Bio 30 - Mitosis + Meiosis KEY

41

B 1. If the normal chromosome number of corn is twenty, what would be the chromosome number of each cell after mitosis?

A. 10
B. 20
C. 30
D. 40

B 2. In mitosis, cleavage of mother cells into daughter cells occurs

A. immediately after prophase
B. during telophase
C. at metaphase
D. during anaphase

C 3. Which of the following statements is part of the cell theory?

A. All organisms consist of many cells.
B. Cells may be produced by spontaneous generation.
C. All cells come from pre-existing cells.
D. A cell is the species for all living organisms.

D 4. In any one animal the chromosome number is exactly the same in

A. the body cell and the unfertilized egg
B. the zygote and the sperm
C. the unfertilized egg and the zygote
D. the body cell and the zygote

D 5. Which of the following is the correct sequence of mitosis?

A. telophase, anaphase, metaphase, prophase
B. anaphase, telophase, prophase, metaphase
C. prophase, anaphase, metaphase, telophase
D. prophase, metaphase, anaphase, telophase

A 6. Of the following, which is a function of the mitotic process?

A. repair of injured sperm-producing tissue
B. development of male or female gametes
C. reduction of the parental chromosomal number
D. preparation for recombination of genetic material

B 7. Certain cells have twice as much DNA as other normal cells of the same organism. This is true of

A. cells that show a decrease in activity of the ribosomes
B. cells that are in an early stage of mitosis
C. a newly formed sperm cell
D. an egg cell immediately before fertilization

7

Use the following diagram to answer question 8.

B 8. The diagram illustrates a cell in

A. interphase
B. anaphase
C. telophase
D. metaphase

B 9. One characteristic of cancerous cells that makes them different from normal cells is that they

A. have a long cell cycle
B. go through rapid cell division
C. have a short life span
D. are very sticky

A 10. Cell division in plant cells is different from that of animal cells in that plant cells

A. separate the cytoplasm with a cell plate
B. do not divide the nuclear material
C. rarely perform mitosis
D. have centrioles to which chromosomes are pulled during mitosis

11. Determine the stage in cell division where the following events occur.

a. Cytokinesis is occuring. telophase

b. Cell growth and normal biochemical activity is occuring. interphase

c. Substantial shortening of spindle fibres occurs. anaphase

d. Chromatids position across the cell prior to separation. metaphase

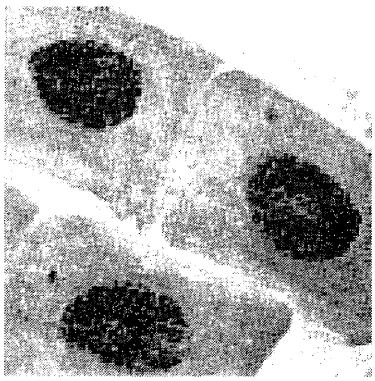
e. Chromosome replication occurs producing identical chromatids. interphase

8

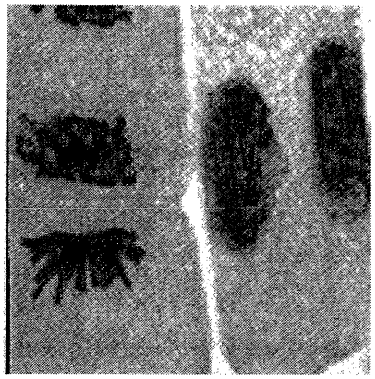
13. Determine the correct order of these photographs of the cell cycle.[1] Write the letters in correct order and identify each phase.

a.

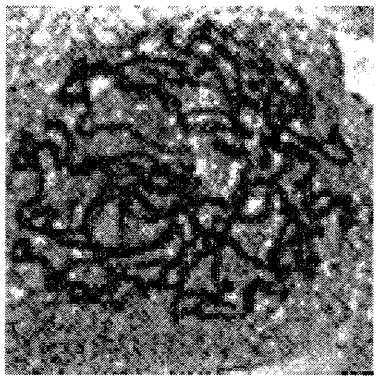
b.



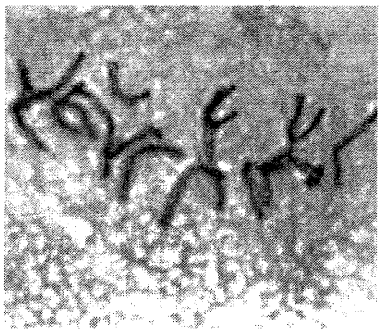
c.



d.



e.



d-proph, e-meta, a-ana, c-telo, b-inter.

(or) bdeac

12. Explain why fraternal twins are no more similar than two siblings born at different times.

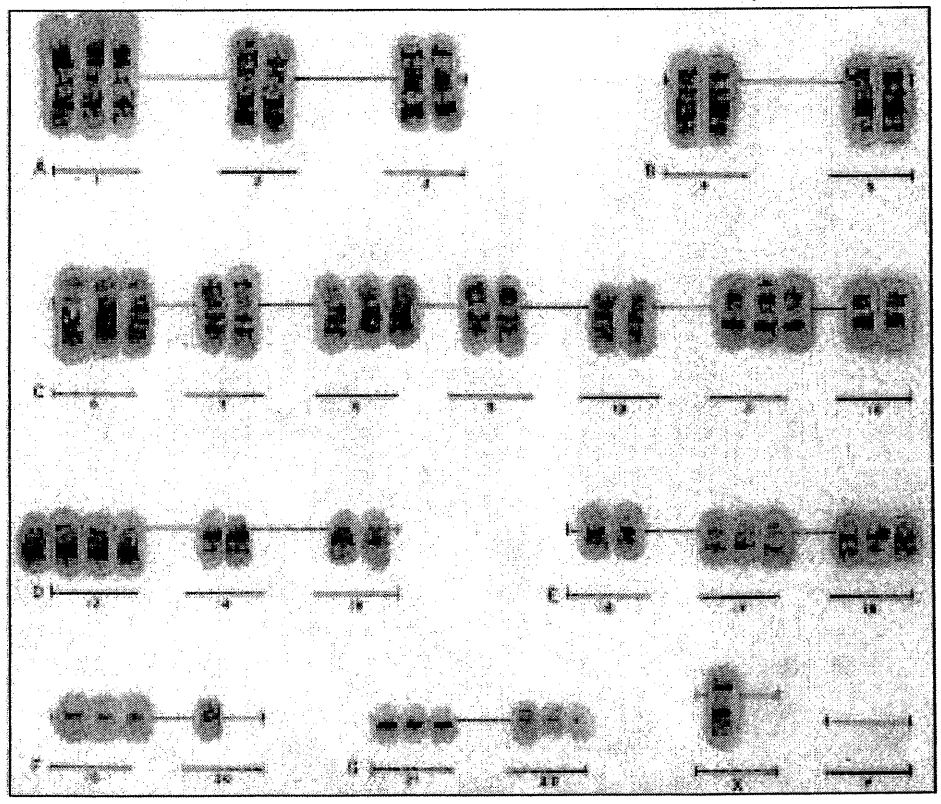
Fraternal twins originate from two different egg cells produced at the same time. These eggs are fertilized by diff. sperm; thus, the twins are as different genetically as any two siblings born at different times.

14. In a paragraph present four ways that cancer cells differ from normal cells.

Cancer cells have the following differences from normal cells.
- cancer cells are capable of dividing in isolation, whereas normal cells need cell-to-cell contact and communication
- cancer cells do not adhere to each other very well, whereas normal cells do. This leads to metastasis of cancer cells.
- cancer cells do not differentiate; thus, they do not change shape. Normal cells do.
- Cancer cells show rapid uncontrolled mitosis; normal cells have a controlled slower rate of division.
- cancer cells may have abnormal chromosome counts; normal cells generally do not. This may include missing chromosomes, extra chromosomes, or translocation of parts of chromosomes.

4

15. Carefully examine this karyotype of chronic myelogenous leukemia.



a. Find the total number of chromosomes.

54 autosomes

55 chromosomes 1 sexchromosome

b. Identify all occurrences of trisomy.

chromosomes → 1, 6, 8, 11, 17, 18, 19, 21, 22

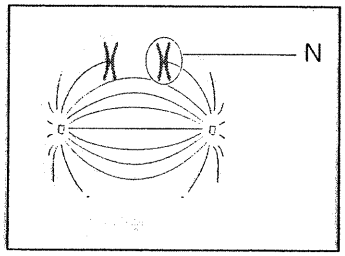
c. Tetraploidy occurs as four chromosomes of one kind. Which chromosome illustrates tetraploidy?

Chromosome 13

d. Which chromosomes are missing from the karyotype?

chromosome 20 and the y of sexchromosome. chromosome are missing

Use the following diagram to answer questions 1 to 4.



C 1. The previous diagram illustrates

A. metaphase during meiotic cell division
B. metaphase during mitotic cell division
C. anaphase during meiotic cell division
D. anaphase during mitotic cell division

D 2. This type of cell division would occur in

A. onion root tissue
B. human body cell
C. any living tissue
D. plant reproductive tissue

A 3. Structure N represents

A. chromosome
B. centriole
C. centromere
D. chromatid

B 4. If there were twenty-three homologous pairs of chromosomes in the body cell of an organism, how many chromosomes will there be in the final cells produced by meiosis?

A. 12
B. 23
C. 46
D. 96

18

D 5. In organisms such as humans with X and Y sex chromosomes, the gender of offspring will be determined by

A. both male and female parents
B. only the female parent
C. chance rather than either parent
D. only the male parent

Questions 6 to 8 are based on the following key to cell division processes. Use the key to classify each of the following statements.

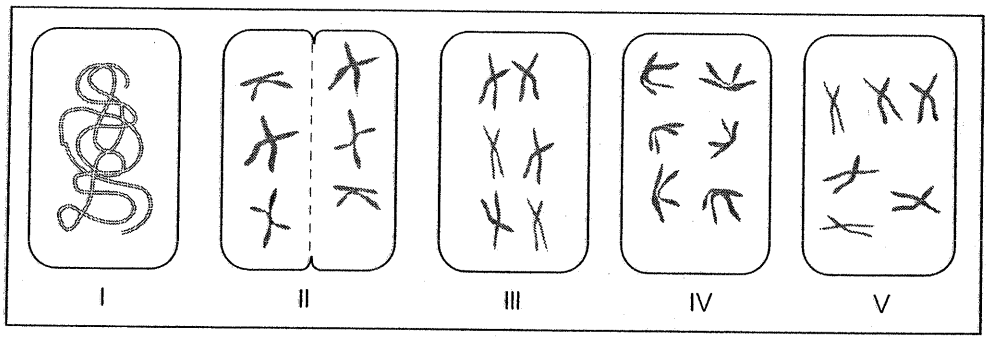
Key: A. mitosis
B. meiosis
C. both mitosis and meiosis
D. neither mitosis nor meiosis

B 6. This type of division prevents an increase in number of chromosomes from generation to generation.

A 7. Diploid cells are formed.

C 8. Each chromosome duplicates itself.

Use the following information to answer question 9.



C 9. The order in which these cell patterns would appear during cell division is

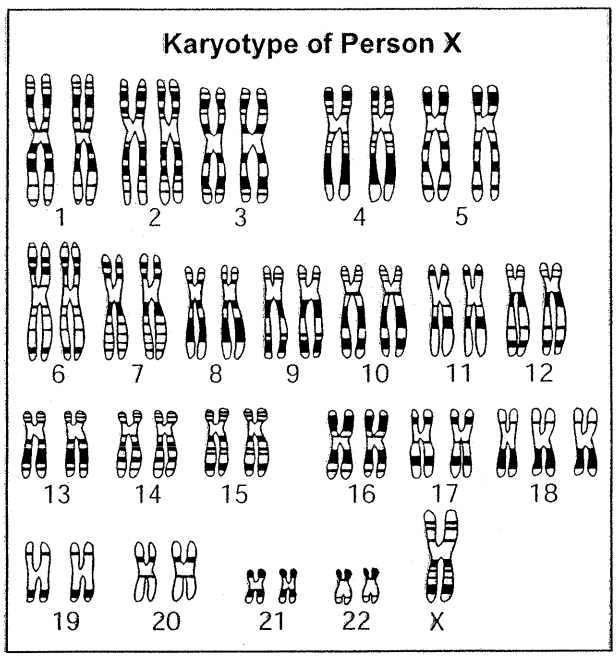
A. I, III, IV, V, II
B. V, III, I, II, IV
C. I, V, III, IV, II
D. III, I, V, II, IV

C 10. Which cell in question 9 could first indicate that nondisjunction had occurred?

A. II
B. III
C. IV
D. V

6

Use the following information to answer question 11.



11. Compose a description of this individual including sex, chromosome numbers, all abnormalities, and an explanation of how this karyotype was formed.

Individual has 46 chromosomes which is a normal # but the makeup of chromosomes is abnormal. There is a trisomy 18, which cause Edward syndrome, and only a single X chromosome, which would cause Turner Syndrome. the individual would be female having one X chromosome and no Y chromosome. Both Edward and Turner syndrome result from nondisjunction. Either the sperm or egg carried too number 18 chromosomes and lacked a sex chromosome prior to fertilization

5

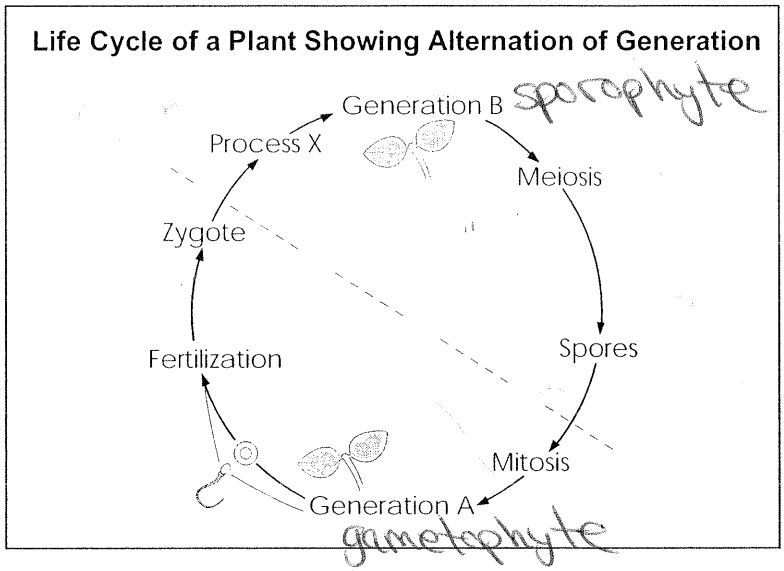
→ what happens when you just have a y chrom

Y

KEY

15

Use the following diagram to answer question 12.



(1) 12. a. Which plant undergoes sexual reproduction?

Plant A

(2) b. The body cells of which generation of plant are diploid in chromosome number? haploid in chromosome number?

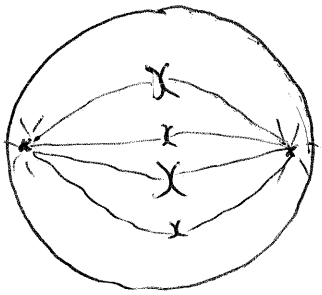
Body cells of Plant B are diploid in chromosome number. The body cells of plant A (gametophyte) are haploid in number.

(2) c. Explain the sporophyte phase of the life cycle.

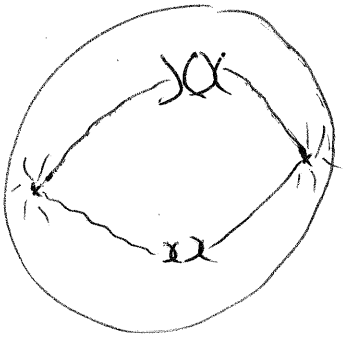
The sporophythe stage begins with plant B which is diploid and has been formed by union of egg and sperm. This plant produces haploid spores by meiosis.

(2) 13. a. Using a diagram of a cell with a chromosome number of four, show how metaphase of mitosis differs from metaphase I of meiosis. Chapters 18 and 19 in your text have examples of cell diagrams.

Mitotic metaphase



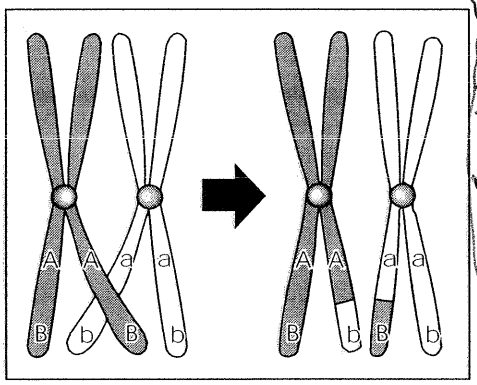
metaphase I of meiosis



(1) b. Explain the significance of this difference.

In mitotic metaphase each chromosome composed of two chromatids acts independently, lining upon the equatorial plate. This alignment produces two cells genetically identical to the origin mother cell. In metapha I the homologous chromoso come together and line up as tetrads. This arrangement leads to reduction of the chromosomes from th diploid # to the haplo number.

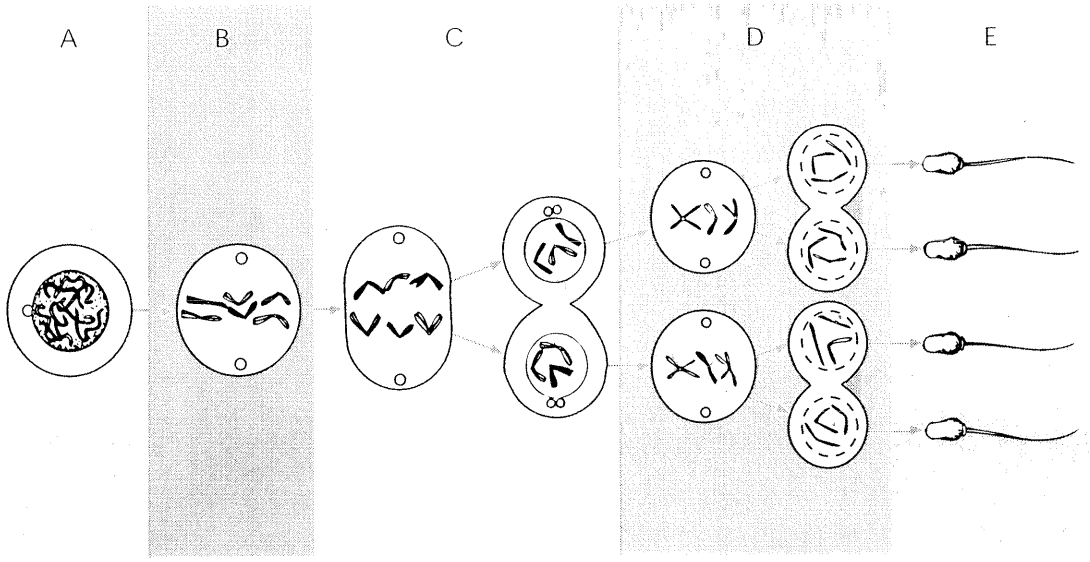
Use the following diagram to answer question 14.



(1) 14. What purpose does the process seen in the previous diagram serve?

This process serves to produce new combinations of genes, thus producing new combinations of traits which add to individual variation among members of a species.

Use the following diagram to answer question 15.



(2) 15. a. Indicate the section of the meiotic process where oogenesis first shows a difference from spermatogenesis. Explain the significance of this difference.

Section C. This causes only one cell to become a functional egg. The other is lost as a polar body. This occurs again in section D.

(1) b. If the genetic composition of the gametes is fifteen chromosomes, what is the number in the cell in Section A?

30 chromosomes

(1) c. Which section shows separation of homologous chromosomes?

section C

(1) d. Which section shows separation of chromatids?

section D

Mitosis/Meiosis - Work Sheet 5

KEY

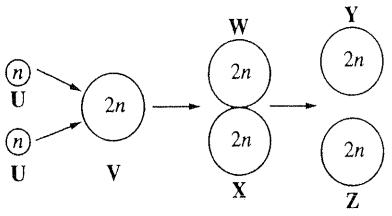
Label the following as either a description of an event in meiosis, mitosis or in both meiosis and mitosis.

Use the following key:
me = meiosis
mi = mitosis
bo = both

1. me — bivalents (- homologous pairs) play an important role
2. bo — chromosomes condense during the division
3. me — crossing-over occurs during the division
4. bo — cytokinesis and decondensation occur at the end of the process
5. mi — daughter cells are the same as parent cells
6. bo — DNA must replicate before the process begins
7. me — end-products are not capable of further division
8. bo — found only in 2n eukaryotic cells
9. me — granddaughter cells are formed as the end products
10. me — has a long prophase
11. me — has two stages of division
12. me — homologous chromosomes align independently to form the equatorial plate
13. mi — interphase only occurs before the division
14. bo — nuclear envelopes disintegrate in preparation for cellular division
15. me — occurs only in reproductive organs
16. bo — spindle fibres are produced to guide division of genetic material
17. me — tetrads are formed
18. me — prepares the cells for syngamy (- fusion of two gametes, enabling genetic information to join.)
19. me — interphase occurs in the middle of the process
20. mi — telophase is the final process

Use the following information to answer the next three questions.

Chromosome Content of Human Cells During a Series of Events



15. In humans, what process must occur before cell **V** forms cells **W** and **X**?

A. Mitosis

B. Meiosis

C. Recombination

D. Nondisjunction

Source: January 2000

16. In humans, what process must have occurred to obtain the cells at **U**?

A. Mitosis

B. Meiosis

C. Fertilization

D. Differentiation

Source: January 2000

17. In humans, cells **Y** and **Z** represent individual cells that

A. are two eggs

B. will no longer divide

C. will become a 4*n* cell

D. could develop into identical twins

Source: January 2000

Use the following information to answer the next question.

Phases of Mitosis

1 Anaphase
2 Metaphase
3 Prophase
4 Telophase

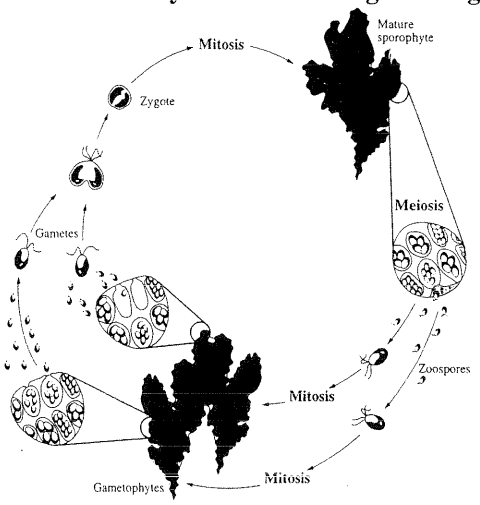
Numerical Response

2. The phases of mitosis in the sequence in which they occur are 3, 2, 1, and 4
(Record your **four-digit** answer .)

Source: January 2000

Use the following information to answer the next question.

The Life Cycle of *Ulva* – a green alga



-from *Campbell*, 1993

18. Which structures in the life cycle of the *Ulva* are haploid (monoploid)?

A. Zoospores and the zygote

B. The sporophyte and the zygote

C. Zoospores and the gametophytes

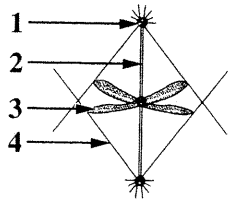
D. The sporophyte and the gametophytes

Source: January 2000

Use the following information to answer the next three questions.

Investigators were interested in determining the role chromosomes play in the formation of the mitotic spindle. Using extracts of eggs from the African frog *Xenopus laevis*, they monitored spindle assembly in a test tube. The researchers replaced the chromosomes with beads coated with random sequences of DNA. The beads served as substitute genetic material, but centrosomes (centrioles) were absent. As well, a part of the centromere was missing.

Simplified Diagram of Normal Mitotic Cell



– from *Travis,* 1996

19. Which of the structures numbered above was replaced by the beads in the experimental setup?

A. 1

B. 2

C. 3

D. 4

Source: June 2000

Use the following additional information to answer the next question.

The investigators observed that the genetic material on the beads condensed and microtubules began to form. Within 90 minutes, the microtubules formed a spindle-like structure that lined up the beads along the centre of the cell.

–from *Travis,* 1996

20. Based on the results of this research, structures or molecules does **not** appear to be necessary for mitosis

- it appears from the description that centrosomes (centrioles) were not part of the experiment and mitosis can progress normally

A. DNA

B. Spindle

C. Centrosomes

D. Microtubules

Source: June 2000

Use the following information to answer the next question.

Other studies showed that the phase that involves pulling chromosomes to the two poles of mitotic cells can be delayed for up to 4.5 h by pulling a chromosome out of line from the centre of the cell.

–from *Travis, 1996*

21. The phase that is delayed and the phase in which the chromosomes line up at the equator are, respectively,

A. telophase and anaphase

B. metaphase and prophase

C. interphase and telophase

D. anaphase and metaphase

Source: June 2000

Use the following information to answer the next question.

A five-month-old human female fetus produces approximately seven million developing ova (eggs) in her ovaries. Approximately 400 000 of these developing ova survive to puberty. Of these, approximately 400 will complete development and be released during a woman's lifetime.

22. This process is similar to spermatogenesis in males in that

A. eggs and sperm are both diploid

B. eggs and sperm are both haploid

C. eggs and sperm are both produced before puberty

D. an equal number of both eggs and sperm reach maturity

Source: June 2000

Use the following information to answer the next two questions.

Amniocentesis is a common prenatal procedure used to obtain cells to test for genetic abnormalities that lead to disorders such as Down syndrome, cystic fibrosis, and hemophilia. The test is usually offered between the 15th and 18th weeks of pregnancy to women who have an increased risk of having children with genetic abnormalities.

23. Down syndrome is a trisomy disorder that can be caused by the presence of three copies of chromosome 21. Which of the following chromosome combinations identifies Down syndrome?

A. 46 chromosomes consisting of 45 autosomes and 1 sex chromosome

B. 46 chromosomes consisting of 44 autosomes and 2 sex chromosomes

C. 47 chromosomes consisting of 45 autosomes and 2 sex chromosomes

D. 47 chromosomes consisting of 44 autosomes and 3 sex chromosomes

Source: June 2000

24. A genetic abnormality such as Down syndrome can be diagnosed by using the cells obtained during amniocentesis to create a

A. karyotype

B. therapeutic gene

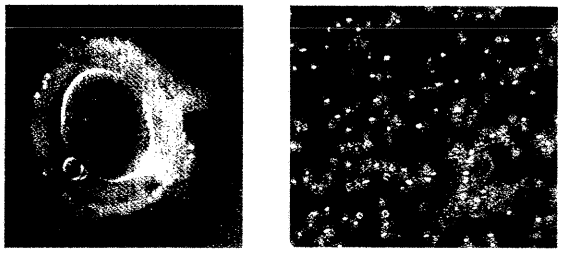
C. DNA fingerprint

D. recombinant vector

Source: June 2000

Use the following information to answer the next two questions.

Mature Human Oocyte **Human Sperm**



—from *Nilsson*, 1990

25. The difference in size between the human oocyte and sperm is **mostly** due to the

A. difference in magnification of the two photographs

B. distance that the sperm must travel in order to reach the oocyte

C. amount of cytoplasm present in the oocyte as compared with that in the sperm

D. number of chromosomes in the nucleus of the oocyte as compared with the number in the sperm

Source: January 2001

26. The nucleus of a human oocyte would normally be

A. diploid and contain 23 chromosomes

B. diploid and contain 46 chromosomes

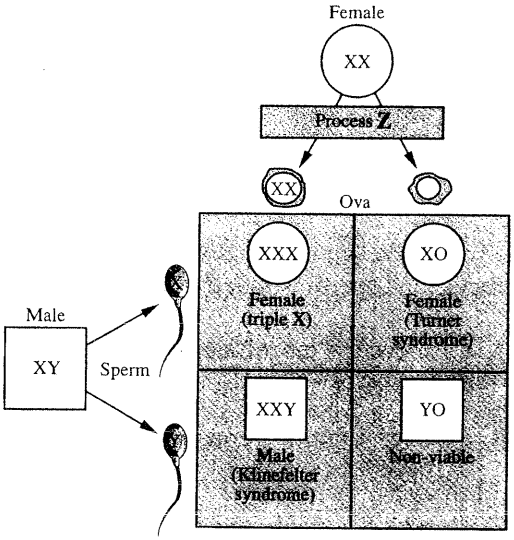
C. haploid and contain 23 chromosomes

D. haploid and contain 46 chromosomes

Source: January 2001

Use the following information to answer the next two questions.

Meiosis is a process that results in the reduction of the chromosome number from diploid to haploid. Sometimes chromosomes fail to separate, which results in an abnormal number of sex chromosomes.



– from *Levine and Miller,* 1991

27. In the diagram above, process **Z** represents

A. fertilization **B.** crossing-over

C. nondisjunction **D.** spermatogenesis

Source: January 2001

Use the following additional information to answer the next question.

Partial Human Karyotype

CHALLENGER QUESTION DIFFICULTY 53.6

28. This partial human karyotype represents the **last** six chromosome pairs, in numerical order. The karyotype presented is that of a

A. male with trisomy 21

B. female with trisomy 21

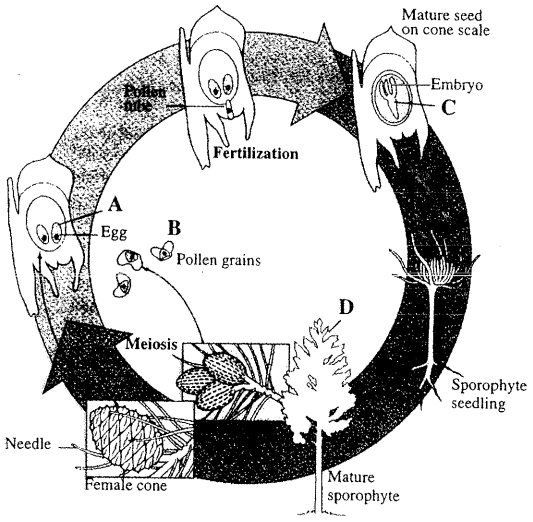
C. male with Turner syndrome

D. female with Turner syndrome

Source: January 2001

Use the following information to answer the next question.

Conifer Life Cycle



Major Stages in the Conifer Life Cycle

1 Haploid stage
2 Diploid stage

– from *Levine and Miller,* 1991

#27-30 omit for this unit ★next unit

Numerical Response

3. Identify the stages in the conifer life cycle, as numbered above, that correspond with the letters that represent these stages on the diagram.

Stages:	1	1	2	2
Diagram:	**A**	**B**	**C**	**D**

Source: January 2001

Use the following information to answer the next four questions.

The flowering plant, *Mirabilis jalapa* (*M. jalapa*) may have branches with all white leaves, all green leaves, and all variegated leaves (leaves with green and white patches) on the same plant. Leaf colour is dependent on the colour of plastids present in cytoplasm. As in the case of other plants, pollen (containing sperm nuclei) contribute chromosomes but almost no cytoplasm to the zygote. The ovule contributes both chromosomes and cytoplasm to the zygote. The following data of offspring phenotypes were collected from crosses between flowers from various branches.

	Source of ovule (female)	
Source of pollen (male)	White Branch	Green branch
White branch	White offspring	Green offspring
Green branch	White offspring	Green offspring
Variegated branch	White offspring	Green offspring

CHALLENGER QUESTION DIFFICULTY 50.8

29. These data indicate that, regardless of its branch source, pollen has no effect on the leaf colour of resulting offspring. A reasonable explanation for this observation is that

A. leaf colour is a codominant trait

B. leaf colour is a dominant-recessive trait

C. cell organelles or cytoplasm are active only in pollen

D. cell organelles or cytoplasm contain genetic information

Source: January 2000

Use the following additional information to answer the next question.

Several geneticists studied *M. jalapa* plants with deep crimson flowers and *M. jalapa* plants with yellow flowers. Cross-pollinating these plants produced plants with scarlet-red flowers (F_1 generation).

These F_1 plants were allowed to self-pollinate, and the resulting seeds produced *M. jalapa* plants with three different flower colours. Data similar to the following were collected for flower colour:

140 deep crimson
310 scarlet-red
160 yellow

–from *Engels*, 1975

30. With respect to the alleles for flower colour, these results indicate

A. X-linked inheritance

B. gene-linked inheritance

C. dominant-recessive inheritance

D. incomplete dominance inheritance

Source: January 2000