Practice Test 04 — Answer Key

Module 8: Cell Division (Mitosis & Meiosis)

Part A: Multiple Choice

1. **B** — DNA is copied during S (Synthesis) phase of interphase.
2. **C** — Prophase → Metaphase → Anaphase → Telophase (remember: PMAT).
3. **B** — Chromosomes line up at the equator of the cell during Metaphase.
4. **A** — Mitosis produces two genetically identical diploid cells.
5. **B** — Mitosis is for growth, repair, and replacement of body (somatic) cells.
6. **C** — Sister chromatids are joined at the centromere.
7. **C** — Sister chromatids separate during Anaphase and are pulled to opposite poles.
8. **B** — Cytokinesis is the division of the cytoplasm.
9. **B** — Meiosis occurs only in germ cells to produce gametes (sperm and eggs).
10. **D** — Meiosis produces four haploid cells.
11. **B** — Crossing over occurs during Prophase I of meiosis.
12. **C** — Gametes are haploid (n), so 46 ÷ 2 = 23 chromosomes.
13. **B** — Homologous chromosomes separate during Anaphase I of meiosis.
14. **B** — A diploid (2n) cell has two complete sets of chromosomes.
15. **B** — Independent assortment occurs during Metaphase I when homologous pairs line up randomly.
16. **B** — Nondisjunction can lead to trisomy conditions such as Down syndrome (Trisomy 21).
17. **B** — Cancer results from uncontrolled cell division due to mutations in cell-cycle genes.

Part B: Fill in the Blank

1. **G1**, **S**, **G2**
2. **Gametes** (sex cells — sperm and eggs)
3. **Synapsis**
4. **Haploid** (n)

5. **Sister chromatids**; **centromere**

Part C: Short Answer

1. **Four Differences Between Mitosis and Meiosis:**

Feature	Mitosis	Meiosis
Purpose	Growth and repair	Produce gametes
Divisions	1	2
Resulting cells	2 identical diploid cells	4 unique haploid cells
Crossing over	No	Yes (Prophase I)

2. **Stages of Mitosis:**
    - **Prophase:** Chromosomes condense and become visible. The nuclear envelope breaks down. Spindle fibers begin to form.
    - **Metaphase:** Chromosomes line up in a single row at the cell's equator (metaphase plate). Spindle fibers attach to the centromere of each chromosome.
    - **Anaphase:** Sister chromatids separate at the centromere and are pulled to opposite poles of the cell by spindle fibers.
    - **Telophase:** Chromosomes decondense. A new nuclear envelope forms around each set of chromosomes. Cytokinesis begins to divide the cytoplasm.

3. **Crossing Over and Independent Assortment:**
    - **Crossing over** happens during Prophase I of meiosis. Homologous chromosomes exchange pieces of DNA, creating new combinations of alleles on each chromosome.
    - **Independent assortment** happens during Metaphase I. Each pair of homologous chromosomes lines up randomly at the equator, so the orientation of one pair does not affect any other pair. In humans (23 pairs), this alone creates over 8 million possible gamete combinations.

- Both crossing over and independent assortment increase genetic variation in offspring.

4. **Nondisjunction:** Nondisjunction is the failure of chromosomes (or sister chromatids) to separate properly during cell division. If this happens during meiosis, the resulting gametes will have too many or too few chromosomes. For example, **Down syndrome (Trisomy 21)** occurs when chromosome 21 fails to separate, producing a gamete with two copies of chromosome 21. When that gamete is fertilized, the child has three copies of chromosome 21 (47 total chromosomes instead of 46).