D. There is no amplification taking place
- E. The proper size of the amplicon has not been reached

<b>Answers:</b>	<b>30) A</b>	<b>31) B</b>
	<b>32) C</b>	<b>33) C</b>

