Jerry Jiang

Cell Biology Unit Exam

1. *[1 mark]*

Which characteristic of stem cells makes them useful for treating Stargardt's disease?

A. They can differentiate into retinal cells.

B. They are readily available from especially created embryos.

C. They transport white blood cells to the eyes.

D. They divide by binary fission so provide sufficient cells.

2. *[1 mark]*

Which functions of life are carried out by all unicellular organisms?

A. Response, homeostasis, growth and photosynthesis

B. Metabolism, ventilation, reproduction and nutrition

C. Response, homeostasis, metabolism and growth

D. Reproduction, ventilation, response and nutrition

3. *[1 mark]*

Why do multicellular organisms have emergent properties?

A. They have more genes than unicellular organisms.

B. Properties of unicellular organisms are enhanced by having many cells.

C. All of their genes are expressed whereas unicellular organisms express only some.

D. They show properties that can only result from the interaction of many cells.

4. *[1 mark]*

What happens to the cell surface area to volume ratio as a cell grows?

A. It decreases, so production of waste material is reduced.

B. It increases, so mineral ion absorption is increased.

C. It increases, so osmosis is reduced.

D. It decreases, so rate of gas exchange is too low.

ACDDBC

5. *[1 mark]*

How do cells in multicellular organisms differentiate?

A. Some cell types divide by mitosis more often than others.

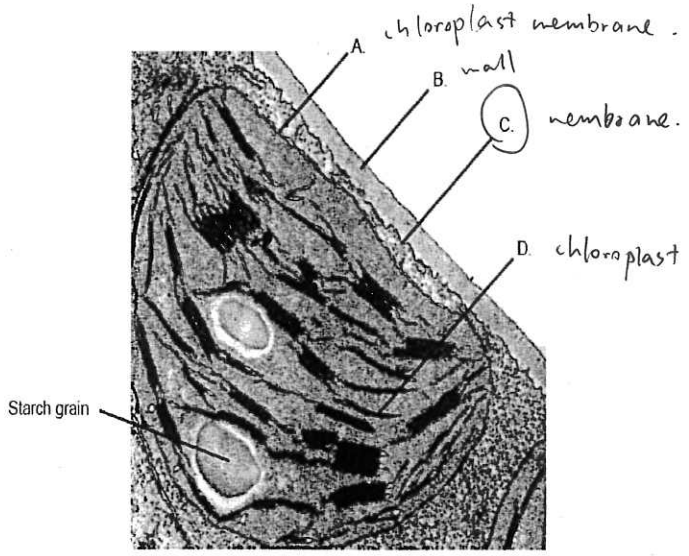
B. They express some of their genes but not others.

C. Some of their proteins denature but not others.

D. Their DNA content changes with time.

6. *[1 mark]*

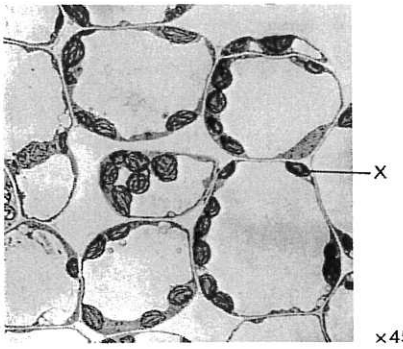
The following electron micrograph shows part of a palisade mesophyll cell. Which of the labelled structures controls the exchange of substances to and from the cell?



[Source: adapted from Eldon Newcomb, http://botit.botany.wisc.edu/about.html]

7. *[1 mark]*

The image shows an electron micrograph of mesophyll cells.



[Source: BIOPHOTO ASSOCIATES/SCIENCE PHOTO LIBRARY]

What is the name of the structure labelled X?

A. Cytoplasm

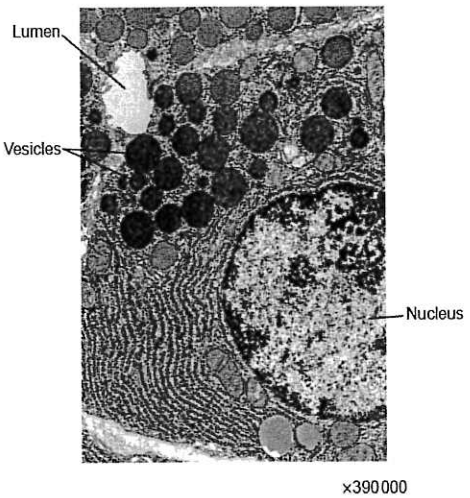
B. Mitochondrion

C. Nucleus

D. Chloroplast

8. *[1 mark]*

The image shows an electron micrograph of pancreatic exocrine cells.



[Source: Meschner AL, *Junqueira's Basic Histology: Text and Atlas*, 12th edition. Copyright McGrawHill Education.]

D C D B

What is the role of the vesicles shown in the micrograph?

A. To transport hormones between the rough endoplasmic reticulum and the Golgi apparatus

B. To store glycogen when blood glucose levels are high

C. To move enzymes out of the cell by exocytosis

D. To digest cellulose

9. *[1 mark]*

Where are proteins synthesized by free ribosomes used?

A. Outside the cell after secretion

B. Within the nucleus

C. Within the lysosomes

D. Within the cytoplasm

10. *[1 mark]*

Which evidence falsifies the Davson–Danielli model?

I. The presence of globular proteins within the phospholipid bilayer

II. Non-polar amino acids cause proteins to remain embedded in membranes

III. Membrane proteins remain in a fixed position inside a membrane

A. I only

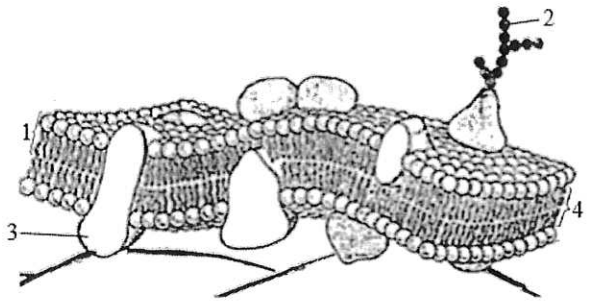
B. I and II only

C. II and III only

D. I, II and III

11. *[1 mark]*

What are the parts of the cell membrane indicated in the diagram?



	1	2	3	4
A.	phospholipid	glycoprotein	integral protein	hydrophobic layer
B.	hydrophilic layer	carbohydrate	cholesterol	phospholipid
C.	phospholipid	peripheral protein	glycoprotein	cholesterol
D.	hydrophobic layer	carbohydrate	integral protein	phospholipid

12. *[1 mark]*

Which process is possible due to the fluidity of cell membranes?

A. Endocytosis

B. Osmosis

C. ATP production

D. Cell recognition

13. *[1 mark]*

What is the approximate thickness of the plasma membrane of a cell?

A. 10 nm

B. 50 nm

C. 10 μm

D. 50 μm

AAABB

14. *[1 mark]*

A number of different proteins are involved in nerve function. Which of the following does not require a membrane protein?

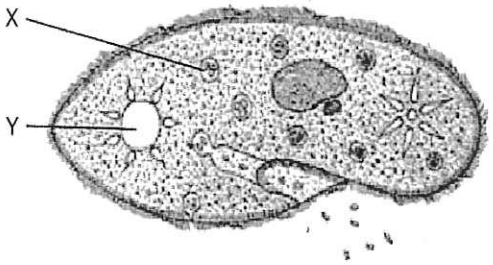
A. Active transport of sodium

B. Diffusion of K^+ into the cell

C. Diffusion of the neurotransmitter across the synapse

D. Binding of the neurotransmitter to the post-synaptic membrane

15. *[1 mark]*



The salt concentration inside the *Paramecium* is 1.8 %. The salt concentration in the surrounding medium suddenly drops to 0.2 %. What will be the likely response?

A. The cell will lose salt to the medium.

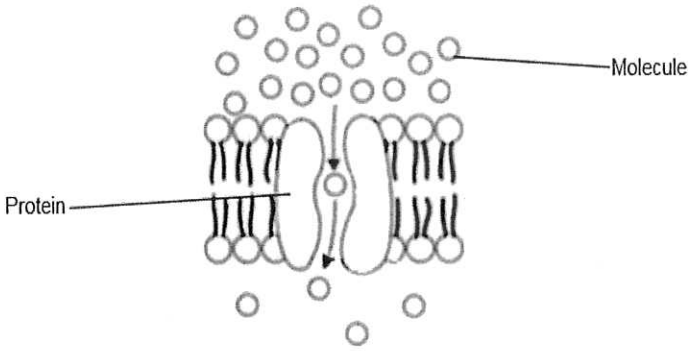
B. The contractile vacuole will expel more water.

C. The cell will swell and eventually burst.

D. The membrane will become more permeable to salt.

16. *[1 mark]*

The diagram is a model of one type of movement across a membrane.



What is this type of movement?

A. Simple diffusion

B. Facilitated diffusion

C. Osmosis

D. Active transport

17. *[1 mark]*

What is osmosis?

A. The movement of water through a membrane from a low to a high solute concentration

B. The movement of solutes through a membrane from a high to a low water concentration

C. The movement of water through a membrane from a high to a low solute concentration

D. The movement of solutes through a membrane from a low to a high water concentration

18. *[1 mark]*

Which pair of features is correct for both diffusion and osmosis?

	Diffusion	Osmosis
A.	net movement of particles from high to low concentration	active transport of water across a partially permeable membrane
B.	net movement of particles from low to high concentration	active transport of water across a partially permeable membrane
C.	net movement of particles from low to high concentration	passive movement of water across a partially permeable membrane
D.	net movement of particles from high to low concentration	passive movement of water across a partially permeable membrane

BADDCD

19. *[1 mark]*

What is evidence for the endosymbiotic theory?

A. RNA can catalyse metabolic reactions. X

B. Meteorites contain organic molecules. X

C. Amino acids can be synthesized from inorganic compounds. X

D. Mitochondria possess their own DNA. ✓

20. *[1 mark]*

The statement relates to Pasteur's experiments.

> In his experiments, Louis Pasteur demonstrated that:
> - if broth was boiled to kill all organisms and was then kept in swan-necked flasks, preventing the entry of organisms, no organisms grew in the broth
> - if the swan-necked flask was broken, mold soon started to grow in the broth.

What did this statement suggest?

A. Mold evolved by endosymbiosis.

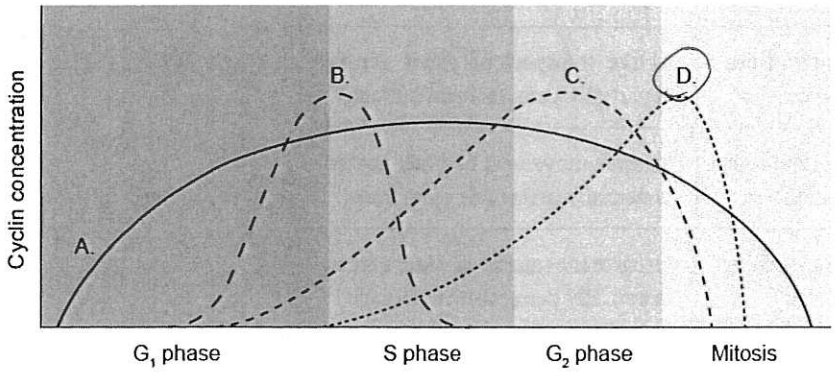
B. Oxygen is required for anaerobic respiration.

C. Cells can only be formed by division of pre-existing cells.

D. Nutrients are a requirement for mold growth.

21. *[1 mark]*

The diagram shows the concentration of four cyclins during the cell cycle. Which curve represents the cyclin that promotes the assembly of the mitotic spindle?



22. *[1 mark]*

During which stage does the cell surface area to volume ratio decrease?

A. Interphase

B. Metaphase

C. Telophase

D. Cytokinesis

23. *[1 mark]*

The following events occur in mitosis.

X: Attachment of spindle microtubules to centromeres

Y: Movement of sister chromatids to opposite poles

Z: Supercoiling of chromosomes

What is the correct sequence of events?

A. X → Z → Y

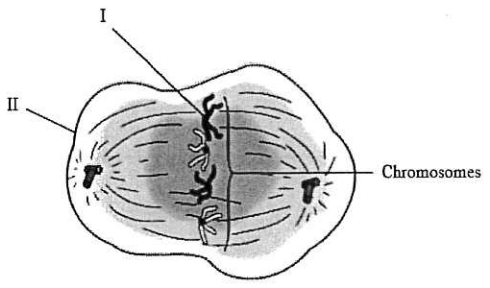
B. X → Y → Z

C. Z → X → Y

D. Z → Y → X

24. *[1 mark]*

The diagram below shows a cell during mitosis.



What are the structures and stage of mitosis?

	Stage of mitosis	Structure I	Structure II
A.	metaphase	chromatid	nuclear membrane
B.	anaphase	centromere	plasma membrane
C.	anaphase	chromatid	nuclear membrane
D.	metaphase	centromere	plasma membrane

25. *[1 mark]*

What is a difference between a cell in the G_1 phase and a cell in the G_2 phase of the cell cycle?

A. A cell in the G_2 phase would be smaller than a cell in the G_1 phase.

B. A cell in the G_2 phase would have more mitochondria than a cell in the G_1 phase.

C. A cell in the G_1 phase would have more DNA in its chromosomes than a cell in the G_2 phase.

D. DNA replication occurs in the G_1 phase but not in the G_2 phase.

26a. *[1 mark]*

List **two** examples of how human life depends on mitosis.

replace of skin cells

tissue repair

26b. *[3 marks]*

Describe the importance of stem cells in differentiation.

Stem cells are undifferentiated cells. They have more plasticity than mature somatic cells. Every cell have the same set of DNA, so stem cells can choose to ~~activate~~ only part of the DNA so that a certain function is performed. According to the emergent property, this action can increase the complexity of the multicellular organisms and ~~illustrate~~ demonstrate more functions. Examples can be red blood cells. They have no nucleus, indicating that they are products of stem cell differentiation.

2

embryo cells are stem cells.

Can differentiate from pluripotent or poti potent.

Can be used to ~~[illegible]~~ healing wounds

27a. *[2 marks]*

Outline the cell theory

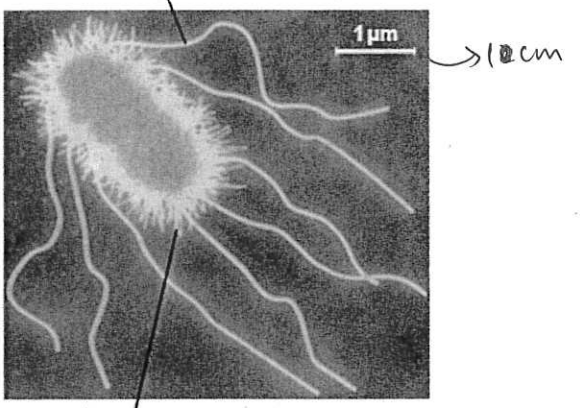
① all cells come from pre-existing cells.

② cell is the basic unit of life.

③ all living organisms is ~~[illegible]~~ composed of cells.

2

27b. *[2 marks]*



Annotate the electron micrograph of the *Escherichia coli* cell with the function of the structures labelled I and II.

2

I: movement towards food source.

II: attachment.

27c. *[1 mark]*

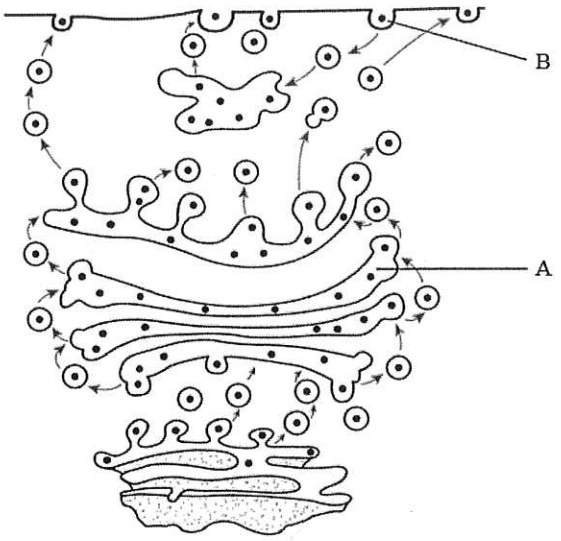
Calculate the magnification of the electron micrograph.

1

$M = \frac{1\text{cm}}{1\mu\text{m}} = \frac{10 \times 10^3 \mu\text{m}}{1\mu\text{m}} = 10^4$

28a. *[1 mark]*

The diagram shows how vesicles are used to transport materials in a cell.



State the name of organelle A.

Golgi apparatus

1

28b. *[1 mark]*

State the process occurring at B.

Endocytosis

1

29. *[8 marks]*

Explain passive transport and active transport across membranes.

	Passive Transport	Active Transport
Requirement of (ATP) energy	NO	YES
gradient	along	against.
from	high → low	low → high.

Passive transport:

- simple diffusion: O_2, CO_2, without any help.
- facillitated diffusion: largen molecules, ions, by the help of carrier proteins/ protein channel.
- osmosis: the diffusion of water across membrane. Partially permeable membrane, from high to low [H_2O] across

Active transport:

- Endocytosis: substance entering cell, wraping up a layer of membrane to form vesicle.
  - phagocytosis: large particles.
  - pinocytosis: liquid.
  - receptor-mediated: will triger when a certain substance reach a concentration
- Exocytosis: substance exiting cell.
- Na^+ - K^+ pump: 3Na^+ out and 2K^+ in, requires 1 ATP at a time.

8

18/19

Name Jerry Jiang. Class C Date 1 Feb.

Bubble Answer Sheet

(A) (B) ● (D)

1. (A) (B) (C) (D) ✓	18. (A) (B) (C) (D) ✓	35. (A) (B) (C) (D)
2. (A) (B) (C) (D) ✓	19. (A) (B) (C) (D) ✓	36. (A) (B) (C) (D)
3. (A) (B) (C) (D) ✓	20. (A) (B) (C) (D) ✓	37. (A) (B) (C) (D)
4. (A) (B) (C) (D) ✓	21. (A) (B) (C) (D) ✓	38. (A) (B) (C) (D)
5. (A) (B) (C) (D) ✓	22. (A) (B) (C) (D) ✓	39. (A) (B) (C) (D)
6. (A) (B) (C) (D) ✓	23. (A) (B) (C) (D) ✓	40. (A) (B) (C) (D)
7. (A) (B) (C) (D) ✓	24. (A) (B) (C) (D) ✓	41. (A) (B) (C) (D)
8. (A) (B) (C) (D) ✓	25. (A) (B) (C) (D) ✓	42. (A) (B) (C) (D)
9. (A) (B) (C) (D) ✓	26. (A) (B) (C) (D)	43. (A) (B) (C) (D)
10. (A) (B) (C) (D) ✓	27. (A) (B) (C) (D)	44. (A) (B) (C) (D)
11. (A) (B) (C) (D) ✓	28. (A) (B) (C) (D)	45. (A) (B) (C) (D)
12. (A) (B) (C) (D) ✓	29. (A) (B) (C) (D)	46. (A) (B) (C) (D)
13. (A) (B) (C) (D) ✓	30. (A) (B) (C) (D)	47. (A) (B) (C) (D)
14. (A) (B) (C) (D)	31. (A) (B) (C) (D)	48. (A) (B) (C) (D)
15. (A) (B) (C) (D) ✓	32. (A) (B) (C) (D)	49. (A) (B) (C) (D)
16. (A) (B) (C) (D) ✓	33. (A) (B) (C) (D)	50. (A) (B) (C) (D)
17. (A) (B) (C) (D) ✓		

AC DD BCD CDBAAAA BBADD CDACDB.

24/25

95% 7