

مراجعة حل أسئلة امتحانات سابقة وفق الهيكل الوزاري



تم تحميل هذا الملف من موقع المناهج الإماراتية

موقع المناهج ← المناهج الإماراتية ← الصف العاشر العام ← علوم ← الفصل الثاني ← ملفات متنوعة ← الملف

تاريخ إضافة الملف على موقع المناهج: 16:50:36 2025-03-17

ملفات اكتب للمعلم اكتب للطالب ا اختبارات الكترونية ا اختبارات ا حلول ا عروض بوربوينت ا أوراق عمل
منهج انجليزي ا ملخصات وتقارير ا مذكرات وبنوك ا الامتحان النهائي للمدرس

المزيد من مادة
علوم:

إعداد: Hossam May

التواصل الاجتماعي بحسب الصف العاشر العام



صفحة المناهج
الإماراتية على
فيسبوك

الرياضيات

اللغة الانجليزية

اللغة العربية

التربية الاسلامية

المواد على تلغرام

المزيد من الملفات بحسب الصف العاشر العام والمادة علوم في الفصل الثاني

مراجعة عامة وفق الهيكل الوزاري منهج بريدج

1

شرح وحل مراجعة وفق الهيكل الوزاري

2

ملخص وشرح درس علم الوراثة المندلية







3

عرض بوربوينت مراجعة الإنقسام المتساوي

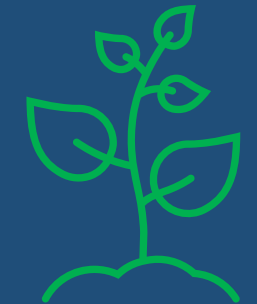
4

عرض بوربوينت حل درس الإنقسام المنصف الإختزالي الجزء الثاني

5



Revision for Biology G10 Gen



Biology Teacher\ May Hossam
Term 2 academic Year 2024-2025

School Principal
Salama Khalfan Al Mazrouei

Question

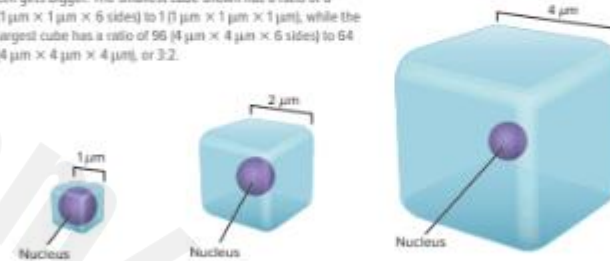
1

Figure 1

Page
73



Figure 1 The ratio of surface area to volume decreases as a cell gets bigger. The smallest cube shown has a ratio of 6 ($1\text{ }\mu\text{m} \times 1\text{ }\mu\text{m} \times 6\text{ sides}$) to 1 ($1\text{ }\mu\text{m} \times 1\text{ }\mu\text{m} \times 1\text{ }\mu\text{m}$), while the largest cube has a ratio of 96 ($4\text{ }\mu\text{m} \times 4\text{ }\mu\text{m} \times 6\text{ sides}$) to 64 ($4\text{ }\mu\text{m} \times 4\text{ }\mu\text{m} \times 4\text{ }\mu\text{m}$), or 3:2.



If the cubic cell grows to $2\text{ }\mu\text{m}$ per side, as represented in **Figure 1**, the surface area becomes $24\text{ }\mu\text{m}^2$ and the volume is $8\text{ }\mu\text{m}^3$. The ratio of surface area to volume is now 3:1, which is less than it was when the cell was smaller. If the cell continues to grow, the ratio of surface area to volume will continue to decrease, as shown by the third cube in **Figure 1**. As the cell grows, its volume increases much more rapidly than the surface area. This means that the cell might have difficulty supplying nutrients and expelling enough waste products. By remaining small, cells have a higher ratio of surface area to volume and can sustain themselves more easily.



Get It?

Explain why a high ratio of surface area to volume benefits a cell.

Transport of substances Another task that can be managed more easily in a small cell than in a large cell is the movement of substances. Recall that the plasma membrane controls cellular transport because it is selectively permeable. Once inside the cell, substances move by diffusion or by motor proteins pulling them along the cytoskeleton.

Diffusion over large distances is slow and inefficient because it relies on random movement of molecules and ions. Similarly, the cytoskeleton transportation network, shown in **Figure 2**, becomes less efficient for a cell if the distance to travel becomes too large. Small cell size maximizes the ability of diffusion and motor proteins to transport nutrients and waste products. Small cells maintain more efficient transport systems.

Magnification: variable

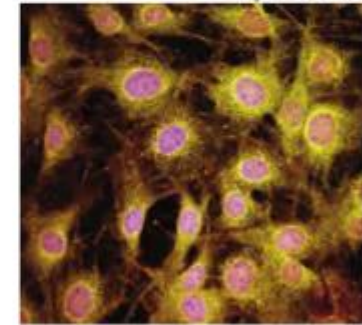


Figure 2 In order for the cytoskeleton to be an efficient transportation pathway, the distances that substances have to travel within a cell must be limited.

Question

1

Figure 1

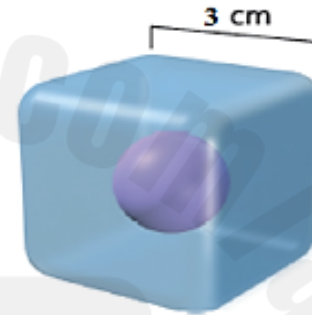
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73

Use the hypothetical cell shown below to answer the question:

استخدم الخلية الافتراضية المبينة أدناه للإجابة عن السؤال:

What is the ratio of its surface area to its volume?

ما نسبة مساحة سطحها إلى حجمها؟



Learning Outcomes Covered

o BIO.3.1.03.033

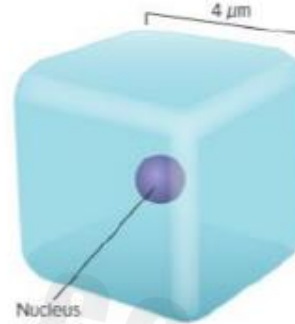
- a. 1:2 ☒
- b. 1:3 ☐
- c. 1:6 ☐
- d. 2:3 ☐

Question 1

Figure 1

Page
73

The figure below demonstrates a cubic cell. What is the ratio of its surface area to its volume?



a.

1:1



b.

2:2



c.

3:2



d.

6:1



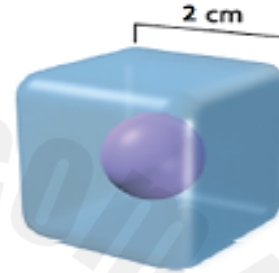
Question

1

Figure 1

Page
73

Use the hypothetical cell shown below to answer the question: استخدم الخلية الافتراضية المبينة أدناه للإجابة عن السؤال:
What is the ratio of its surface area to its volume? ما نسبة مساحة سطحها إلى حجمها؟



Learning Outcomes Covered

o BIO.3.1.03.033

- a. 1:2 ☐
- b. 1:3 ☐
- c. 1:6 ☐
- d. 2:3 ☒

Question

2

Figure 4

Page
75

The Cell Cycle

Cells reproduce by a cycle of growing and dividing called the **cell cycle**. Cellular reproduction allows your body to grow and heal certain injuries. Each time a cell goes through one complete cell cycle, it becomes two cells. The duration of the cell cycle varies. Some eukaryotic cells might complete the cycle in as few as eight minutes, while other cells might take up to one year. For most normal, actively dividing animal cells, the cell cycle takes about 12–24 hours. There are three main stages of the cell cycle.

Interphase

Interphase is the stage during which the cell grows, develops into a mature, functioning cell, duplicates the DNA in its nucleus, and prepares for division. Interphase is divided into three stages as shown in **Figure 4**: G_1 , S , and G_2 , also called Gap 1, synthesis, and Gap 2. When these activities are completed, the cell begins mitosis.

Gap 1 (G_1) The first stage of interphase, G_1 , is the period immediately after a cell divides. During G_1 , a cell is growing, carrying out normal cell functions, and preparing to replicate DNA. Some cells, such as muscle and nerve cells, exit the cell cycle at this point and do not divide again.

Synthesis (S) The second stage of interphase, S , is the period when a cell copies its DNA in preparation for cell division.

Gap 2 (G_2) The G_2 stage follows the S stage and is the period when the cell prepares for the division of its nucleus. A protein that makes microtubules for cell division is synthesized at this time. During G_2 , the cell also takes inventory and makes sure it is ready to continue with mitosis.

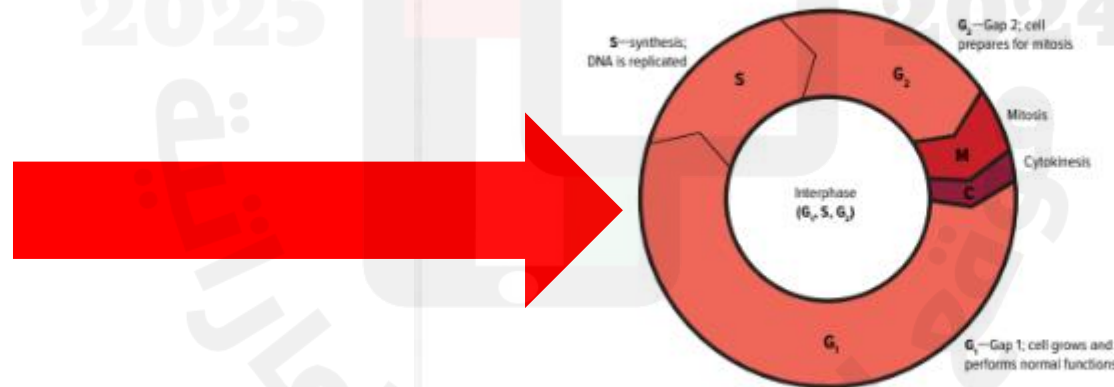


Figure 4 The cell cycle involves three stages—interphase, mitosis, and cytokinesis. Interphase is divided into three substages.

Hypothesize why cytokinesis represents the smallest amount of time that a cell spends in the cell cycle.

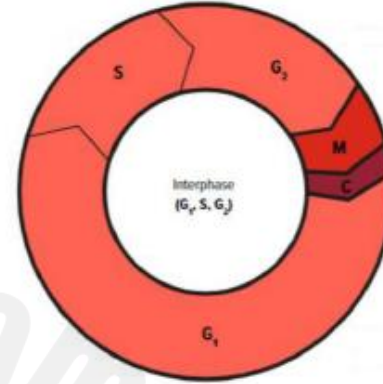
Question

2

Figure 4

Page
75

The image below illustrates the cell cycle. Which stage in the picture below represents the preparations for mitosis ?



a.

S

b.

G₁

c.

G₂

d.

M



Question

2

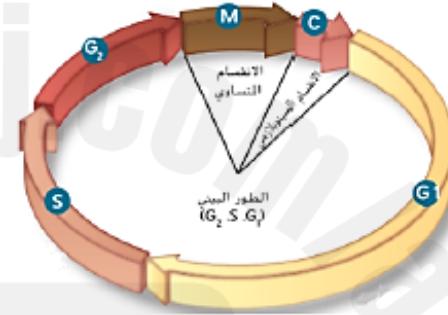
Figure 4

Page
75

Interphase, mitosis, and cytokinesis.

Interphase is divided into three substages.

Which stage of the following involves DNA replication?



الطور البيني والانقسام المتساوي والانقسام السيتوبلازمي.

وينقسم الطور البيني إلى ثلاث مراحل فرعية.

أي مرحلة مما يلي يتضمن فيها DNA؟

Learning Outcomes Covered

• BIO.3.1.03.023

- a. C ☐
- b. G1 ☐
- c. G2 ☐
- d. S ☒

Question

2

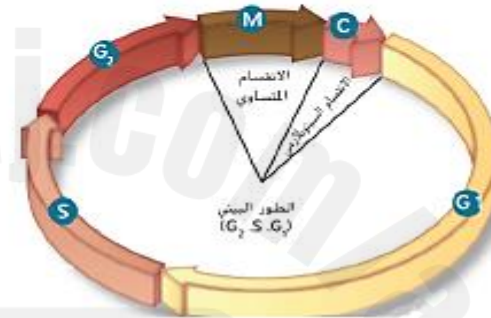
Figure 4

Page
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In the figure below, the cell cycle involves three stages—interphase, mitosis, and cytokinesis.

Interphase is divided into three substages. In which stage of the following does a cell prepare for mitosis?

في الشكل أدناه، تتضمن دورة الخلية ثلاث مراحل: الطور البيني والانقسام المتساوي والانقسام السيتوبلازمي. وينقسم للطور البيني إلى ثلاث مراحل فرعية. في أي مرحلة مما يلي تستعد فيه الخلية للانقسام المتساوي؟



Learning Outcomes Covered

• BIO.3.1.03.037

- a. ☐ C
- b. ☐ G1
- c. ☒ G2
- d. ☐ S

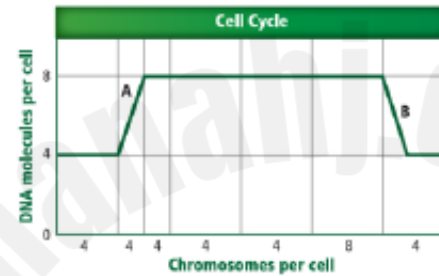
Question

2

Figure 4

Page
75

The following graph shows a cell over the course of its cell cycle. Use this graph to answer question:
What stage occurred in the area labeled (B)?



يعرض الرسم البياني التالي دورة حياة الخلية. استخدم هذا الرسم البياني للإجابة عن السؤال:
ما العملية التي حدثت في المنطقة المسماة (B)؟



Learning Outcomes Covered

o BIO.3.1.03.033

- | | | | |
|----|-------------|-----------------------|----------------------------------|
| a. | Interphase | الطور البيني | <input type="radio"/> |
| b. | Cytokinesis | الانقسام السيتوبلازمي | <input checked="" type="radio"/> |
| c. | Mitosis | الانقسام المتساوي | <input type="radio"/> |
| d. | Metabolism | الأيض | <input type="radio"/> |

Question

3

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Apoptosis

Not every cell is destined to survive. Some cells go through a process called **apoptosis** (a pup TOH sus), or programmed cell death. Cells going through apoptosis actually shrink and shrivel in a controlled process. All animal cells appear to have a “death program” that can be activated. One example of apoptosis occurs during the development of the human hand and foot. When the hands and feet begin to develop, cells occupy the spaces between the fingers and toes. Normally, this tissue undergoes apoptosis, with the cells shriveling and dying at the appropriate time so that the webbing is not present in the mature organism.

An example of apoptosis in plants is the localized death of cells that results in leaves falling from trees during autumn. Apoptosis also occurs in cells that are damaged beyond repair, including cells with DNA damage that could lead to cancer. Apoptosis can help to protect organisms from developing cancerous growths.

Abnormal cell cycle: cancer

When cells do not respond to the normal cell cycle control mechanisms, a condition called cancer can result. **Cancer** is the uncontrolled growth and division of cells—a failure in the regulation of the cell cycle.

When unchecked, cancer cells can kill an organism by crowding out normal cells, resulting in the loss of tissue function. Cancer cells spend less time in interphase than do normal cells, which means cancer cells grow and divide unrestrained as long as they are supplied with essential nutrients. **Figure 12** shows how cancer cells can intrude on normal cells.

Causes of cancer Cancer does not just occur in a weak organism. In fact, cancer occurs in many healthy, active, and young organisms. The changes that occur in the regulation of cell growth and division of cancer cells are due to mutations or changes in the segments of DNA that control the production of proteins, including proteins that regulate the cell cycle. Often, the genetic change or damage that occurs is repaired. But if the repair systems fail, cancer can result. Various environmental factors can affect the occurrence of cancer cells. Substances and agents that are known to cause cancer are called **carcinogens** (kar SĪhnuh jenz).



Figure 12 Cancer cells often have an abnormal, irregular shape compared to normal cells. In this image some cancer cells are entering vessels, which might carry them to another part of the body. This is one way cancer can spread from one body part to another.

CROSSCUTTING CONCEPTS

Systems and Systems Models Develop a physical model to illustrate the cell cycle. Your model does not need to show each step in mitosis, but it should illustrate the role of the cell cycle in producing and maintaining complex organisms. What are the limitations of your model? How could you improve your model?

STEM CAREER Connection

Occupational Health and Safety Specialist

Do you always have your eyes out for safety hazards? Do you like the idea of being responsible for protecting people from harm? Occupational health and safety specialists work to ensure people are safe while they work. They inspect workplaces to ensure safety regulations are followed. Workplace radiation and chemical hazards can be carcinogenic.

Question 3

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81

Which is the best definition of **apoptosis**?

أي مما يلي يصف موت الخلية؟

Learning Outcomes Covered

◦ BIO.3.1.03.037

- a. Occurs in all cells يحدث في كل الخلايا ☐
- b. Is a programmed cell death هو موت خلوي مبرمج ☒
- c. Disrupts the normal development of an organism يعيق النمو الطبيعي للكائن الحي ☐
- d. Is a response to hormones هو استجابة للهرمونات ☐

Question

3

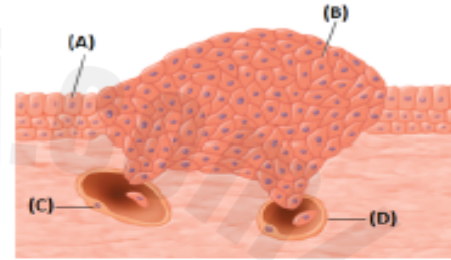
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The illustration below shows one way cancer can spread from one body part to another.

Which letter of the following indicates **cancer cells**?

الشكل أدناه يبين إحدى الطرق التي يمكن أن ينتشر بها السرطان من جزء إلى آخر في الجسم.

أي حرف مما يلي يشير إلى **خلايا سرطانية**؟



Learning Outcomes Covered

• BIO.3.1.03.032

- a. ☐ A
- b. ☒ B
- c. ☐ C
- d. ☐ D

Question

4

Figure
9,10

Page
79

Anaphase The chromatids are pulled apart during **anaphase**, which results in the separation of replicated DNA. In anaphase, microtubules of the spindle apparatus shorten, which pulls at the centromeres. The sister chromatids separate into two identical chromosomes. At the end of anaphase, the microtubules, with the help of motor proteins, move the chromosomes toward the poles of the cell.

Telophase The last stage of mitosis is called **telophase**. Telophase is the stage of mitosis during which the chromosomes arrive at the poles of the cell and begin to relax, or decondense. As shown in **Figure 9**, two new nuclei are formed, each with a complete set of DNA. Two new nuclear membranes begin to form and the nucleoli reappear. Structures used for mitosis are recycled by the cell to build parts of the cytoskeleton.

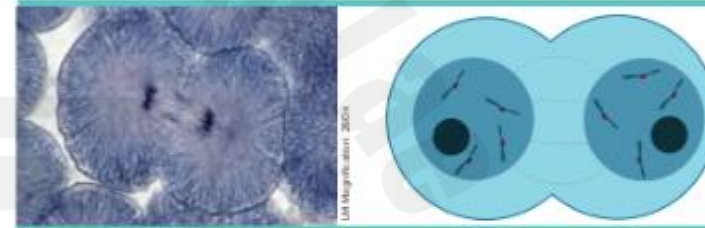


Figure 9 By the end of telophase, the cell has completed the work of duplicating the genetic material and dividing it into two “packages,” but the cell has not completely divided.

Cytokinesis

Toward the end of mitosis, the cell begins **cytokinesis** (si toh kih NEE sis) by which a cell’s cytoplasm divides. This results in two cells with identical nuclei. In animal cells, cytokinesis is accomplished by using microfilaments to constrict, or pinch, the cytoplasm, as shown in **Figure 10**. The area where constriction occurs is called the furrow.

Plant cells have a rigid cell wall. Instead of pinching in half, a new structure called a cell plate forms between the two daughter nuclei. Cell walls then form on either side of the cell plate. Once this new wall is complete, there are two genetically identical cells.

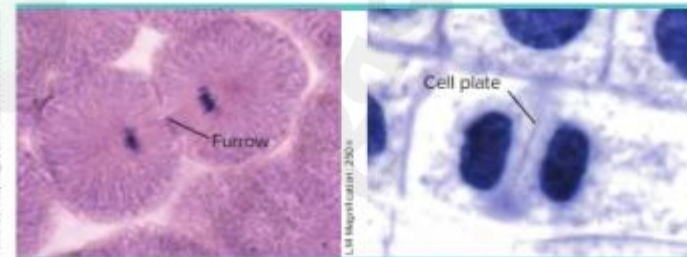


Figure 10 Left: In animal cells, cytokinesis begins with a furrow that pinches the cell and eventually splits the two cells apart. Right: Plant cells build a cell plate that divides the cell into the two daughter cells.

Question

4

Figure
9,10

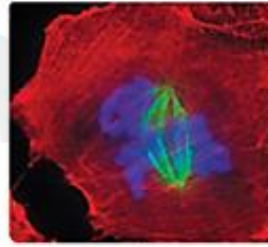
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In the figure below, which letter of the following indicates cytokinesis in **animal cell**?

في الشكل أدناه، أي حرف مما يلي يشير إلى انقسام الميتوبلازمي في خلية حيوانية؟



(A)



(B)



(C)



(D)

Learning Outcomes Covered

- BIO.3.1.03.023
- BIO.3.1.03.036

a. A

b. B

c. C

d. D



Question

4

Figure
9,10

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79

Which of the following occurs during cytokinesis?

Learning Outcomes Covered

o BIO.3.1.03.035

a.

Cytokinesis results in genetic diversity in animal cells



b.

A cell plate forms in plant cells



c.

Cytokinesis results in genetic diversity in plant cells



d.

A cell plate forms in animal cells



Question

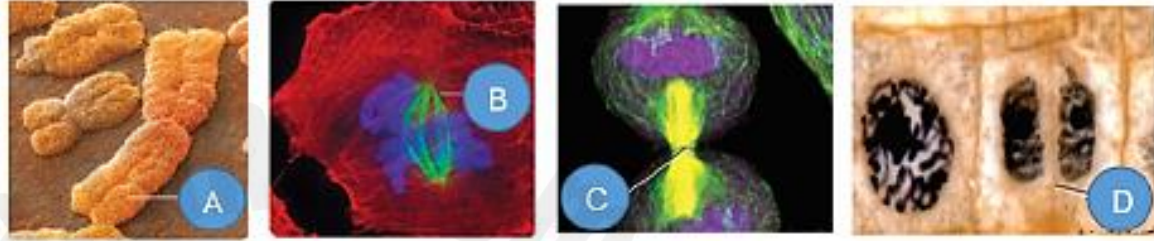
4

Figure
9,10

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In the figure below, which letter of the following indicates the cell plate?

في الشكل أدناه، أي حرف مما يلي يشير إلى الصفحة الخلوية؟



Learning Outcomes Covered

• BIO.3.1.03.036

a. A

b. B

c. C

d. D



Question

5

Figure 6

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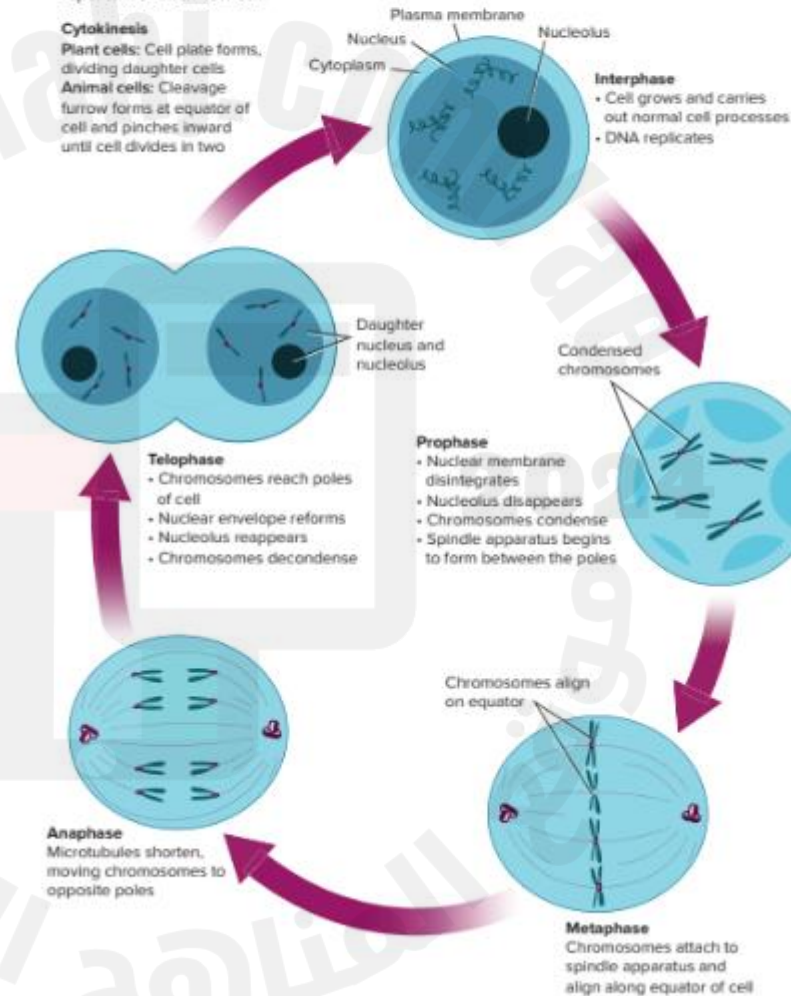
Figure 6 Visualizing the Cell Cycle

The cell cycle begins with interphase. Mitosis follows, occurring in four stages—prophase, metaphase, anaphase, and telophase. Mitosis is followed by cytokinesis, then the cell cycle repeats with each new cell.

Cytokinesis

Plant cells: Cell plate forms, dividing daughter cells

Animal cells: Cleavage furrow forms at equator of cell and pinches inward until cell divides in two

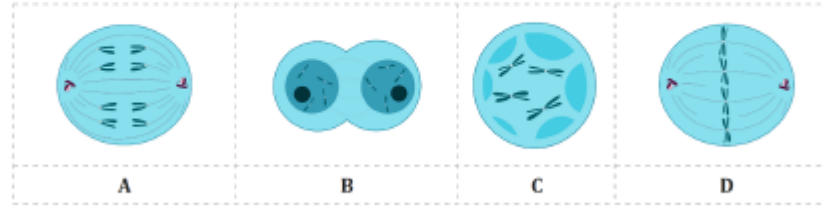


Question 5

Figure 6

Page
77

The image below illustrates four different stages in mitosis. Which letter represents the Anaphase in the picture below?



a.

A



b.

B



c.

C



d.

D



Question

5

Figure 6

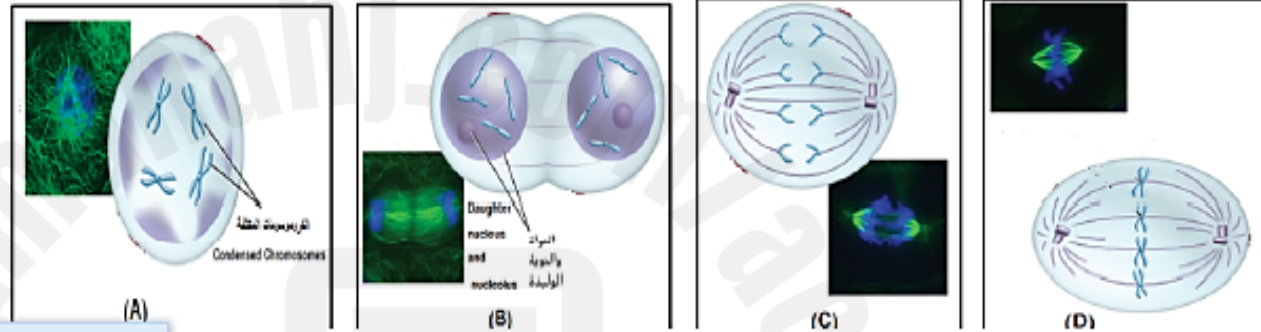
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The figure below shows the phases of mitosis, study it and then answer the question:

Which letter of the following indicates **Anaphase**?

الشكل أدناه يبين أطوار الانقسام المتساوي، أدرسه ثم أجب عن السؤال:

أي حرف مما يلي يشير إلى الطور الانفصالي؟



Learning Outcomes Covered

- BIO.3.1.03.023
- BIO.3.1.03.036

- a. **A**
- b. **B**
- c. **C**
- d. **D**



Question

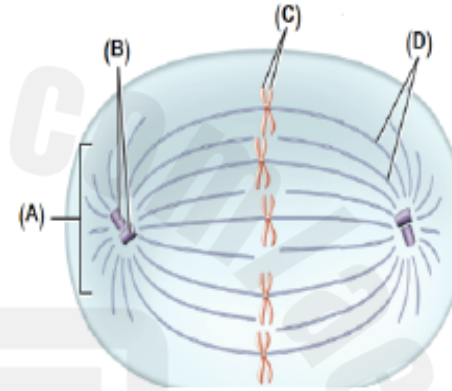
5

Figure 6

Page
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The figure below shows the spindle apparatus.
Which letter of the following indicates **Aster**?

الشكل أدناه، يبين مكونات الجهاز المغزلي.
أي حرف مما يلي يشير إلى الألياف النجمية؟



Learning Outcomes Covered

- BIO.3.1.03.023
- BIO.3.1.03.036

- a. **A** ☒
- b. **B** ☐
- c. **C** ☐
- d. **D** ☐

Question

5

Figure 6

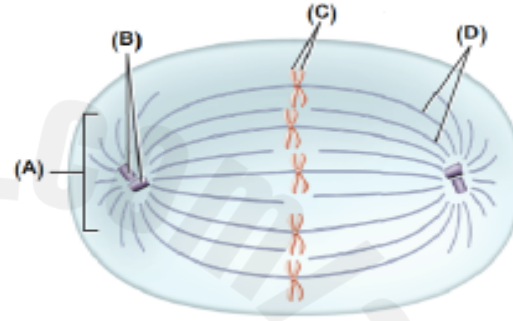
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The figure below shows the spindle apparatus.

Which letter of the following refers to **spindle fibers**?

الشكل أدناه، يبين مكونات الجهاز المغزلي.

أي حرف مما يلي يشير إلى **خيوط المغزل**؟



Learning Outcomes Covered

o BIO.3.1.03.036

a.

A

b.

B

c.

C

d.

D



Question

6

Figure 12

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Apoptosis

Not every cell is destined to survive. Some cells go through a process called **apoptosis** (a pup TOH sus), or programmed cell death. Cells going through apoptosis actually shrink and shrivel in a controlled process. All animal cells appear to have a "death program" that can be activated. One example of apoptosis occurs during the development of the human hand and foot. When the hands and feet begin to develop, cells occupy the spaces between the fingers and toes. Normally, this tissue undergoes apoptosis, with the cells shriveling and dying at the appropriate time so that the webbing is not present in the mature organism.

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Abnormal cell cycle: cancer

When cells do not respond to the normal cell cycle control mechanisms, a condition called cancer can result. **Cancer** is the uncontrolled growth and division of cells—a failure in the regulation of the cell cycle. When unchecked, cancer cells can kill an organism by crowding out normal cells, resulting in the loss of tissue function.

Cancer cells spend less time in interphase than do normal cells, which means cancer cells grow and divide unrestrained as long as they are supplied with essential nutrients. **Figure 12** shows how cancer cells can intrude on normal cells.

Causes of cancer Cancer does not just occur in a weak organism. In fact, cancer occurs in many healthy, active, and young organisms. The changes that occur in the regulation of cell growth and division of cancer cells are due to mutations or changes in the segments of DNA that control the production of proteins, including proteins that regulate the cell cycle. Often, the genetic change or damage that occurs is repaired. But if the repair systems fail, cancer can result. Various environmental factors can affect the occurrence of cancer cells. Substances and agents that are known to cause cancer are called **carcinogens** (kar SIHnuh junz).



Figure 12 Cancer cells often have an abnormal, irregular shape compared to normal cells. In this image some cancer cells are entering vessels, which might carry them to another part of the body. This is one way cancer can spread from one body part to another.

CCC CROSSCUTTING CONCEPTS

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STEM CAREER Connection

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Question 6

Figure 12

Page
81

Which of the following is a characteristic of cancer cells?

a.

Controlled cell division



b.

Involves genetic changes



c.

Cytokinesis stage is skipped



d.

Cell cyclins function normally



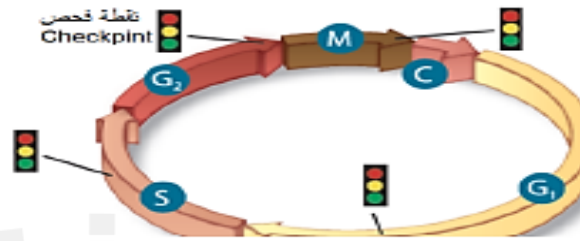
Question 6

Figure 12

Page
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Explain the relationship between cancer cells and the cell cycle?

اشرح العلاقة بين الخلايا السرطانية ودورة الخلية؟



Learning Outcomes Covered

o BIO.3.1.03.032

- a. They have unrestrained cell division and spend short time in interphase. تمز بالانقسام غير مقيد للخلية وتقتضي فترة قصيرة في الطور البيني ☒
- b. They have restrained cell division and spend short time in interphase. تمز بالانقسام مقيد للخلية وتقتضي فترة قصيرة في الطور البيني ☐
- c. They have unrestrained cell division and spend long time in Interphase. تمز بالانقسام غير مقيد للخلية وتقتضي فترة طويلة في الطور البيني ☐
- d. They have restrained cell division and spend long time in Interphase. تمز بالانقسام مقيد للخلية وتقتضي فترة طويلة في الطور البيني ☐

Substances and agents known to cause cancer are called _____

answer choices

- ☒ Cancer-Causing Agents ☒ Cyclins
- ☒ Carcinogens ☒ Cancerous Material

Question

7

Figure 3

Page
74

Cellular communication The need for signaling proteins to move throughout the cell also limits cell size. In other words, cell size affects the ability of the cell to communicate instructions for cellular functions. If the cell becomes too large, it becomes almost impossible for cellular communications, many of which involve movement of substances and signals to various organelles, to take place efficiently. For example, the signals that trigger protein synthesis might not reach the ribosome fast enough for protein synthesis to occur to sustain the cell.

Chromosomes

If a DNA strand 140 million nucleotides long was laid out in a straight line, it would be about five centimeters long. How does all of this DNA fit into a microscopic cell? In prokaryotes, the DNA molecule is contained in the cytoplasm and consists mainly of a ring of DNA and associated proteins. In eukaryotes, the DNA strand is wound up in a tight coil called a chromosome.

Chromatin and chromosomes

DNA is found in the nucleus of eukaryotic cells. DNA can take two forms in the nucleus. **Chromatin** (KROH muh tun) is the relaxed form of DNA. However, the DNA is not relaxed at all times. **Chromosomes** (KROH muh sohms) are condensed structures that contain the DNA that are visible during mitosis. Chromosomes are passed from generation to generation of cells.

Eukaryotic DNA is organized into chromosomes. Human chromosomes range in length from 51 million to 245 million base pairs. The phosphate groups in DNA create a negative charge, which attracts the DNA to the positively charged histone proteins and forms a **nucleosome**. The nucleosomes group together into chromatin fibers, which supercoil to make up the structure recognized as a chromosome, shown in Figure 3.

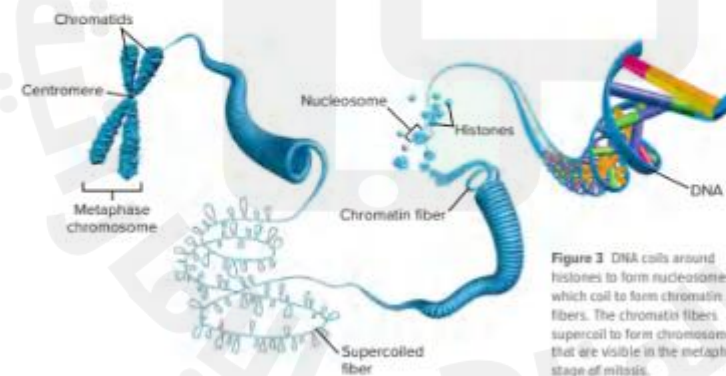


Figure 3 DNA coils around histones to form nucleosomes, which coil to form chromatin fibers. The chromatin fibers supercoil to form chromosomes that are visible in the metaphase stage of mitosis.



Question

7

Figure 3

Page
74

_____ is the relaxed form of DNA inside of the cell's nucleus

answer choices _____

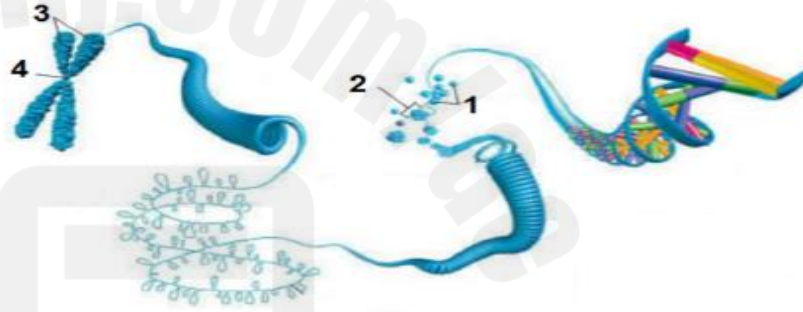
● Chromosomes

● Nucleotides

● Amino Acids

● Chromatin

The image below illustrates the human DNA structure. Which of the following numbers represents the chromatids?



a.

1



b.

2



c.

3



d.

4



Question

8

Table 2

Page
93

Autosomes Autosomes are chromosomes that are not sex chromosomes. Humans have 22 pairs of autosomes. Down syndrome, Patau Syndrome, and Edward's syndrome are all examples of nondisjunction in autosomes.

One of the earliest known human chromosomal disorders is Down syndrome. It is the result of an extra chromosome 21, shown in **Figure 22**. Therefore, Down syndrome often is called trisomy 21. Many individuals with Down syndrome can live 60 or more years. The characteristics of Down syndrome include distinctive facial features, short stature, heart defects, and mental disability, as shown in **Figure 22**. The frequency of children born with Down syndrome in the United States is approximately one out of 800.

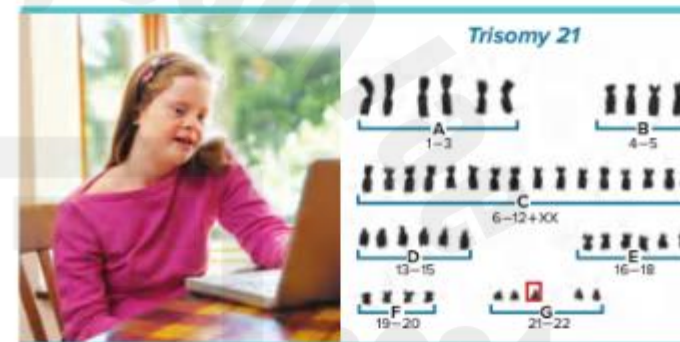


Figure 22 A person with Down syndrome has distinctive features and will have a karyotype that shows three copies of chromosome number 21.

Sex chromosomes Nondisjunction occurs in both autosomes and sex chromosomes. Some of the results of nondisjunction in human sex chromosomes are listed in **Table 2**. An individual with Turner's syndrome has only one sex chromosome. This condition results from fertilization with a gamete that had no sex chromosome. An individual with Klinefelter's syndrome has three sex chromosomes. This condition results from fertilization with a gamete that had two sex chromosomes.

Table 2 Nondisjunction in Sex Chromosomes

Genotype	XX	XO	XXX	XY	XXY	XYY	OY
Example							
Phenotype	Genetically classified as female	Female with Turner's syndrome	No phenotypic affect	Genetically classified as male	Male with Klinefelter's syndrome	No phenotypic affect	Results in death

Question 8

Table 2

Page
93

Which of the following phenotypes can be identified by the zygote showed in the figure below?



a.

Klinefelter's syndrome

b.

Turner's syndrome

c.

Edwards syndrome

d.

Down syndrome

Question 8

Table 2

Page
93

Which of the following genotypes results in death in case of nondisjunction of sex chromosomes?

أي من الطرز الجينية التالية تسبب الوفاة في حالة عدم انفصال الكروموسومات الجنسية؟

Learning Outcomes Covered

o 3.1.8

a. XXX

b. XO

c. XXY

d. OY

Question 9

Figure 18

Page
88

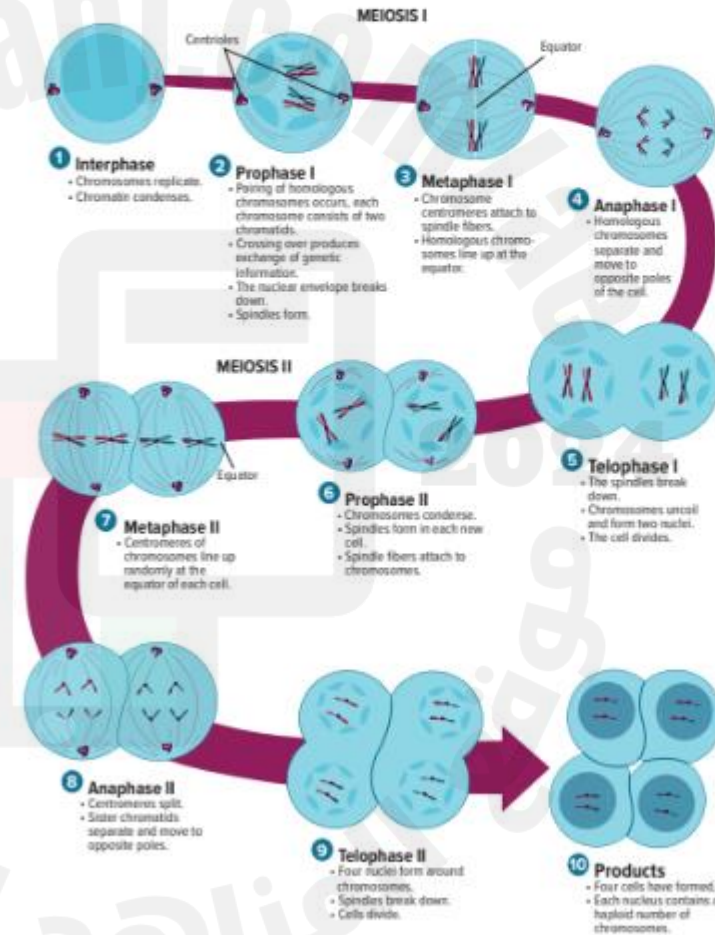


88

UAE Inspire Science Biology, Student Edition, 2024-25

Figure 18 Visualizing Meiosis

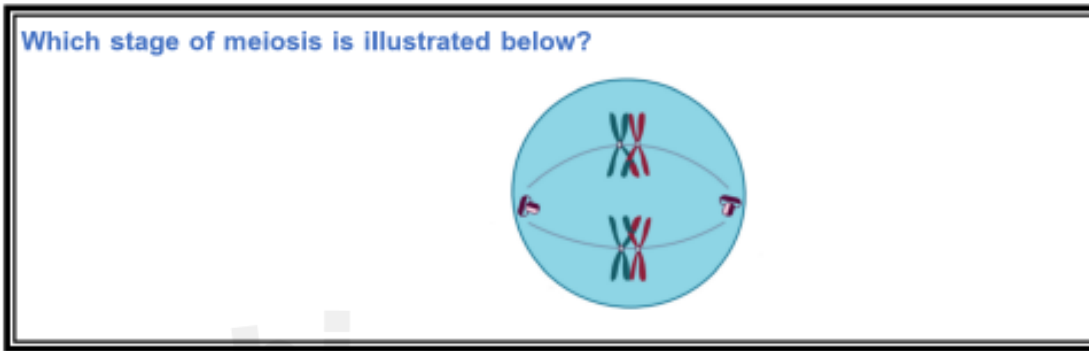
Follow along the stages of meiosis I and meiosis II, beginning with interphase at the left.



Question 9

Figure 18

Page
88



- a. **Metaphase I** ☒
- b. Metaphase II ☐
- c. Prophase I ☐
- d. Prophase II ☐

Question

9

Figure 18

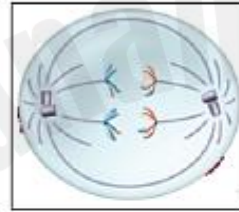
Page
88

The figure below shows some phases of meiosis, study it and then answer the following question:

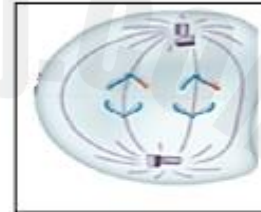
Which letter of the following indicates the **Metaphase II**?

الشكل أدناه يبين بعض أطوار الانقسام المتصف، أدرسه ثم أجب عن السؤال التالي:

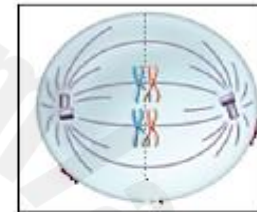
أي حرف مما يلي يشير إلى **الطور الاستوائي الثاني**؟



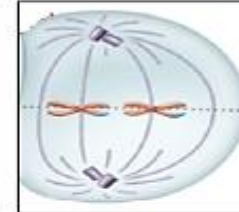
(A)



(B)



(C)



(D)

Learning Outcomes Covered

- BIO.3.1.03.023
- BIO.3.1.03.036
- BIO.3.1.03.038

- a. ☐ A
- b. ☐ B
- c. ☐ C
- d. ☒ D

Question

9

Figure 18

Page
88

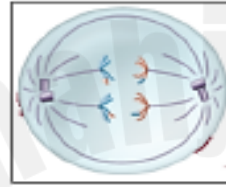
The figure below shows some phases of meiosis, study it and then answer the following question:

Which letter of the following indicates **Anaphase II**?

الشكل أدناه يبين بعض أطوار الانقسام المتصف، أدرسه ثم

أجب عن السؤال التالي:

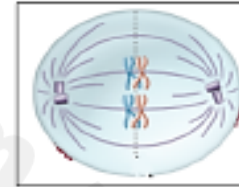
أي حرف مما يلي يشير إلى التطور الانفصالي الثاني؟



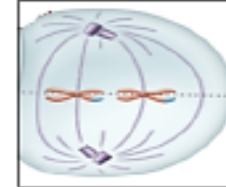
(A)



(B)



(C)



(D)

Learning Outcomes Covered

o BIO.3.1.03.051

a.

A



b.

B



c.

C



d.

D



Question 9

Figure 18

Page
88

Crossing over would most likely occur during which stage of the cell cycle?

في أي من مراحل دورة الخلية يرجح حدوث عملية العبور؟

Learning Outcomes Covered

◦ BIO.3.3.02.010

- a. When DNA is being replicated أثناء تضاعف DNA ☐
- b. When homologous chromosomes line up in pairs عندما تصطف الكروموسومات المتماثلة في أزواج ☒
- c. When centromeres are separated عندما تنفك القطع المركزية ☐
- d. When cytokinesis begins عندما تبدأ عملية انقسام السيتوبلازم ☐

Question 10

Table 1

Page
89

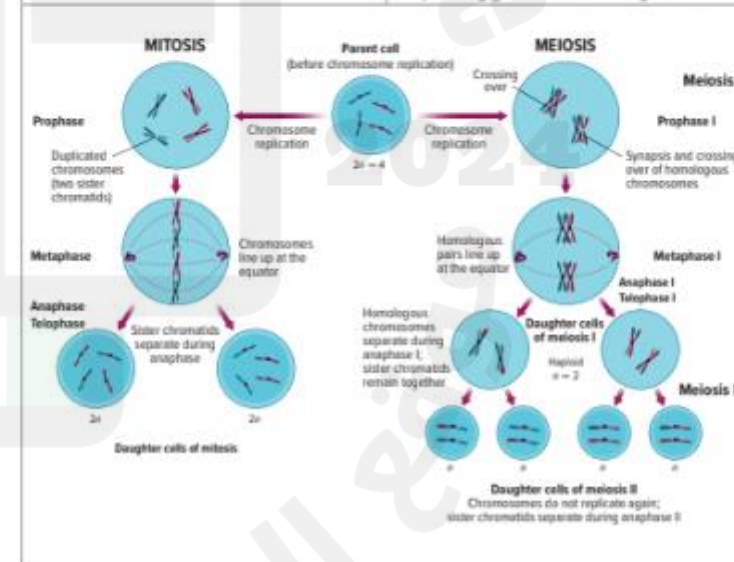


The Importance of Meiosis

Table 1 shows a comparison of mitosis and meiosis. Recall that mitosis consists of only one set of division phases and produces two identical diploid daughter cells. Meiosis, however, consists of two sets of divisions and produces four haploid daughter cells that are not identical. Meiosis is important because it results in genetic variation.

Table 1 Mitosis and Meiosis

Mitosis	Meiosis
One division occurs during mitosis.	Two sets of divisions occur during meiosis: meiosis I and meiosis II.
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Two identical cells are formed per cell cycle.	Four haploid cells (n) are formed per cell cycle.
The daughter cells are genetically identical.	The daughter cells are not genetically identical because of crossing over.
Mitosis occurs only in body cells.	Meiosis occurs only in reproductive cells.
Mitosis is involved in growth and repair.	Meiosis is involved in the production of gametes and providing genetic variation in organisms.



Question 10

Table 1

Page
89

Which of the following is a characteristic of meiosis?

أي مما يلي من خصائص الانقسام المنصف؟

Learning Outcomes Covered

◦ BIO.3.3.02.010

- a. Synapsis of homologous chromosomes does not occur لا يحدث تشابك بين الكروموسومات المتماثلة ☐
- b. The daughter cells are genetically identical الخلايا الوليدة متطابقة وراثياً ☐
- c. It occurs only in reproductive cells يحدث في الخلايا التناسلية فقط ☐
- d. It occurs only in body cells يحدث في الخلايا الجسمية فقط ☒

Question

11

Figure 22

Page 93

Autosomes Autosomes are chromosomes that are not sex chromosomes. Humans have 22 pairs of autosomes. Down syndrome, Patau Syndrome, and Edward's syndrome are all examples of nondisjunction in autosomes.

One of the earliest known human chromosomal disorders is Down syndrome. It is the result of an extra chromosome 21, shown in Figure 22. Therefore, Down syndrome often is called trisomy 21. Many individuals with Down syndrome can live 60 or more years. The characteristics of Down syndrome include distinctive facial features, short stature, heart defects, and mental disability, as shown in Figure 22. The frequency of children born with Down syndrome in the United States is approximately one out of 800.

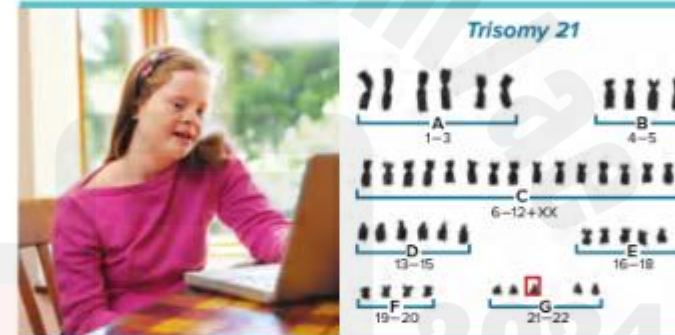


Figure 22 A person with Down syndrome has distinctive features and will have a karyotype that shows three copies of chromosome number 21.

Sex chromosomes Nondisjunction occurs in both autosomes and sex chromosomes. Some of the results of nondisjunction in human sex chromosomes are listed in Table 2. An individual with Turner's syndrome has only one sex chromosome. This condition results from fertilization with a gamete that had no sex chromosome. An individual with Klinefelter's syndrome has three sex chromosomes. This condition results from fertilization with a gamete that had two sex chromosomes.

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Example							
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Question

11

Figure
22

Page
93

Which of the following abnormal male gametes will form
a male with Down syndrome when fertilized with a normal egg?

أي من الأمشاج الذكرية غير الطبيعية التالية تُكون
ذكر مصاب بمتلازمة داون عند إخصابها لبويضة طبيعية؟

Learning Outcomes Covered

- BIO.3.3.01.008
- BIO.3.3.02.021

- | | | |
|----|--|---------------------------------------|
| a. | 22 somatic chromosome and sex chromosomes XY | 22 كروموسوم جسدي وكروموسومين جنسين XY |
| b. | 21 somatic chromosome and sex chromosomes XY | 21 كروموسوم جسدي وكروموسومين جنسين XY |
| c. | 22 somatic chromosome and sex chromosomes XX | 22 كروموسوم جسدي وكروموسومين جنسين XX |
| d. | 23 somatic chromosome and sex chromosome y | 23 كروموسوم جسدي وكروموسوم جنسي y |

Question 12

Figure 15

Page
85

Meiosis I

Gametes are formed during a process called **meiosis**, which is a type of cell division that reduces the number of chromosomes; therefore, it is referred to as a reduction division. Meiosis occurs in the reproductive structures of organisms that reproduce sexually, forming haploid gametes or spores.

While mitosis maintains the chromosome number during cellular reproduction and in organisms that reproduce asexually, meiosis reduces the chromosome number by half through the separation of homologous chromosomes. A cell with $2n$ number of chromosomes will have gametes with n number of chromosomes after meiosis, as illustrated in Figure 15. Meiosis involves two consecutive cell divisions called meiosis I and meiosis II.

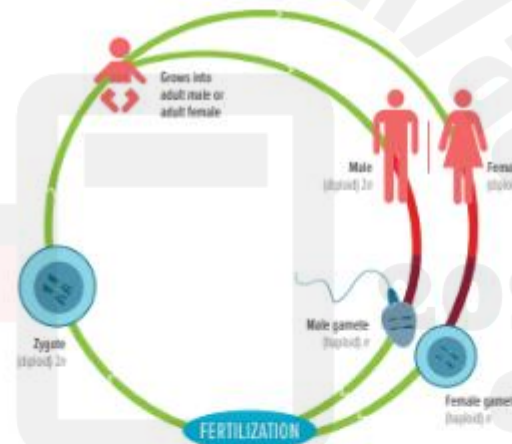


Figure 15 The sexual life cycle in animals involves meiosis, which produces gametes. When gametes combine in fertilization, the number of chromosomes is restored.

Describe what happens to the number of chromosomes during meiosis.

STEM CAREER Connection

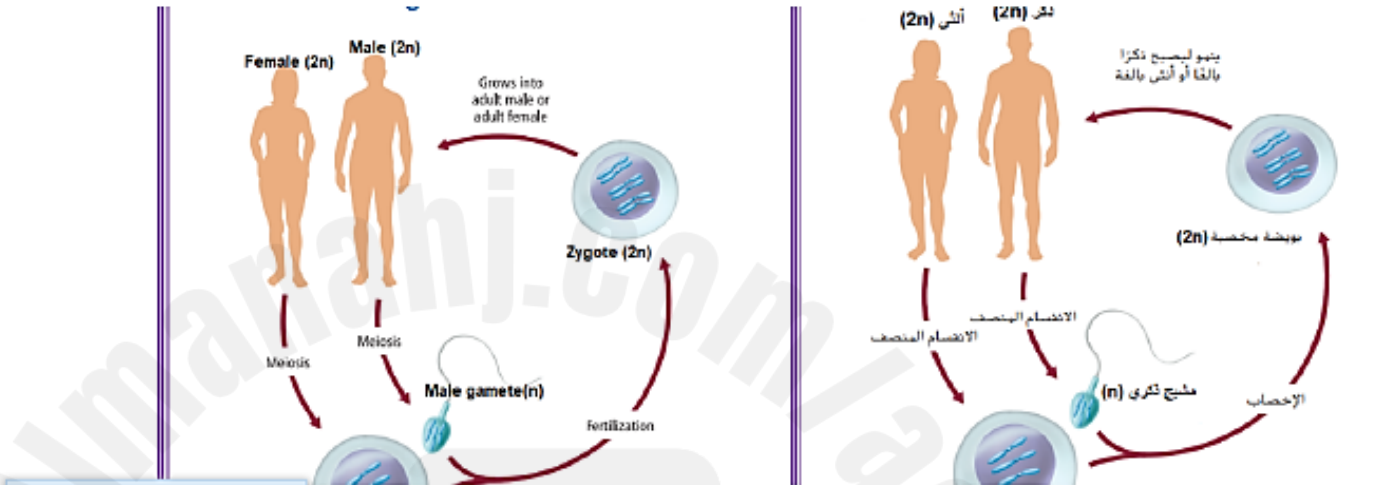
Medical Scientist

Medical scientists study different tissues and systems in the human body. Their work helps to advance our knowledge and improve human health. Medical scientists who specialize in fertilization and the early stages of life are called embryologists.

Question

12

Figure 15



Learning Outcomes Covered

o BIO.3.1.03.025

Page
85

- a. Chromosomes will be duplicated in gametes يزداد إلى الضعف في الأمشاج ☐
- b. Chromosomes will be halved in gametes ينخفض إلى النصف في الأمشاج ☒
- c. Chromosomes will be only replicated in male gametes يتضاعف في الأمشاج المذكرة فقط ☐
- d. Chromosomes will be decreased in female gametes only ينخفض في الأمشاج المؤنثة فقط ☐

Question

13

Table 2

Page
93

Autosomes Autosomes are chromosomes that are not sex chromosomes. Humans have 22 pairs of autosomes. Down syndrome, Patau Syndrome, and Edward's syndrome are all examples of nondisjunction in autosomes.

One of the earliest known human chromosomal disorders is Down syndrome. It is the result of an extra chromosome 21, shown in **Figure 22**. Therefore, Down syndrome often is called trisomy 21. Many individuals with Down syndrome can live 60 or more years. The characteristics of Down syndrome include distinctive facial features, short stature, heart defects, and mental disability, as shown in **Figure 22**. The frequency of children born with Down syndrome in the United States is approximately one out of 800.

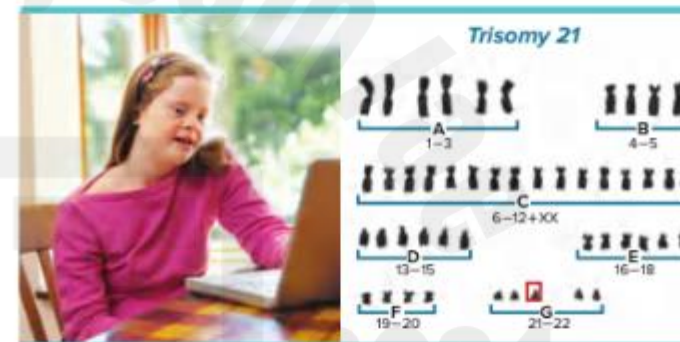


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Example							
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Question 13

Table 2

Page
93

Which of the following genotypes results in death in case of nondisjunction of sex chromosomes?

أي من الطرز الجينية التالية تسبب الوفاة في حالة عدم انفصال الكروموسومات الجنسية؟

a. XXX



b. XO



c. XXY



d. OY



Question

13

Table 2

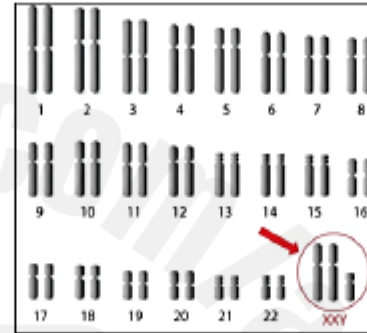
Page
93

In the figure below,

which disorder can be identified in the Karyotype?

في الشكل الوارد أدناه،

أي اختلال يُظهره النمط النووي؟



Learning Outcomes Covered

◊ BIO.3.3.02.019

- | | | |
|----|------------------------|-------------------|
| a. | Turner's syndrome | متلازمة تيرنر |
| b. | Down syndrome male | متلازمة داون ذكر |
| c. | Down syndrome female | متلازمة داون أنثى |
| d. | Klinefelter's syndrome | متلازمة كلاينفلتر |

Question 14

Page
91

Karyotypes and Nondisjunction

Karyotypes

The study of genetic material does not involve the study of genes alone. Scientists also study whole chromosomes by using images of chromosomes stained during metaphase. The staining bands identify or mark identical places on homologous chromosomes. During metaphase of mitosis, each chromosome has condensed greatly and consists of two sister chromatids. The pairs of homologous chromosomes are arranged in decreasing size to produce a micrograph called a **karyotype** (KER ee uh tipe). Karyotypes of a human female and a human male, shown in **Figure 20**, each have 23 pairs of chromosomes: 22 autosomes and nonmatching sex chromosomes. Females will have two X chromosomes while males will have one X chromosome and one Y chromosome.

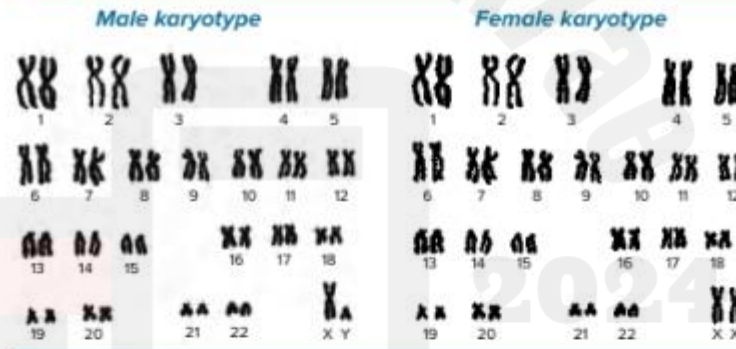


Figure 20 Karyotypes arrange the pairs of homologous chromosomes in order of decreasing size. Distinguish which two chromosomes are arranged separately from the other pairs.

Nondisjunction

During cell division, the chromosomes separate, with one of each of the sister chromatids going to opposite poles of the cell. Therefore, each new cell has the correct number of chromosomes. Cell division during which sister chromatids fail to separate properly, which does happen occasionally, is called **nondisjunction**.

If nondisjunction occurs during meiosis I or meiosis II, the resulting gametes will not have the correct number of chromosomes, as shown in **Figure 21** on the next page. When one of these gametes fertilizes another gamete, the resulting offspring will not have the correct number of chromosomes. **Figure 21** shows that nondisjunction can result in extra copies of a certain chromosome or only one copy of a particular chromosome in the offspring. Having a set of three chromosomes of one kind is called trisomy (TRI so me). Having only one of a particular type of chromosome is called monosomy (MAH ruh some). Nondisjunction can occur in any organism in which gametes are produced through meiosis. In humans, alterations of chromosome numbers are associated with serious human disorders, which are often fatal.

Question 14

Page
91

Why does nondisjunction occur?

لماذا يحدث عدم الانفصال؟

a. The sister chromatids do not separate.

عدم انفصال الكروماتيدات الشقيقة ☒

b. The nucleoli do not disappear.

عدم اختفاء النويات ☐

c. Cytokinesis does not occur properly.

عدم انقسام السيتوبلازم بصورة صحيحة ☐

d. The chromosomes do not condense properly.

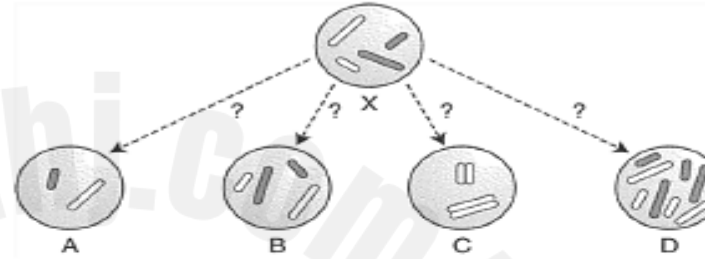
عدم تكاثف الكروموسومات بصورة صحيحة ☐

Question 14

Page
91

Observe the cell labeled (X) in the figure below containing (4) chromosomes. Which of the four cells below represents a healthy gamete that could be produced from this cell?

لاحظ الخلية المسماة (X) في الشكل أدناه التي تحتوي على (4) كروموسومات. أي من الخلايا الأربع أدناها تمثل مشجياً سليماً يمكن أن ينتج عن هذه الخلية؟



Learning Outcomes Covered

o BIO.3.3.02.011

a.

A

b.

B

c.

C

d.

D

Question 15

Table 1

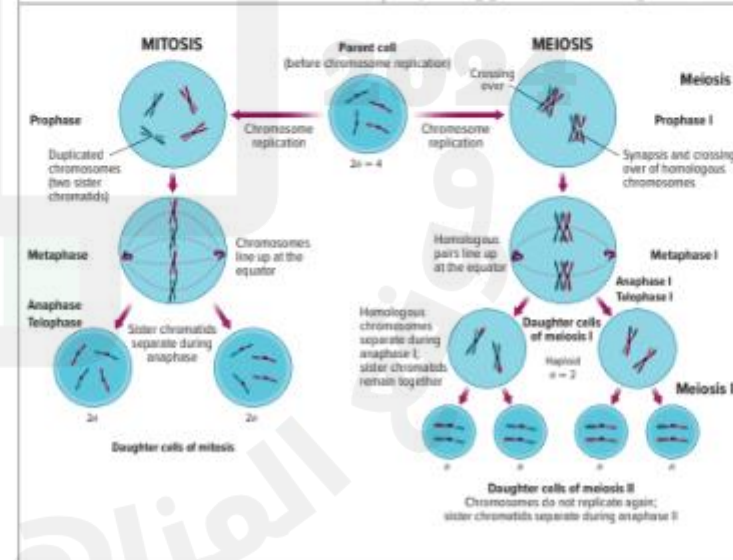
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The Importance of Meiosis

Table 1 shows a comparison of mitosis and meiosis. Recall that mitosis consists of only one set of division phases and produces two identical diploid daughter cells. Meiosis, however, consists of two sets of divisions and produces four haploid daughter cells that are not identical. Meiosis is important because it results in genetic variation.

Table 1 Mitosis and Meiosis

Mitosis	Meiosis
One division occurs during mitosis.	Two sets of divisions occur during meiosis: meiosis I and meiosis II.
DNA replication occurs during interphase.	DNA replication occurs once before meiosis I.
Synapsis of homologous chromosomes does not occur.	Synapsis of homologous chromosomes occurs during prophase I.
Two identical cells are formed per cell cycle.	Four haploid cells (n) are formed per cell cycle.
The daughter cells are genetically identical.	The daughter cells are not genetically identical because of crossing over.
Mitosis occurs only in body cells.	Meiosis occurs only in reproductive cells.
Mitosis is involved in growth and repair.	Meiosis is involved in the production of gametes and providing genetic variation in organisms.



Question 15

Table 1

Page
89

Which of the following is true in regard to Meiosis?

a.

One division takes place



b.

Occurs only in body cells



c.

Involved in growth and repair



d.

Two sets of division takes place



Question

16

Figure 6

Page
77

Figure 6 Visualizing the Cell Cycle

The cell cycle begins with interphase. Mitosis follows, occurring in four stages—prophase, metaphase, anaphase, and telophase. Mitosis is followed by cytokinesis, then the cell cycle repeats with each new cell.

Cytokinesis

Plant cells: Cell plate forms, dividing daughter cells.

Animal cells: Cleavage furrow forms at equator of cell and pinches inward until cell divides in two.

Interphase

- Cell grows and carries out normal cell processes
- DNA replicates

Prophase

- Nuclear membrane disintegrates
- Nucleolus disappears
- Chromosomes condense
- Spindle apparatus begins to form between the poles

Chromosomes align on equator

Metaphase

Chromosomes attach to spindle apparatus and align along equator of cell

Telophase

- Chromosomes reach poles of cell
- Nuclear envelope reforms
- Nucleolus reappears
- Chromosomes decondense

Daughter nucleus and nucleolus

Anaphase

Microtubules shorten, moving chromosomes to opposite poles

2025

Question

16

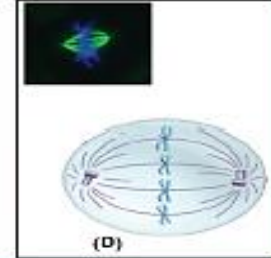
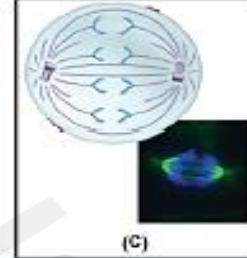
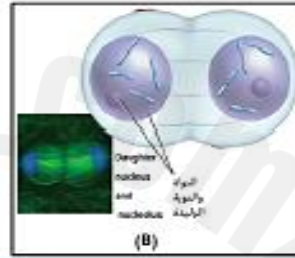
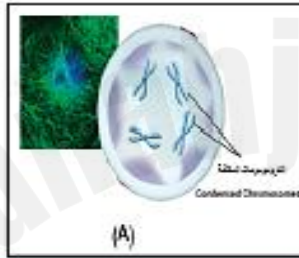
Figure 6

Page
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The figure below shows the phases of mitosis, study it and answer the question: السؤال: الشكل أدناه يبين أطوار الانقسام المتساوي، أدرسه ثم أجب عن:

Which letter of the following indicates **Metaphase**?

أي حرف مما يلي يشير إلى الطور الاستوائي؟



Learning Outcomes Covered

o BIO.3.1.03.036

a.

A

b.

B

c.

C

d.

D



Question 17

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Mitosis

Mitosis (mi TOH sus) is the stage of the cell cycle during which the cell's nucleus and nuclear material divide. During mitosis, the cell's replicated genetic material separates and the cell prepares to split into two cells. The key activity of mitosis is the accurate separation of the cell's replicated DNA. This enables the cell's genetic information to pass into the new cells intact, resulting in two daughter cells that are genetically identical. In multicellular organisms, the process of mitosis increases the number of cells as a young organism grows to its adult size.

Organisms also use mitosis to replace damaged cells. Recall the last time you were accidentally cut. The body's process of healing the cut involves generating new skin cells. These new cells are produced by your existing skin cells. Under the scab, the existing skin cells divided by mitosis and cytokinesis to create new skin cells that filled the gap in the skin caused by the injury. Mitosis is also important for maintaining chromosome number in organisms that undergo asexual reproduction.



Get It?

Explain the role of mitosis in the processes of growth and repair.

The stages of mitosis

Mitosis is divided into four stages: prophase, metaphase, anaphase, and telophase. The stages occur in the same order during each mitotic division.

Prophase The first and longest of the four stages is called **prophase**. In this stage, the cell's chromatin condenses to form chromosomes. At this point, each chromosome is a single structure containing the genetic material that was replicated during interphase.

In prophase, the chromosomes are shaped like an X, as shown in Figure 5. Each half of this X is called a sister chromatid. **Sister chromatids** are structures that contain identical copies of DNA.

The structure at the center of the chromosome where the sister chromatids are attached is called the **centromere**. A centromere is important because it ensures that a complete copy of the replicated DNA will become part of the daughter cells at the end of the cell cycle.

Locate prophase in the cell cycle diagram illustrated in Figure 6 on the next page, and note the position of the sister chromatids in the nucleus. As you continue to read about the stages of mitosis in this lesson, refer to Figure 6 to follow the chromatids through metaphase, anaphase, and telophase. Use the diagram to track the changes that occur as the cell moves through the cell cycle.



SEM Magnification: unavailable

Figure 5 Chromosomes in prophase are actually sister chromatids that are attached at the centromere.

Question 17

Page
76

The labeled structures in the image represent the .

homologous chromosomes

chromatin

centromere



Which of the following structures are made of chromatin and become visible during cell division?

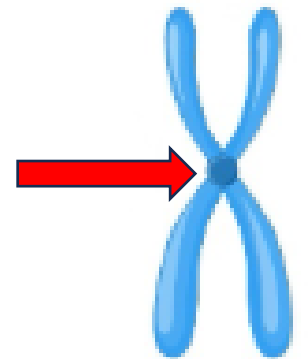
☐ nuclei

☐ histones

☐ proteins

☒ chromosomes ✓

The structure that joins sister chromatids together is called a .



Question

18

Table 2

Page 93

Autosomes Autosomes are chromosomes that are not sex chromosomes. Humans have 22 pairs of autosomes. Down syndrome, Patau Syndrome, and Edward's syndrome are all examples of nondisjunction in autosomes.

One of the earliest known human chromosomal disorders is Down syndrome. It is the result of an extra chromosome 21, shown in **Figure 22**. Therefore, Down syndrome often is called trisomy 21. Many individuals with Down syndrome can live 60 or more years. The characteristics of Down syndrome include distinctive facial features, short stature, heart defects, and mental disability, as shown in **Figure 22**. The frequency of children born with Down syndrome in the United States is approximately one out of 800.

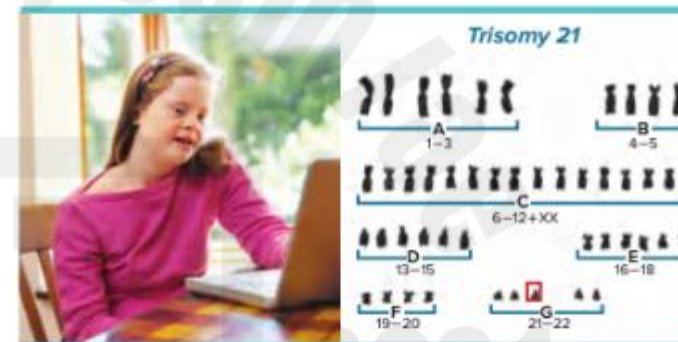


Figure 22 A person with Down syndrome has distinctive features and will have a karyotype that shows three copies of chromosome number 21.

Sex chromosomes Nondisjunction occurs in both autosomes and sex chromosomes. Some of the results of nondisjunction in human sex chromosomes are listed in **Table 2**. An individual with Turner's syndrome has only one sex chromosome. This condition results from fertilization with a gamete that had no sex chromosome. An individual with Klinefelter's syndrome has three sex chromosomes. This condition results from fertilization with a gamete that had two sex chromosomes.

Table 2 Nondisjunction in Sex Chromosomes

Genotype	XX	XO	XXX	XY	XXY	XYY	OY
Example							
Phenotype	Genetically classified as female	Female with Turner's syndrome	No phenotypic affect	Genetically classified as male	Male with Klinefelter's syndrome	No phenotypic affect	Results in death

Question 18

Table 2

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93

Which of the following phenotypes can be identified by the zygote shown in the figure below?



a.

Female



b.

Male



c.

Male with Klinefelter syndrome



d.

Female with Down syndrome



Question 19

Figure 17

Page
86

Interphase

Recall that the cell cycle includes interphase prior to the four stages of mitosis. Cells that undergo meiosis rather than mitosis also go through interphase as part of the cell cycle. Cells in interphase carry out various metabolic processes, including the replication of DNA and the synthesis of proteins.

Prophase I

As a cell enters prophase I, the replicated chromosomes become visible. As in mitosis, the replicated chromosomes consist of two sister chromatids. As the homologous chromosomes condense, they begin to form pairs in a process called synapsis. The homologous chromosomes are held tightly together along their lengths, as illustrated in Figure 16.



Get It?

Distinguish between homologous chromosomes and sister chromatids.

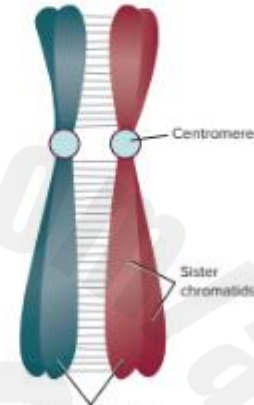


Figure 16 The homologous chromosomes are physically bound together during synapsis in prophase I.

Notice that in **Figure 17** the red and green chromosomes have exchanged segments. This exchange occurs during synapsis. **Crossing over** is a process during which chromosomal segments are exchanged between a pair of homologous chromosomes. Crossing over is a process that increases genetic variation.

As prophase I continues, centrioles move to the cell's opposite poles. Spindle fibers form and bind to the sister chromatids at the centromere.

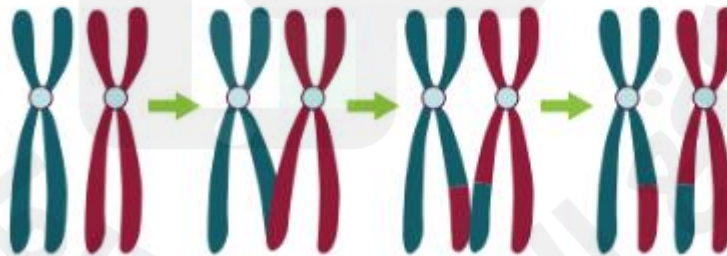


Figure 17 The results of crossing over are new combinations of genes. Determine which chromatids exchanged genetic material.

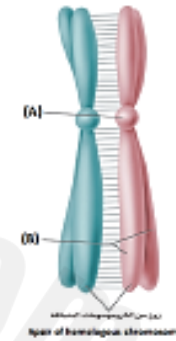


Question 19

Figure 17

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86

The figure below shows the homologous chromosomes that are physically bound together during synapsis in prophase I. What does the letter (A) stand for?



الشكل أدناه يبين تلاصق الكروموسومات المتماثلة
مما أثناء عملية التشابك في الطور التمهيدي الأول.
ما الذي يشير إليه الحرف (A)؟

Learning Outcomes Covered

◦ BIO.3.3.02.010

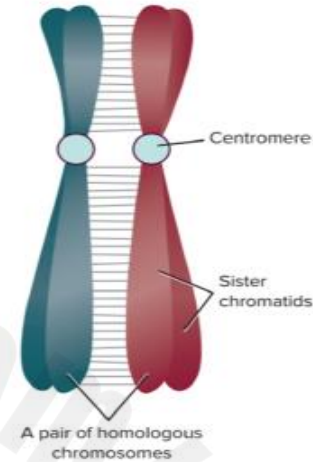
- | | | | |
|----|-----------------------|--------------------------|----------------------------------|
| a. | The centromere | القطعة المركزية | <input checked="" type="radio"/> |
| b. | The sister chromatids | الكروماتيدات الشقيقة | <input type="radio"/> |
| c. | Non-sister chromatids | الكروماتيدات غير الشقيقة | <input type="radio"/> |
| d. | The nucleolus | النوية | <input type="radio"/> |

Question 19

Figure 17

Page
86

In the figure below, the homologous chromosomes are physically bound together during synapsis in the stage of



a.

Prophase I



b.

Metaphase I



c.

Anaphase I



d.

Telophase I



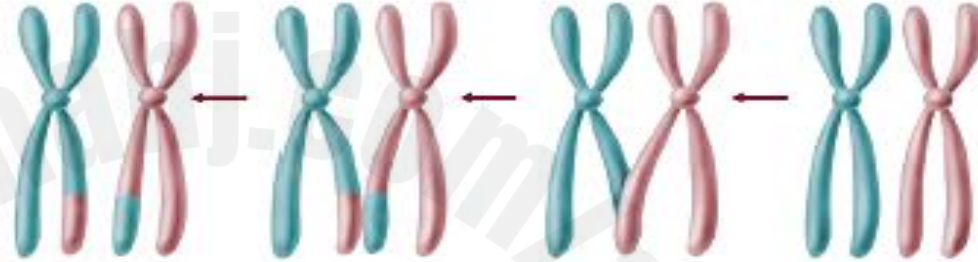
Question 19

Figure 17

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86

based on the figure below, answer the following question:
Which chromatids segments exchange genetic material?

استناداً إلى الشكل أدناه أجب عن السؤال التالي:
أي أجزاء الكروماتيدات يحدث فيها تبادل للمادة الوراثية؟



Learning Outcomes Covered

• BIO.3.3.02.010

- a. The bottom right segment of the chromosome on the left and the bottom left segment of the chromosome on the right
القطعة السفلية اليمنى من الكروموسوم الأزرق والقطعة السفلية اليسرى من الكروموسوم الأحمر
- b. The bottom left segment of the chromosome on the left and the bottom right segment of the chromosome on the right
القطعة السفلية اليسرى من الكروموسوم الأزرق والقطعة السفلية اليمنى من الكروموسوم الأحمر
- c. The top left segment of the chromosome on the left and the bottom right segment of the chromosome on the right
القطعة العلوية اليسرى من الكروموسوم الأزرق والقطعة السفلية اليمنى من الكروموسوم الأحمر
- d. The bottom left segment of the chromosome on the right and the top right segment of the chromosome on the left
القطعة السفلية اليسرى من الكروموسوم الأزرق والقطعة العلوية اليمنى من الكروموسوم الأحمر

Question 20

Figure 17

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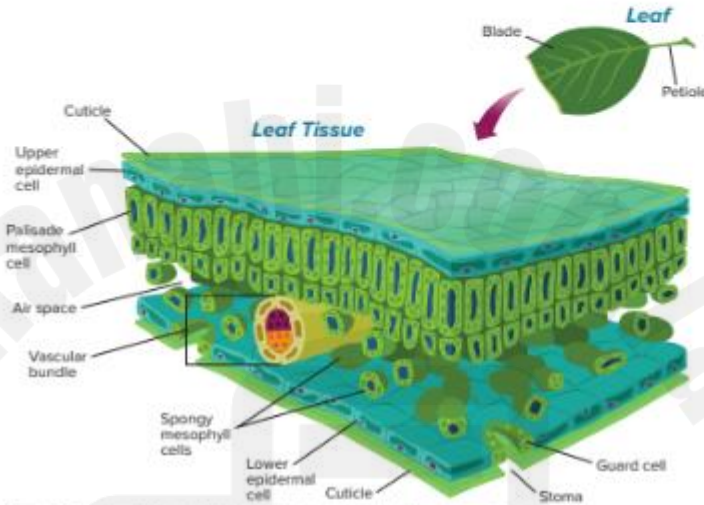


Figure 17 The different tissues of leaves illustrate the relationship between structure and function.

Leaves

There are many shapes and colors of leaves, and their arrangements on plants are different for different species. Also, the sizes of leaves can range from as large as 2 m in diameter to less than 1 mm in length. In a growing season, the number of leaves that a plant can produce varies from a few, such as for a daffodil, to hundreds of thousands produced by a mature hardwood tree.

Leaf structure

Leaves are plant organs. Leaf structure, shown in Figure 17, is well-adapted for its main function—photosynthesis. Most leaves have a flattened portion called the blade that has a relatively large surface area. Depending on the plant species, the blade might be attached to the stem by a stalk called a **petiole** (PET ee ohl). The petiole's vascular tissue connects the stem's vascular tissues to the leaf's vascular tissue or veins.

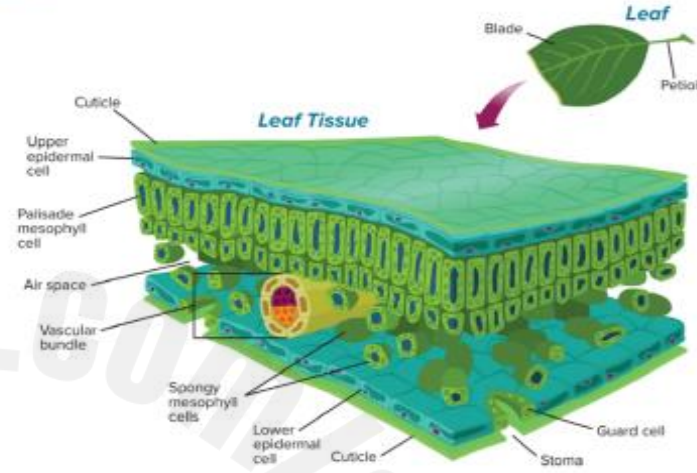
The internal structure of most leaves is well-adapted for photosynthesis. Figure 17 shows tightly packed cells directly below a leaf's upper epidermis. This location has the maximum exposure to light, and therefore, most photosynthesis takes place in these column-shaped cells. They contain many chloroplasts and make up the tissue called the **palisade mesophyll** (mehz uh fihl), or palisade layer. Below the palisade mesophyll is the **spongy mesophyll**, consisting of irregularly-shaped, loosely packed cells with spaces surrounding them. Oxygen, carbon dioxide, and water vapor move through the spaces in the spongy mesophyll. In most plants, water travels from the roots up through the stems and into the leaves, replacing the water used in photosynthesis and lost from the plant by evaporation. Water evaporates from the inside of a leaf to the outside through stomata in a process called **transpiration** that helps pull the water column upward.

Question 20

Figure 17

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The figure below represents the leaf structure, where does most photosynthesis take place?



a.

Cuticle



b.

Palisade mesophyll cells



c.

Stoma



d.

Spongy mesophyll cells



Question 20

Figure 17

Page
118

Which of the following is the function of leaves in a plant?

a.

Anchor plants

b.

Act as support

c.

Perform photosynthesis

d.

Store food

Question 20

Figure 17

Page
118

The important gases, carbon dioxide and oxygen, **enter and leave the leaf** through the

answer choices

- ☐ upper epidermis
- ☐ stomata
- ☐ phloem
- ☐ guard cells

Which layer of the leaf contains most of the chloroplasts for photosynthesis?

answer choices

- ☐ Vascular bundle layer
- ☐ Spongy mesophyll layer
- ☐ Palisade mesophyll layer
- ☐ Epidermis layer

What is the function of the cuticle in the leaf structure?

answer choices

- ☐ Regulates photosynthesis
- ☐ Increases water absorption
- ☐ Reduces water loss through evaporation
- ☐ Enhances root growth

Question 20

Figure 17

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118

thin stalk that connects the blade of the leaf to the plant's stem

answer choices

☐ blade

☐ petiole

☐ cuticle

☐ epidermis

Specialized cells that **trap light** on top of the leaf are called _____ cells

answer choices

☐ stem

☐ stomata

☐ root

☐ palisade mesophyll

Which structures open and close stomata to allow gas exchange but prevent water loss in leaves?

answer choices

☐ Epidermis

☐ Guard cells

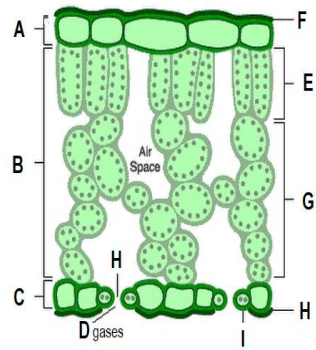
☐ Vascular tissue

☐ Spongy mesophyll

Question 20

Figure 17

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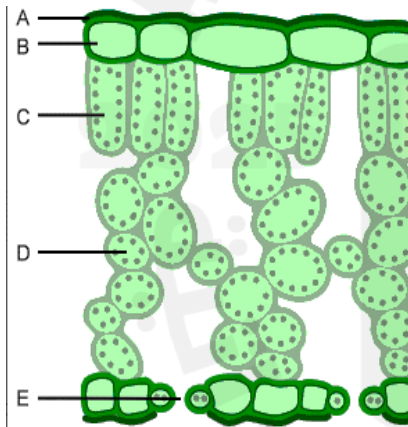
What is the name of the elongated, tightly packed cells (part E) directly under the upper epidermis?

● Palisade mesophyll

● Spongy mesophyll

● Guard cell

● Lower epidermis



Which of the following is pointing to the "guard cell"?

● B

● D

● C

● E

Question

21




Table 8

Page
120



What do you notice about the plants in **Table 8**? These are examples of tropisms. A **tropism** (TROH puh zum) is a plant's growth response to an external stimulus. If resulting plant growth is toward the stimulus, it is called a positive tropism. If the resulting plant growth is away from the stimulus, it is called a negative tropism.

Table 8 Plant Tropisms

Phototropism	Gravitropism	Thigmotropism
		
Stimulus: Light Response: <ul style="list-style-type: none">• Growth toward light source	Stimulus: Gravity Response: <ul style="list-style-type: none">• Positive downward growth• Negative upward growth	Stimulus: Mechanical Response: <ul style="list-style-type: none">• Growth toward point of contact

Check Your Progress

Summary

- The structure of plant cells and tissues are related to their function.
- There are several different types of plant tissues—meristematic, dermal, vascular, and ground tissues.
- The three main organs of a plant are roots, stems, and leaves.
- Nastic plant responses are not dependent on the direction of the stimulus; tropisms are responses to stimuli from a specific direction.

Demonstrate Understanding

1. **Compare and contrast** the types of plant cells.
2. **Explain** how a plant tissue's structure is related to its function.
3. **Summarize** the primary functions of each plant organ.
4. **Describe** three plant tropisms.

Explain Your Thinking

5. **Create** a table that summarizes the structures and functions of the different plant tissues.
6. **Evaluate** why the role of stomata in a plant is important.

Question

21

Table 8

Page
120

What **type of tropism** is shown in the image below?

ما نوع الانتحاء المبين في الصورة أدناه؟



Learning Outcomes Covered

◦ BIO.3.1.01.081

- a. Positive gravitropism انتحاء أرضي موجب ☐
- b. Negative phototropism انتحاء ضوئي سالب ☐
- c. Positive phototropism انتحاء ضوئي موجب ☒
- d. Thigmotropism انتحاء لمسي ☐

Question 21

Table 8

Page
120

What type of tropism is shown in the picture below?



a.

Phototropism



b.

Thigmotropism



c.

Positive gravitropism



d.

Negative gravitropism



Question

21

Table 8

Page
120

What type of **tropism** is shown in the image below?

ما نوع الانتحاء المبين في الصورة أدناه؟



Learning Outcomes Covered

◦ BIO.3.1.01.081

a. Positive Phototropism

انتحاء ضوئي موجب

b. Negative Phototropism

انتحاء ضوئي سالب

c. Positive gravitropism

انتحاء أرضي موجب

d. Negative gravitropism

انتحاء أرضي سالب

Question

22

Table 6

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117

Stem structure and function

The main function of a plant's stem is support of a plant's leaves and reproductive structures. Vascular tissues in stems transport water and dissolved substances throughout the plant and provide support. These tissues are arranged in bundles, or groups, that are surrounded by parenchyma cells.

EARTH SCIENCE Connection Cells produced by the apical meristem result in an increase in the length of the stem. As the plant grows taller, the stem diameter increases. The increase in stem diameter in woody plants is due to the production of cells by the vascular cambium. The production of xylem and phloem throughout the year can produce annual growth rings. The age of a tree can be estimated by counting the annual growth rings at the base of its trunk, like those shown in Figure 16.



Figure 16 An annual growth ring forms in the stem of a woody plant when growth resumes after a period of little or no growth.

Infer how the amount of available moisture might affect the width of an annual growth ring.

Types of stems

Stems are plant organs and all stems have adaptations that help plants survive, as shown in Table 6. In some plants, these adaptations enable stems to store excess food, and in other plants, they help withstand drought, cold, or heat.

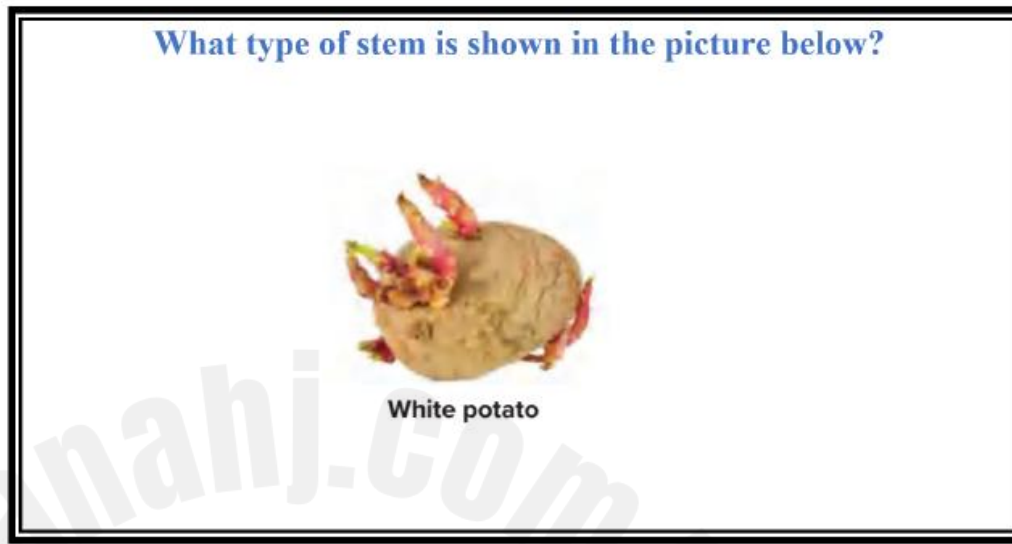
Table 6 Types of Stems

Type	Tuber	Rhizome	Runner
Example	 White potato	 Ginger	 Spider plant
Function	<ul style="list-style-type: none">• Food storage	<ul style="list-style-type: none">• Food storage• Asexual reproduction	<ul style="list-style-type: none">• Asexual reproduction
Type	Bulb		Corm
Example	 Narcissus		 Crocus
Function	<ul style="list-style-type: none">• Food storage		<ul style="list-style-type: none">• Food storage

Question 22

Table 6

Page
117



a.

Tuber



b.

Rhizome



c.

Runner



d.

Corm



Question

22

Table 6

Page
117

What is the type of stem shown in the picture below?



a.

Tuber

b.

Rhizome

c.

Runner

d.

Corm

Question

22

Table 6

Page
117

The figure below shows types of stems. Study it and answer the following question:

Which letter of the following refers to **Runner stem**?

يوضح الشكل أنواع الساق، تدرسه جيداً

ثم أجب عن السؤال التالي:

أي حرف مما يلي يشير إلى **الساق الجارية**؟



(A)



(B)



(C)



(D)

Learning Outcomes Covered

o BIO.3.1.01.078

a.

A



b.

B



c.

C



d.

D



Question 23

Page
114

Vascular tissues

In a plant, the physiological processes of transporting water, food, and dissolved substances is the main function of two types of vascular tissue—xylem and phloem.

Xylem Water that contains dissolved minerals enters a plant through its roots. The water with dissolved minerals is transported throughout a plant within a system of xylem that flows continuously from the roots to the leaves. **Xylem** (ZI lum) is the water-carrying vascular tissue composed of specialized cells called vessel elements and tracheids (tray KEY ihdz). At maturity, each vessel element and tracheid consists of just its cell wall. This lack of cytoplasm at maturity allows water to flow freely through these cells.

Vessel elements are tubular cells that are stacked end-to-end, forming strands of xylem called vessels. Vessel elements are open at each end with barlike strips across the openings. In some plants, mature vessel elements lose their end walls. This enables the free movement of water and dissolved substances from one vessel element to another.

Tracheids are long, cylindrical cells with pitted ends, shown in Figure 13. The cells are found end-to-end and form a tubelike strand. Unlike some mature vessel elements, mature tracheids have end walls. For this reason, tracheids are less efficient than vessel elements at transporting materials.

In gymnosperms, or nonflowering seed plants, xylem is composed almost entirely of tracheids. However, in flowering seed plants, xylem consists of tracheids and vessels. Because vessels are more efficient at transporting water and materials, scientists propose that this might explain why flowering plants inhabit many different environments.

Phloem The main food-carrying tissue is **phloem** (FLOH em). It transports dissolved sugars and other organic compounds throughout a plant. Recall that xylem only transports materials away from the roots. Phloem, however, transports substances from the leaves and stems to the roots and from the roots to the leaves and stems. Although not used for transport, there are sclereids and fibers associated with the phloem. These sturdy sclerenchyma cells provide support for the plant.



Figure 13 Tracheids and vessel elements are the conducting cells of the xylem.

Question 23

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114

Which of the following plant structures is the vascular tissue that transports water and dissolved minerals from roots to leaves?

a.

Parenchyma



b.

Phloem



c.

Xylem



d.

Epidermis



Question 23



Identify the main food-carrying tissue of plants.

answer choices

☐ xylem

☐ tracheids

☒ phloem

☐ vessel elements

What type of vascular tissue is responsible for transporting the sugars made in photosynthesis from the leaves to the roots?

answer choices

☐ Cuticle

☐ Stomata

☒ Phloem

☐ Xylem

Which type of tissue carries water in plants.

answer choices

☒ xylem

☐ tracheids

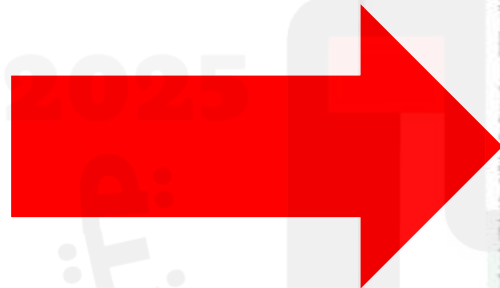
☐ phloem

☐ vessel elements

Question 24

Table 4

Page
111



LESSON 2

PLANT STRUCTURE AND FUNCTION



FOCUS QUESTION

What are the structures and functions of plant cells and tissues?

Plant Cells

You can identify a typical plant cell by the presence of a cell wall, a large central vacuole, and chloroplasts. However, there are many different types of plant cells—each with one or more adaptations that enable it to carry out a specific function. Three types of plant cells form most plant tissues. Table 4 shows each of these cells and their functions.

Table 4 Plant Cells and Functions

Cell Type	Examples	Functions
Parenchyma	 LM Magnification: 20X	<ul style="list-style-type: none">• Storage• Photosynthesis• Gas exchange• Protection• Tissue repair and replacement
Collenchyma	 LM Magnification: 20X	<ul style="list-style-type: none">• Support• Transport of materials
Sclerenchyma	 LM Magnification: unaided eye	<ul style="list-style-type: none">• Support for surrounding tissues• Provides flexibility for plant• Tissue repair and replacement

3D THINKING

Disciplinary Core Ideas

Crosscutting Concepts

Science & Engineering Practices

COLLECT EVIDENCE

Use your Science Journal to record the evidence you collect as you complete the readings and activities in this lesson.

INVESTIGATE

GO ONLINE to find these activities and more resources.

Applying Practices: Hierarchical Organization in Plants
HS-LS1-2. Develop and use a model to illustrate the hierarchical organization of interacting systems that provide specific functions within multicellular organisms.

Question

24

Table 4

Page
111

Which from this function it is **not** related to parenchyma cells?

a.

Storage

b.

Photosynthesis

c.

Support

d.

Protection

Question 24

Table 4

Page
111

What do you expect would happen to a sunflower plant if it lost all its collenchyma cells?

a.

it will turn brown



b.

it will lose its petals



c.

it will fall over easily



d.

it will stop growing



Question

24

Table 4

Page
111

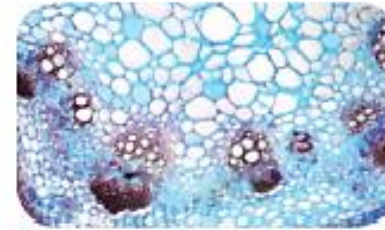
The figure below shows the Sclerenchyma cells in a plant.
Which of the following is a function of it?

يوضح الشكل أدناه الخلايا السكلرنشيمية في
النبات. أي مما يلي من وظائفها؟



sclereid

الخلايا الحجرية



fibers

الألياف

Learning Outcomes Covered

o BIO.3.1.01.078

a.

Support and Transport of materials

الدعم ونقل المواد



b.

Storage

التخزين

c.

Photosynthesis

البناء الضوئي

d.

Gas exchange

تبادل الغازات

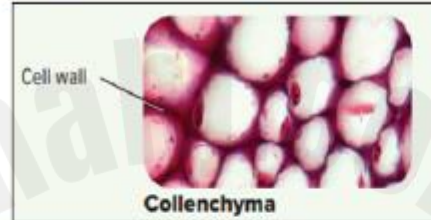
Question

24

Table 4

Page
111

The figure below shows the collenchyma cells in a plant. Which of the following is **not** a function of it?



يوضح الشكل أدناه الخلايا الكولنشيمية في النبات. أي مما يلي **ليس** من وظائفها؟



Learning Outcomes Covered

o BIO.3.1.01.078

a.	Gas exchange	تبادل الغازات
b.	Support for surrounding tissues	دعم الأنسجة المحيطة
c.	Provides flexibility for plant	توفير المرونة للنبات
d.	Tissue repair and replacement	إصلاح الأنسجة واستبدالها

Question

25

Figure 11

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113

Dermal tissue—the epidermis

The layer of cells that makes up the outer covering on a plant is dermal tissue, also called the **epidermis**. Cells of the epidermis resemble pieces of a jigsaw puzzle with interlocking ridges and dips, as shown in **Figure 11**. Most epidermal cells can secrete a fatty substance that forms the cuticle. The cuticle helps reduce water loss from plants and it prevents bacteria and other disease-causing organisms from entering a plant.

Stomata Plants can have several adaptations of their epidermis, such as stomata—small openings through which gases pass. The two cells that form a stoma are **guard cells**. Changes in the shapes of guard cells open and close the stomata, as shown in **Figure 11**.

Trichomes Some epidermal cells on leaves and stems produce hairlike projections called trichomes (TRĭ kōhmz), shown in **Figure 12**. Trichomes can give leaves a fuzzy appearance and can help protect the plant from insect and animal predators.

Root hairs Some roots have root hairs. Root hairs, as shown in **Figure 12**, increase a root's surface area and enable the root to take in a greater volume of materials.

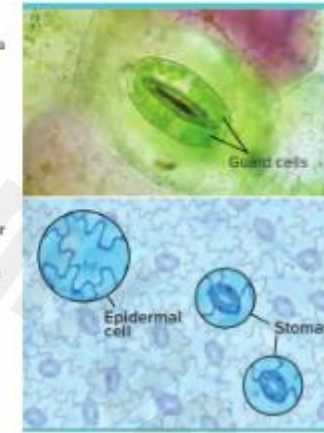


Figure 11 The surface of a leaf is composed of tightly-packed epidermal cells that help protect the plant and prevent water loss. Stomata open and close to allow gases in and out.

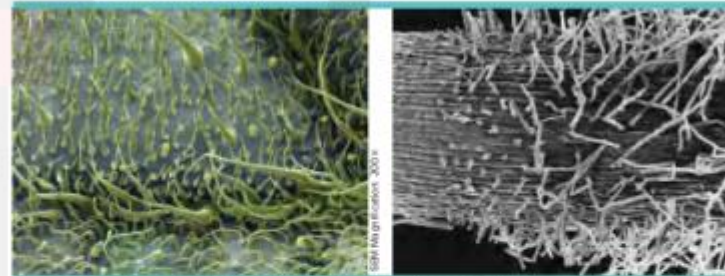


Figure 12 Epidermal adaptations help plants survive. **Left:** The tiny glands at the tip of a trichome can contain toxic substances. **Right:** Root hairs are fragile extensions of root epidermal cells that increase the root's surface area.

Explain how both of these adaptations are considered to be survival mechanisms.

WORD ORIGINS

trichome

from the Greek word *trichōma*, meaning growth of hair

CCC CROSSCUTTING CONCEPTS

Systems and System Models

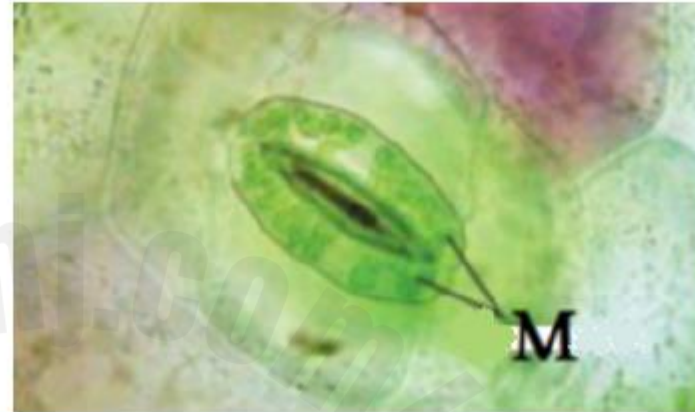
Using evidence from the text, construct a concept map that shows how the tissues that make up each plant organ (root, stem, and leaf) work together.

Question 25

Figure 11

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Which of the answer represent the M letter in the picture below?



a.

Guard cells

b.

Phloem

c.

Xylem

d.

Pericycle



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Remember... Study your textbook First!

With my best wishes

Biology Teacher\ May Hossam



School Principal
Salama Khalfan Al Mazrouei