**1) The centromere is a region in which**A) chromatids remain attached to one another until anaphase.
B) metaphase chromosomes become aligned at the metaphase plate.
C) chromosomes are grouped during telophase.
D) the nucleus is located prior to mitosis.
E) new spindle microtubules form at either end.

**2) Starting with a fertilized egg (zygote), a series of five cell divisions would produce an early embryo with how many cells?**A) 4 B) 8 C) 16 D) 32 E) 64

**3) If there are 20 chromatids in a cell, how many centromeres are there?**A) 10 B) 20 C) 30 D) 40 E) 80

**4) Suppose a biologist can separate one of a dozen pieces of chromatin from a eukaryotic (animal)** nucleus. It might consist of which of the following?
A) one-twelfth of the genes of the organism B) two chromosomes, each with six chromatids
C) a single circular piece of DNA D) two long strands of DNA plus proteins

**5) At which phase are centrioles beginning to move apart in animal cells?**A) telophase B) anaphase C) prometaphase D) metaphase E) prophase

**6) If cells in the process of dividing are subjected to colchicine, a drug that interferes with the formation of the spindle apparatus, at which stage will mitosis be arrested?**A) anaphase B) prophase C) telophase D) metaphase E) interphase

**7) If there are 20 centromeres in a cell at anaphase, how many chromosomes are there in each daughter cell following cytokinesis?**
A) 10 B) 20 C) 30 D) 40 E) 80

**8) Where do the microtubules of the spindle originate during mitosis in both plant and animal cells?**A) centromere B) centrosome C) centriole D) chromatid E) kinetochore

**9) Taxol is an anticancer drug extracted from the Pacific yew tree. In animal cells, Taxol disrupts microtubule formation. Specifically, Taxol must affect**A) the formation of the mitotic spindle. B) anaphase.

C) formation of the centrioles. D) chromatid assembly.

**10) Which of the following are primarily responsible for cytokinesis in plant cells but not in animal cells?**

A) kinetochores B) Golgi-derived vesicles C) actin and myosin D) centrioles

**11) Movement of the chromosomes during anaphase would be most affected by a drug that**A) reduces cyclin concentrations. B) increases cyclin concentrations.
C) prevents elongation of microtubules. D) prevents shortening of microtubules.

**12) A group of cells is assayed for DNA content immediately following mitosis and is found to have an average of 8 picograms of DNA per nucleus. How many picograms would be found at the end of S and the end of G₂?**A) 8; 8 B) 8; 16 C) 16; 8 D) 16; 16 E) 12; 16

**13) For anaphase to begin, which of the following must occur?**A) Chromatids must lose their kinetochores. B) Cohesin must attach sister chromatids to each other.
C) Cohesin must be cleaved enzymatically. D) Kinetochores must attach to the metaphase plate.
E) Spindle microtubules must begin to depolymerize.

**14) Which of the following best describes how chromosomes move toward the poles of the spindle during mitosis?**A) The chromosomes are "reeled in" by the contraction of spindle microtubules.
B) Motor proteins of the kinetochores move the chromosomes along the spindle microtubules.
C) Nonkinetochore spindle fibers serve to push chromosomes in the direction of the poles.
**D) The chromosomes are "reeled in" by the contraction of spindle microtubules, and motor proteins of the kinetochores move the chromosomes along the spindle microtubules.**
E) The chromosomes are "reeled in" by the contraction of spindle microtubules, motor proteins of the kinetochores move the chromosomes along the spindle microtubules, and nonkinetochore spindle fibers serve to push chromosomes in the direction of the poles.

**15) During which phase of mitosis do the chromatids become chromosomes?**A) telophase B) anaphase C) prophase D) metaphase E) cytokinesis

**16) Which of the following is (are) required for motor proteins to function in the movement of chromosomes toward the poles of the mitotic spindle?**A) intact centromeres B) an MTOC (microtubule organizing center)
C) a kinetochore attached to the metaphase plate D) ATP as an energy source

**17) What is a cleavage furrow?**A) a ring of vesicles forming a cell plate B) the separation of divided prokaryotes
C) a groove in the plasma membrane between daughter nuclei

**18) Which of the following proteins are involved in binary fission as well as eukaryotic mitotic division?**A) cyclins B) Cdks C) MPF D) actin and tubulin E) cohesins

**19) Using which of the following techniques would enable your lab group to distinguish between a cell in G₂ and a cell from the same organism in G₁?**
A) microscopy B) electron microscopy C) spectrophotometry D) radioactive-labeled nucleotides

**20) Which of the following is released by platelets in the vicinity of an injury?**A) PDGF B) MPF C) protein kinase D) cyclin E) Cdk

**PDGF = Platelet-derived growth factor**

**21) Which of the following triggers the cell's passage past the G₂ checkpoint into mitosis?**A) PDGF B) MPF C) protein kinase D) cyclin E) Cdk

**MPF = Maturation-promoting factor**

**22) Proteins that are involved in the regulation of the cell cycle, and that show fluctuations in concentration during the cell cycle, are called**A) ATPases. B) kinetochores. C) kinases. D) proton pumps. E) cyclins.

**23) Density-dependent inhibition is explained by which of the following?**A) As cells become more numerous, they begin to squeeze against each other, restricting their size and ability to produce control factors.
B) As cells become more numerous, the cell surface proteins of one cell contact the adjoining cells and they stop dividing.
C) As cells become more numerous, the protein kinases they produce begin to compete with each other, such that the proteins produced by one cell essentially cancel those produced by its neighbor.
D) As cells become more numerous, more and more of them enter the S phase of the cell cycle.
E) As cells become more numerous, the level of waste products increases, eventually slowing down metabolism.