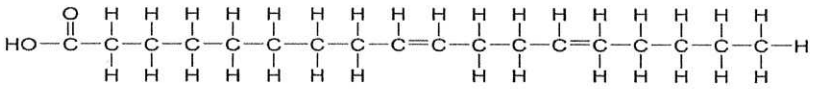
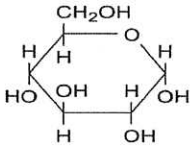
Molecular Biology Unit Test **/40** Name: Jerry Jiang

1. Which of the molecules contain peptide bonds or are sugar molecules?

I.



II.



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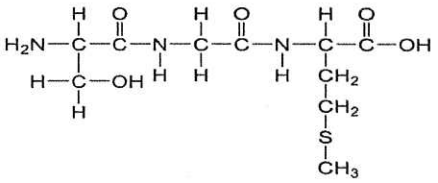
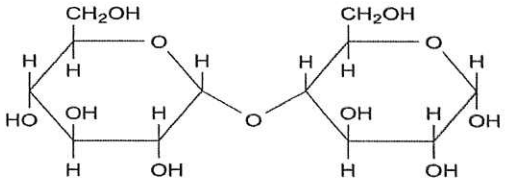
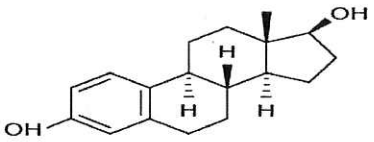


IV.



	Contain peptide bonds	Are sugar molecules
A.	I, III	II
B.	III	II, IV
C.	I, III, IV	II
D.	I	III, IV

2. What characteristic shows that this steroid molecule is a lipid?



A. It is made of carbon rings.

B. It has a very low proportion of oxygen to carbon.

C. It contains OH groups as do fatty acids.

D. It is made only of nitrogen, oxygen and hydrogen.

3. Olive oil may reduce the risk of coronary heart disease. What is/are the compound(s) responsible for the health benefits of olive oil?

I. Cis unsaturated fatty acids
II. Trans unsaturated fatty acids
III. Saturated fatty acids

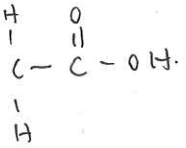
A. I only
B. I and II only
C. II and III only
D. I, II and III

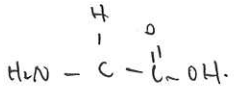
4. Why is sweat a good coolant for the body?

A. The arterioles that transfer water to sweat move closer to the skin surface when it is hot.
B. Breaking H bonds between water molecules in sweat requires energy from body heat.
C. Sweat contains minerals such as sodium chloride.
D. Sweat is non-polar.

5. Which always contains carbon, hydrogen and oxygen?

I.	Carbohydrate
II.	II. Protein
III.	III. Fat





A. I and II only

B. I and III only

C. II and III only

D. I, II and III

6. What is decreased when lactase is added to milk?

A. Sweetness

B. Disaccharides

C. Calcium

D. Monosaccharides

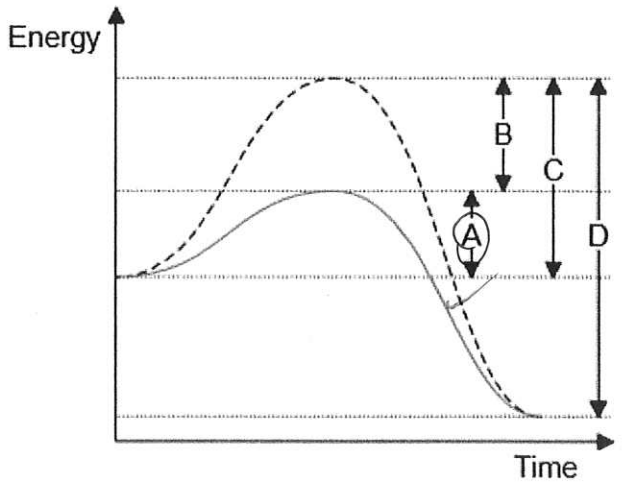
7. Which sugars are examples of a monosaccharide and disaccharide?

	Monosaccharide	Disaccharide
A.	fructose	galactose
B.	lactose	maltose
C.	sucrose	fructose
D.	galactose	lactose

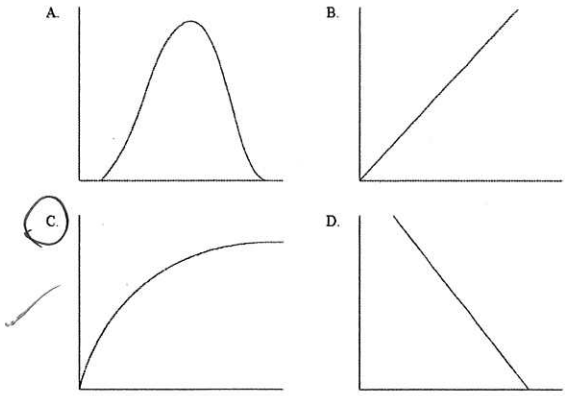
8. Why does exposure to high temperatures cause an enzyme to lose its biological properties?

A. The substrate blocks the active site at high temperatures.
B. The three dimensional structure of the enzyme becomes changed.
C. Chemical reactions cannot take place at high temperatures.
D. High temperatures increase the activation energy of reactions.

9. Which is the activation energy of a reaction when it is catalysed by an enzyme?



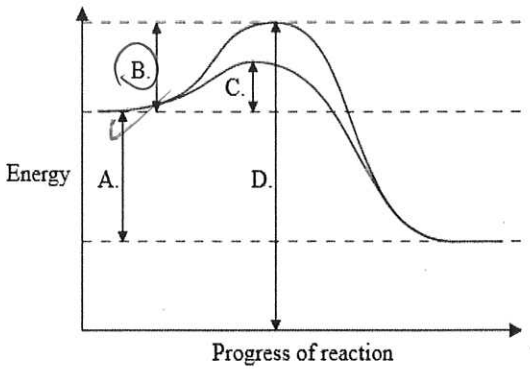
10. Which graph shows the effect of increasing substrate concentration on enzyme activity?



11. What is an allosteric site?

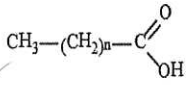
A. The area on an enzyme that binds the end-product of a metabolic pathway
B. The area on a competitor molecule that inhibits an enzyme reaction
C. The site on an enzyme where the substrate binds
D. The active part of a non-competitive inhibitor of an enzyme reaction

12. The following graph shows energy changes with and without enzymes during a chemical reaction. Which letter represents the activation energy required to carry out this reaction without an enzyme catalyst?

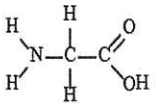


13. Which structure represents a fatty acid?

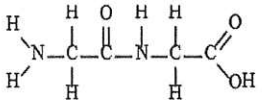
A.



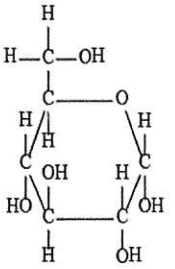
B.



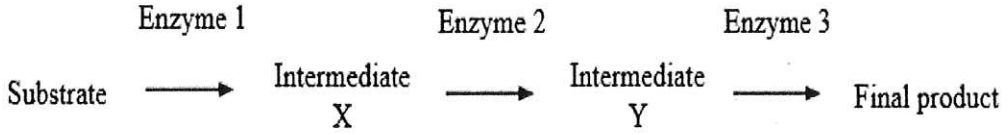
C.



D.



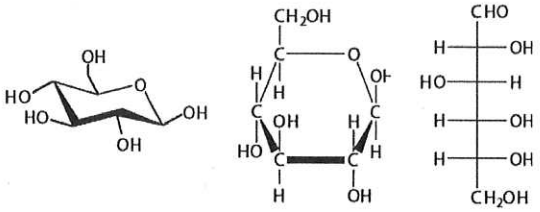
14. A substrate undergoes a series of enzyme-catalysed reactions to form intermediate substances X, Y and then the final product.



What would be the effect on the reaction of adding a competitive inhibitor to enzyme 2?

A. The substrate would not react to form intermediate X.
B. The concentration of intermediate X would increase.
C. The activity of enzyme 3 would increase to compensate.
D. No final product would be formed.

15. The diagrams show three representations of the structure of the **same** chemical substance.



What chemical substance is shown?

A. Ribose
B. Glucose
C. Fatty acid
D. Amino acid

16. Which statement describes glycogen?

A. It is a hormone involved in the control of blood glucose.
B. It is a component of the cell wall in plants.
C. It is a monosaccharide converted to pyruvate during cell respiration.
D. It is a polysaccharide found in animals.

17. Which of the following is **true** about a polar amino acid and cellulose?

A. Both are polysaccharides.
B. Both contain nitrogen.
C. Both are hydrophobic.
D. Both contain hydrogen atoms.

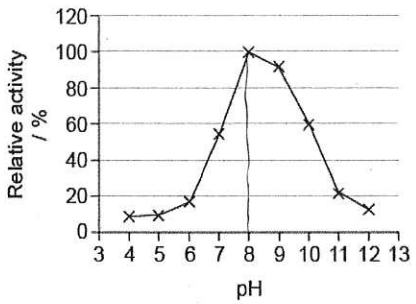
18. Blood is a water-based transport medium. Which property of water makes it a good transport medium?

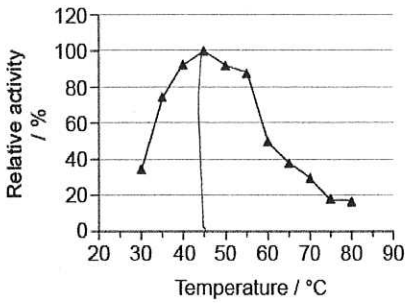
A. High specific heat
B. Transparency
C. Versatility as a solvent
D. It has its greatest density at 4°C

18/18

Part B : Short Answer

19 Keratin is a protein found in hair, nails, wool, horns and feathers. The graphs show the relative keratinase activity obtained in experiments into keratin digestion at different pH values and different temperatures.





19a. *[1 mark]* Determine the optimum pH and temperature of keratinase.

optimum pH: 8

optimum Temp: 45°C

19b. *[2 marks]*

Suggest **two** changes occurring in the reaction vessel that could be used to indicate keratinase activity.

for the pH experiment

① the speed of keratin disappearing (for instance how fast the hair disappears)

② the rate of temperature increase (since this is a catabolic reaction and they are exergonic. However this might need very sensitive measurement but is practible).

③ the speed of volume decreasing. (it's catabolism and is hydrolysis, so water in the reaction vessel will be used)

19c. *[2 marks]*

State **two** conditions that should be kept constant in both experiments.

① the amount of keratin protein and keratinase use in every single data collection process.

reaction time of each trial.

② ~~in the pH experiment, the temperature of each trial is kept constant.~~

2

20a. *[1 mark]*

The diagram below shows the structure of lactase

[Source: Kindly provided by RL Miesfeld, The University of Arizona, Tucson, AZ USA]

1

Identify the protein structures indicated by I and II.

I: alpha helix

II: beta pleated sheet

20b. *[1 mark]*

Describe how structure I is held together.

The alpha helixes ~~are~~ is held together by the intermolecular force like hydrogen bonding or covalent bonding like (disulfite?) bond and ~~is~~ appears in the secondary structure of the protein.

1

21. *[3 marks]*

Other than acting as catalysts state **three** functions of proteins, giving an example of each.

immunity: immunoglobulin

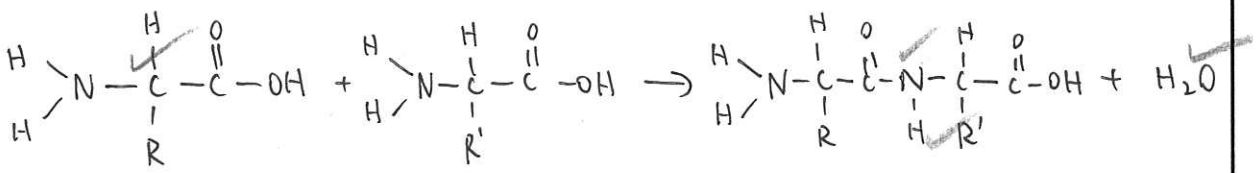
structural: collagen

transportive: haemoglobin

3

22. *[4 marks]*

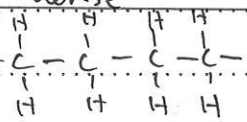
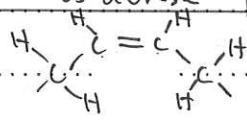
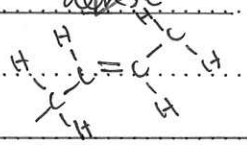
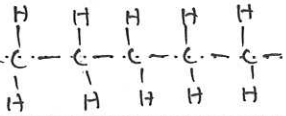
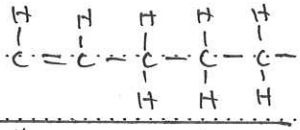
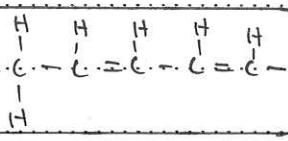
Draw molecular diagrams to show the condensation reaction between two amino acids to form a dipeptide.



4

23. *[4 marks]*

Distinguish between the structures of the different types of fatty acids.

① saturated vs.	cis-unsaturated	vs. trans-unsaturated
saturated or not? carbon all saturated no double bond	Carbon not saturated have double bond	Carbon not saturated have double bond
shape straight	bent	straight
density dense	less dense	dense
illustration 		
Type	saturated? double bond?	structure
② saturated vs.	carbon all saturated no double bond	
monounsaturated vs.	one pair of carbon unsaturated one double bond	
polyunsaturated	multiple pairs of carbon unsaturated multiple double bond	

4

24. *[3 marks]*

Distinguish between anabolism, catabolism and metabolism.

- Anabolism & Catabolism are subsets of metabolism.
- Metabolism is the network of all the catalyze-based reaction in a cell or an organism.

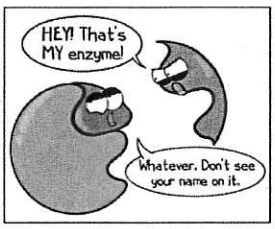
Anabolism	Catabolism
① formation of macromolecules from monomers.	breakdown of macromolecules into smaller pieces.
② condensation	hydrolysis
③ endergonic	exergonic

anabolism
condensation (catalyzed)
monomer + ΔH (OH⁻) ⇌ polymer
catabolism
hydrolysis

↓
metabolism

3

25. [1 mark]

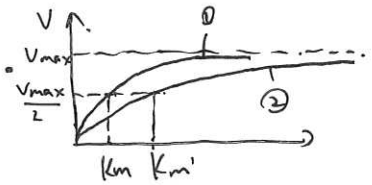


excellent!

Describe what is happening in the cartoon above.

1

- This is a really lovely illustration of competitive inhibition.
- The competitive inhibitor is sleeping on the ~~allo~~ active site, blocking the substrate from attaching to the site and being catalyzed.
- This phenomenon can be outcompete by the dramatic increase in substrate concentration ([S]).



① reaction without inhibitor

② reaction with inhibitor,

as a result, V max stay constant while Km increase, indicating bonding affinity decrease, which is what happens in the cartoon.

- An example: cyanide is competitive inhibitor to cell. (stop ATP production)

22/22 + 18/18 = 40/40 (100%) Wow