DPP - Daily Practice Problems

Chapter-wise Sheets

Date : _____ **Start Time :** _____ **End Time :** _____

BIOLOGY CB10

SYLLABUS : Cell Cycle and Cell Division

Max. Marks : 180 **Marking Scheme :** + 4 for correct & (–1) for incorrect **Time : 60 min.**

INSTRUCTIONS : This Daily Practice Problem Sheet contains 45 MCQs. For each question only one option is correct. Darken the correct circle/ bubble in the Response Grid provided on each page.

1. In cell cycle, DNA replication takes place in
(a) G_1 phase (b) G_2 phase
(c) mitotic metaphase (d) S phase

2. During cell division, the spindle fibres attach to the chromosome at a region called
(a) chromocentre (b) kinetochore
(c) centriole (d) chromomere

3. Chromosome duplication without nuclear division refers to
(a) meiosis (b) mitosis
(c) androgenesis (d) endomitosis

4. During which stages (or prophase I substages) of meiosis do you expect to find the bivalents and DNA replication respectively?
(a) Pachytene and interphase (between two meiotic divisions)
(b) Pachytene and interphase (just prior to prophase I)
(c) Pachytene and S phase (of interphase just prior to prophase I)
(d) Zygotene and S phase (of interphase prior to prophase I)

5. The two chromatids of a metaphase chromosome represent
(a) replicated chromosomes to be separated at anaphase
(b) homologous chromosomes of a diploid set
(c) non-homologous chromosomes joined at the centromere
(d) maternal and paternal chromosomes joined at the centromere

6. Recombination of genes occur at
(a) prophase in mitosis
(b) prophase I in meiosis
(c) prophase II in meiosis
(d) metaphase II in meiosis

RESPONSE GRID	1. ⓐⓑⓒⓓ 2. ⓐⓑⓒⓓ 3. ⓐⓑⓒⓓ 4. ⓐⓑⓒⓓ 5. ⓐⓑⓒⓓ 6. ⓐⓑⓒⓓ

Space for Rough Work

7. Four daughter cells formed after meiosis are
(a) genetically similar (b) genetically different
(c) anucleate (d) multinucleate

8. In animal cells, cytokinesis involves
(a) the separation of sister chromatids
(b) the contraction of the contractile ring of microfilament
(c) depolymerisation of kinetochore microtubules
(d) a protein kinase that phosphorylates other enzymes

9. The number of chromatids in a chromosome at anaphase is
(a) 2 in mitosis and 1 in meiosis
(b) 1 in mitosis and 2 in meiosis
(c) 2 each in mitosis and meiosis
(d) 2 in mitosis and 4 in meiosis

10. During cell division, sometimes there will be failure of separation of sister chromatids. This event is called
(a) interference (b) complementation
(c) non-disjunction (d) coincidence

11. In which stage of the cell cycle histone proteins synthesized in a eukaryotic cell?
(a) During G_2 stage of prophase
(b) During S-phase
(c) During entire prophase
(d) During telophase

12. What is true about telophase stage?
(a) Chromosomes lose their identity as discrete elements
(b) Chromosomes cluster at opposite spindle poles
(c) Nuclear envelope, nucleolus, Golgi complex and ER reform
(d) All of these

13. Match Column-I with Column-II and select the correct option from the codes given below.

	Column-I		**Column-II**
A.	Disintegration of nuclear membrane	I.	Anaphase
B.	Appearance of nucleolus	II.	Prophase
C.	Division of centromere	III.	Telophase
D.	Replication of DNA	IV.	S-phase

(a) A-II; B-III; C-I; D-IV
(b) A-II; B-III; C-IV; D-I
(c) A-III; B-II; C-I; D-IV
(d) A-III; B-II; C-IV; D-I

14. The centromere is situated close to its ends and forming one extremely short and one very long arm in
(a) Metacentric chromosome
(b) Sub-metacentric chromosome
(c) Acrocentric chromosome
(d) Telocentric chromosome

15. Select the events that do not occur in interphase stage of cell-cycle
A. RNA and protein synthesis.
B. Cytoplasmic growth.
C. Polymerisation of spindle fibres protein.
D. Disappearance of Golgi bodies and ER.
E. DNA molecules in highly supercoiled stage.
(a) C, D & E (b) D & E only
(c) B, C & D (d) C & D only

16. The stage between two meiotic divisions is called interkinesis and
(a) Is long lived
(b) Is followed by prophase I
(c) Is generally short lived and followed by prophase II
(d) Involves duplication of genes and centrioles

17. Which is correct w.r.t. anaphase?
(a) Centromeres split and chromatids separate
(b) Spindle fibres attach to kinetochores
(c) Chromosomes are moved to spindle equator
(d) Chromatid splits by recombinase activity

18. Maximum cytoplasmic growth occurs in
(a) G_1-phase (b) S-phase
(c) G_2-phase (d) M-phase

19. Diagrammatic representation of chromosomes of a species, is called
(a) Karyotype (b) Crytogram
(c) Cladogram (d) Idiogram

20. Which one of the following events is incorrect for cell cycle?
(a) All events are under genetic control
(b) Maximum cell growth occurs in M-phase
(c) DNA synthesis occurs only during one specific
(d) Centriole duplication occurs in S-phase

RESPONSE GRID					
	7. (a)(b)(c)(d)	**8.** (a)(b)(c)(d)	**9.** (a)(b)(c)(d)	**10.** (a)(b)(c)(d)	**11.** (a)(b)(c)(d)
	12. (a)(b)(c)(d)	**13.** (a)(b)(c)(d)	**14.** (a)(b)(c)(d)	**15.** (a)(b)(c)(d)	**16.** (a)(b)(c)(d)
	17. (a)(b)(c)(d)	**18.** (a)(b)(c)(d)	**19.** (a)(b)(c)(d)	**20.** (a)(b)(c)(d)	

Space for Rough Work

21. The sequence of events by which a cell duplicates its genome, synthesises other constituents of the cell and eventually divide into two daughter cell is termed as
(a) Karyochorists (b) I-phase
(c) Cell cycle (d) M-phase

22. Lampbrush chromosomes are seen in which typical stage?
(a) Mitotic anaphase (b) Mitotic prophase
(c) Mitotic metaphase (d) Meiotic prophase

23. In telophase of mitosis, the mitotic spindle breaks down and nuclear membranes form. This is essentially the opposite of what happens in
(a) prophase. (b) interphase.
(c) metaphase. (d) S phase.

24. Most cells divide if they receive the proper signal at a checkpoint in the _____ phase of the cell cycle.
(a) M (b) G_1 (c) S (d) G_2

25. Which of the following carry the same genetic information?
(a) sister chromatids
(b) X and Y chromosomes
(c) all autosomes
(d) homologous chromosomes

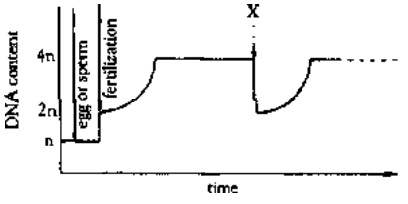
26. A zoologist examined an intestine cell from a crayfish and counted 200 chromosomes, each consisting of 2 chromatids, at prophase I of mitosis. What would he expect to see in each of the four cells at telophase II of meiosis if he looked in the crayfish ovary?
(a) 50 chromosomes, each consisting of 2 chromatids
(b) 50 chromosomes, each consisting of 1 chromatid
(c) 100 chromosomes, each consisting of 2 chromatids
(d) 100 chromosomes, each consisting of 1 chromatid

27. Which of the following is true of kineto-chores?
(a) They are localized at the centromere of each chromosome.
(b) They are the sites where microtubules attach to separate the chromosomes.
(c) They are organized so that there is one per sister chromatid in meiosis.
(d) All of the above

28. Chromosome movement during anaphase is the result of :
(a) the molecular motors at the kinetochores that move the chromosomes toward the poles.
(b) molecular motors at the centrosome that pull the microtubules toward the poles.
(c) shortening of the microtubules at the centrosome that pull the chromosomes toward the poles.
(d) a and c

29. Programmed cell death (apoptosis) :
(a) occurs in cells that have been deprived of essential nutrients.
(b) occurs only in cells that have damaged DNA
(c) is a natural process during development.
(d) is signaled by the initiated of mitosis.

30. The following graph represents the changes in the quantity of DNA present in the cell cycle at different stages.



What stage takes place at X?
(a) anaphase (b) cytokinesis
(c) interphase (d) metaphase

31. The absence of centrioles from higher plant cells means that during somatic cell nuclear division there is :
(a) no apparent organiser of mitotic spindles
(b) no equatorial arrangement of chromo-somes at metaphase.
(c) no new cell wall laid down at telophase.
(d) no spindle formed.

32. The amount of DNA in a mammalian cell in early prophase I is x.
What is the amount of DNA in the same cell in anaphase I of meiosis?
(a) $\frac{x}{4}$ (b) $\frac{x}{2}$ (c) x (d) 2x

RESPONSE GRID					
	21. ⓐⓑⓒⓓ	**22.** ⓐⓑⓒⓓ	**23.** ⓐⓑⓒⓓ	**24.** ⓐⓑⓒⓓ	**25.** ⓐⓑⓒⓓ
	26. ⓐⓑⓒⓓ	**27.** ⓐⓑⓒⓓ	**28.** ⓐⓑⓒⓓ	**29.** ⓐⓑⓒⓓ	**30.** ⓐⓑⓒⓓ
	31. ⓐⓑⓒⓓ	**32.** ⓐⓑⓒⓓ			

Space for Rough Work

33. Fully differentiated cells which do not divide are supposed to be in :
(a) G_1 - phase (b) G_2 - phase
(c) S - phase (d) G_0 - phase

34. A cell can not divide if it does not cross :
(a) Hayflick limit (b) cytokinesis
(c) restriction point (d) G_0 - phase

35. Synapsis is of _____ kind(s) :
(a) one (b) two (c) three (d) four

36. If a stock has 2n = 48 and scion microspore mother cell has 2n = 24; then root cell and the microspores will have _____ chromosomes respectively.
(a) 12, 48 (b) 48, 12 (c) 24, 12 (d) 24, 96

37. A plant has number of chromosome groups arranged at equatorial plane of metaphase-I whose 2n = 50; the number of chromosomes visible will be :
(a) 100 (b) 25 (c) 50 (d) 75

38. To produce 10 seeds how many meiosis will be needed and how many pollen grain will be wasted?
(a) 13 and 2 (b) 2 and 14
(c) 10 and 10 (d) None

39. Which one of the following list contain the correct order of meiotic events ?
(a) Separation of sister chromatids, recombination, formation of the synaptonemal complex, separation of homologous chromosomes
(b) Separation of homologous chromosomes, formation of the synaptonemal complex, recombination, separation of sister chromatids
(c) Formation of synaptonemal complex, recombination, separation of sister chromatids, separation of homologous chromosomes
(d) Formation of the synaptonemal complex, recombination, separation of homologous chromosomes, separation of sister chromatids.

40. In meiosis, actual haploidy in terms of DNA comes in
(a) Metaphase-I (b) Anaphase-II
(c) Anaphase-I (d) Interkinesis

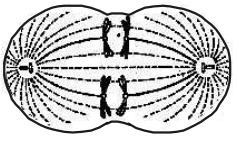
41. Which of the following can not be considered as mitogen ?
(a) Cytokinin (b) Insulin
(c) Cholchicine (d) Auxin

42. G_2 phase is not assiciated with
(a) Synthesis of some non-histone proteins
(b) Synthesis of tubulin proteins for spindle fibres
(c) DNA synthesis
(d) Duplication of centrioles

43. Replication of centriole occurs during
(a) Early anaphase (b) Mid metaphase
(c) Late metaphase (d) Interphase

44. A cell in mitotic prophase can be distinguished from a cell in meiotic prophase by
(a) Formation of tetrad in a meiotic cell
(b) The terminalization of chiasmata in late prophase of mitosis
(c) Zipping in early prophase of mitosis
(d) Presence of only half as many chromosomes in the meiotic cell

45. The diagram shows a cell whose diploid chromosome number is four. Which one of the following option shows correct stage of cell ?



(a) Metaphase
(b) Anaphase of mitosis
(c) Anaphase I of meiosis
(d) Anaphase II of meiosis

RESPONSE GRID					
	33. ⓐⓑⓒⓓ	**34.** ⓐⓑⓒⓓ	**35.** ⓐⓑⓒⓓ	**36.** ⓐⓑⓒⓓ	**37.** ⓐⓑⓒⓓ
	38. ⓐⓑⓒⓓ	**39.** ⓐⓑⓒⓓ	**40.** ⓐⓑⓒⓓ	**41.** ⓐⓑⓒⓓ	**42.** ⓐⓑⓒⓓ
	43. ⓐⓑⓒⓓ	**44.** ⓐⓑⓒⓓ	**45.** ⓐⓑⓒⓓ		

Space for Rough Work

DAILY PRACTICE PROBLEM DPP CHAPTERWISE 10 - BIOLOGY			
Total Questions	45	Total Marks	180
Attempted		Correct	
Incorrect		Net Score	
Cut-off Score	40	Qualifying Score	50
Success Gap = Net Score – Qualifying Score			
Net Score = (Correct × 4) – (Incorrect × 1)			

HINTS & SOLUTIONS

DPP /CB10

1. (d) G_1 phase, also called Gap I phase is characterized by increase in cell size. In the S phase or synthetic phase DNA molecules replicate. G_2 is the second growth phase or Gap II where in there is intensive formation of RNAs and proteins. In the mitotic metaphase, the chromosomes are arranged at the equatorial plate.

2. (b) Kinetochore is the proteinaceous covering of centriole, to which spindle fibers attach.

3. (b) Mitosis is the process in which eukaryotic cell separates the chromosomes in its cell nucleus, into two identical sets in two daughter nuclei. It is generally followed immediately by cytokinesis, which divides the nuclei, cytoplasm, organelles and cell membrane into two daughter cells containing roughly equal shares of these cellular components. Mitosis and cytokinesis together define the mitotic (M) phase of the cell cycle - the division of the mother cell into two daughter cells, genetically identical to each other and to their parent cell.

4. (d) In bivalent formation of chromosomes during meiosis, the homologous chromosomes are arranged in pairs. The phenomenon is called synapsis and it occurs during zygotene stage. DNA replication occurs during S phase or synthetic phase which is the second phase of interphase.

5. (a) **6. (b)** **7. (b)** **8. (b)** **9. (b)**

10. (c) **11. (b)**

12. (d) During telophase, the individual chromosomes are no longer seen and chromatin material tends to collect in a mass at the two poles. Chromosomes cluster at opposite spindle poles and their identity is lost as discrete elements. Nuclear envelope assembles around the chromosome clusters. Nucleolus, Golgi complex and ER reform.

13. (a) **14. (c)**

15. (a) Condensation initiates in prophase.

16. (c) Interkinesis is the stage that occurs in between meiosis-I and meosis-II

17. (a) During anaphase, centromeres split resulting in the separation of sister chromatids towards opposite poles.

18. (c) **19. (d)** **20. (a)**

21. (d) A = Diplotene B = Dissolution
C = Pachytene D = Anaphase - II

22. (d) The lampbrush chromosomes occuring in prophase of meiosis II are highly elongated special kind of synapsed mid-prophase or diplotene chromosome bivalents which have already undergone crossing over. Lampbrush chromosomes occur in pairs. Each chromosome of a pair has a double main axis due to presence of two elongated chromatids. Both the adjacent chromatids bear rows of large number of chromomeres. Two adjacent chromomeres are separated by interchromomeric stretches. Many of the chromomeres give out lateral projections or loops. The lateral loops provide a test tube or lampbrush-like appearance to the chromosome pair. Lateral loops take part in rapid transcription of DNA to mRNA meant for synthesis of yolk and other substances required for growth and development of meiocytes.

23. (a) The mitotic spindle forms and the nuclear membrane disperses during prophase.

24. (b) If at G_1 cells are given the signal to divide, they are unlikely to be stopped at subsequent checkpoints.

25. (a) Sister chromatids are the two identical strands of a duplicated chromosome.

26. (d) Meiosis reduces the chromosome count from diploid to haploid and halves the amount of genetic material.

27. (d) Kinetochores are assembled at the centromere of each chromosome and are the sites where microtubules attach to segregate the chromosomes. In meiosis there is only one fused kinetochore per chromosome; in mitosis there are two kinetochores per chromosome.

28. (d) Chromosomes are attached tot he microtubules at their kinetochores. There are molecular motors at the kinetochores which help move the chromosomes to the poles by the shortening of the kinetochore microtubules.

29. (c) Programmed cell death occurs during the development of many organisms (for instance, tadpoles lose their tails to become adult frogs). One of the stimuli for programmed cell death. Necrosis (cell death that is not programmed) occurs when cells have been deprived of cell cycle, in which cells reproduce, and is not a step in programmed cell death.

30. (b) After fertilization, the DNA content in the cell increases because of the fusion of genetic material of the parents. Mitosis then occurs and is followed by cytokinesis at x, which is the division of the cytoplasm into 2 compartments, i.e. 2 cells.

31. (a) Although no centrioles are visible, there is spindle formation and the chromosomes do exhibit equatorial arrangement. Spindle formation is probably by another organelle, unknown as yet.

32. (c) At prophase I, DNA replication has already occurred, and the original amount of DNA has been doubled to x. At anaphase I, the amount of DNA in the cell remains the same because no cytokinesis has occurred yet to separate the cytoplasm.

33. (d) G_0 represents a stage in G_1 in which cells are supposed to be withdrawn from division.

34. (c) Restriction point represents a stage in G_1 phase If the cell has passed restriction point, it would divide.

35. (c) Pairing can be procentric proterminal pairing or intermediate condition (also called as random synapsis which may occur simultaneously at all chromomeres).

36. (b) Stock is the one that receives the graft which has 2n = 48. This would produce the root which will have 2n = 48. Scion has 2n = 24, would produce microspore (n = 2)

37. (c) The number of chromosome will be same (50), but each chromosome will have 2 chromatids.

38. (a) No. of required meiosis = $n + \frac{n}{4} = \frac{5n}{4}$

where n = no. of seeds.

$= \frac{5\times10}{4} = \frac{50}{4} = 12.5 = 13$

10 Megaspore + 10 Microspore = 10 seeds

To produce 10 Megaspores, 10 meiotic division would be needed

13 – 10 = 3 meiosis will produce 12 microspore

So, wastage of pollen grain = 2

39. **(d)** The correct order of mitotic events which occur during meiosis is: Formation of synaptonemal complex, recombination, separation of homologous chromosomes, separation of sister chromatids.

40. **(b)**

41. **(c)** Any agent that stimulates cell division is called mitogen e.g., temperature, cytokinin, auxin, gibberellin, insulin and steroids.

42. **(c)**

43. **(d)** During the S-period, the centrioles separate and undergo duplication which produces two pairs of centrioles still contained within the radiating masses of microtubules.

44. **(a)**

45. **(c)** The given figure shows anaphase I of meiosis. In anaphase I, the homologous chromosomes break apart while sister chromatids remains associated at their centromere. At the end of anaphase I, two groups of chromosomes are produced at two poles, having half the number of parental chromosomes.