

BA02 — Cell Biology & Genetics

BA02 · AFCAT General Awareness — Biology

★ Moderate-High Yield

The cell is the fundamental unit of life. AFCAT keeps this at Class 9-10 level: organelle functions, mitosis vs meiosis, and DNA base-pairing rules. Master the nicknames and ratios for full marks.

➔ **AFCAT Focus:** Mitochondria = powerhouse; ribosome = protein factory; lysosome = suicidal bag; Golgi = post office. Mitosis → 2 diploid cells (growth). Meiosis → 4 haploid cells (gametes). DNA: A-T (2 bonds); G-C (3 bonds). Watson & Crick 1953. Monohybrid cross phenotype ratio = 3:1.

PART 1 — CELL TYPES & ORGANELLES

1. Prokaryote vs Eukaryote

Feature	PROKARYOTE	EUKARYOTE
Nucleus	NO membrane-bound nucleus; naked DNA (nucleoid region)	TRUE nucleus with nuclear membrane
Organelles	ABSENT (no membrane-bound organelles)	PRESENT (mitochondria, Golgi etc.)
Cell Wall	PRESENT — Peptidoglycan (bacteria)	Plant: cellulose wall; Animal: no cell wall
Ribosomes	70S (smaller)	80S (larger)
Examples	Bacteria, Blue-green algae (1–10 µm)	Plant, Animal, Fungal cells (10–100 µm)

2. Cell Organelles

Organelle	Function	Nickname	Key Detail
Nucleus	Contains DNA; controls all cell activity	Control centre	Double membrane; nucleolus makes rRNA
Mitochondria	Cellular respiration; produces ATP	Powerhouse of cell	Has own DNA; semi-autonomous; double membrane
Ribosome	Protein synthesis (mRNA translation)	Protein factory	No membrane; 70S prokaryote; 80S eukaryote
Golgi Apparatus	Packaging & secretion of proteins/lipids	Post office of cell	Single membrane; forms lysosomes
Lysosome	Digests worn organelles and foreign material	Suicidal bag	~40 hydrolytic enzymes; causes autolysis
Chloroplast	Photosynthesis	Plants ONLY	Double membrane; contains chlorophyll

PART 2 – CELL DIVISION & GENETICS

3. Mitosis vs Meiosis

MITOSIS – Equational Division

- ▶ **Result:** 2 daughter cells; same chromosome count ($2n \rightarrow 2n$)
- ▶ **Purpose:** Growth, repair, replacement of body cells
- ▶ **Stages:** Prophase → Metaphase → Anaphase → Telophase

MEIOSIS – Reductional Division

- ▶ **Result:** 4 daughter cells; half chromosome count ($2n \rightarrow n$)
- ▶ **Purpose:** Formation of gametes (sperm and egg)

▶ Cells genetically identical to parent

▶ **Human:** 46 chromosomes (2n) → gametes with 23 (n)

▶ Cells genetically varied (crossing over)

4. Genetics – Mendel & DNA

Mendel's Laws:

- Dominance: dominant trait appears in F1; recessive masked (not lost)
- Segregation: alleles separate in gamete formation; each gamete gets one allele
- Monohybrid (Tt × Tt): phenotype ratio = **3 Tall : 1 Dwarf (3:1)**; genotype = 1:2:1

DNA Double Helix (Watson & Crick, 1953):

- A pairs with T (2 hydrogen bonds)
- G pairs with C (3 hydrogen bonds)
- Central dogma: DNA → mRNA → Protein



AFCAT PYQs – Cell Biology

Q1. "Powerhouse of the cell"? **AFCAT PYQ**

(a) Nucleus (b) Ribosome (c) Mitochondria (d) Lysosome

✓ (c) Mitochondria

Mitochondria produce ATP via cellular respiration. They have their own DNA (semi-autonomous). Most numerous in metabolically active cells. The most repeated AFCAT cell biology question.

Q2. In DNA, adenine always pairs with: **AFCAT PYQ**

(a) Guanine (b) Cytosine (c) Thymine (d) Uracil

✓ (c) Thymine

DNA: A-T (2 H-bonds) and G-C (3 H-bonds). In RNA, Thymine is replaced by Uracil (A pairs with U in RNA). AFCAT tests the DNA vs RNA distinction.

Quick Memory Chart — BAO2

Organelle

Nicknames

- ♦ Mitochondria: Powerhouse (ATP)
- ♦ Ribosome: Protein factory
- ♦ Lysosome: Suicidal bag
- ♦ Golgi: Post office
- ♦ Nucleus: Control centre

Cell Division

- ♦ Mitosis: 2 cells, same $2n$, growth
- ♦ Meiosis: 4 cells, half n , gametes
- ♦ Human: 46 chromosomes ($2n$)
- ♦ Gamete: 23 chromosomes (n)

DNA

- ♦ Watson & Crick: 1953
- ♦ A-T (2 bonds); G-C (3 bonds)
- ♦ Monohybrid F2: 3:1 phenotype
- ♦ DNA → mRNA → Protein



Practice Exercise

E1. Which organelle is absent in plant cells but present in animal cells?

- (a) Cell wall (b) Chloroplast (c) Centriole (d) Vacuole

E2. If Guanine = 20%, what is Adenine content in that DNA?

- (a) 20% (b) 30% (c) 40% (d) 60%

Answers:

E1 → (c) Centriole [forms spindle fibres; absent in plant cells] | E2 → (b) 30% [G=C=20%, so G+C=40%; A+T=60%; A=T, so A=30%]

 **Mock Tests**

 **Subject Quiz**

 **Telegram**

This material is for personal AFCAT exam preparation only.

Unauthorised reproduction or distribution is prohibited.

All rights reserved · ODEA.Classes@gmail.com · OliveDefence.com