Unit 15 · Gametogenesis

ANSWER KEY · FOR TEACHERS

Full marks 32

Give the marks for the points in the marking scheme; an answer in other words that says the same is right.

1 Key words

1. Leydig
2. Sertoli
3. spermiogenesis
4. spermiation
5. lampbrush
6. polar body
7. non-cleidoic
8. mesolecithal

K · 4

Each carries 0.5 mark.

2 Label the diagram

1. acrosome
2. centrioles
3. nucleus
4. main piece
5. mitochondria
6. end piece

K · 3

Each carries 0.5 mark.

3 Multiple choice

i. **d.** to penetrate the egg — K · 1

The acrosome holds **enzymes (sperm lysins)** that digest a way through the egg's coverings, so the sperm can **penetrate the egg**. Energy comes from the middle piece's mitochondria; the genes are in the nucleus.

ii. **c.** follicular cells — K · 1

Each growing oocyte is wrapped in a layer of **follicle (follicular) cells**, which feed it and make hormones. Sertoli cells are in the testis; a chorion and a corpus luteum belong to other animals' eggs and ovaries.

iii. **c.** the acrosome forms from the Golgi body — U · 1

Spermiogenesis has **no division**: it changes the shape of a spermatid into a sperm, the Golgi body forming the **acrosome**, the nucleus condensing, the tail growing and most cytoplasm being lost. The chromosome number was halved earlier, in meiosis I.

iv. **d.** the entry of a sperm into the egg — U · 1

A frog lays its eggs as secondary oocytes, stopped at metaphase II. **The entry of a sperm** makes the egg complete meiosis II, giving off the second polar body.

v. **b.** 13 — A · 1

Meiosis halves the number of chromosomes, one of each pair going into each gamete: 26 ÷ 2 = **13**. When a sperm (13) fuses with an egg (13), the zygote has 26 again.

4 Short answers

a. MARKING SCHEME — K · 2

- ✓ The making of gametes in the gonads.
- ✓ Spermatogenesis and oogenesis.

b. MARKING SCHEME — U · 2

- ✓ Meiosis halves the chromosomes: 2n = 26 to gametes with n = 13.
- ✓ Fusion restores 26, so the number stays constant instead of doubling each generation.

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c. MARKING SCHEME A · 2

- ✓ The egg turns freely once the membrane lifts, and the heavy yolky half sinks.
- ✓ The pigment above absorbs warmth and shields from UV (or hides the egg from predators).

d. MARKING SCHEME U · 3

- ✓ A gray band in the fertilized egg opposite the sperm's entry point.
- ✓ The pigmented cortex rotates about 30° towards the entry point, uncovering paler cytoplasm.
- ✓ It marks the future dorsal lip of the blastopore (dorsal side), making the egg bilaterally symmetrical.

5 Long answers

a. ANSWER U · 4

Spermatogenesis is the formation of haploid, motile **sperms** from the germ cells in the seminiferous tubules of the **testes**.

1. **Multiplication phase:** primordial germ cells of the germinal epithelium divide by **mitosis** into many **spermatogonia** (2n).
2. **Growth phase:** a spermatogonium grows a little, fed by the Sertoli cells, into a **primary spermatocyte** (2n); its DNA is replicated.
3. **Maturation phase: meiosis I** gives **two secondary spermatocytes** (n); **meiosis II** gives **four spermatids** (n).
4. **Spermiogenesis:** each spermatid becomes a sperm (acrosome from the Golgi body, nucleus condensed, tail from the distal centriole, middle piece of mitochondria, cytoplasm lost).

Chart: primordial germ cell (2n) → spermatogonia (2n) → primary spermatocyte (2n) → 2 secondary spermatocytes (n) → 4 spermatids (n) → 4 sperms.

MARKING SCHEME

- ✓ Definition, and the multiplication phase (mitosis gives spermatogonia).
- ✓ Growth phase: primary spermatocyte.
- ✓ Maturation: meiosis I and II give two secondary spermatocytes, then four spermatids.
- ✓ Spermiogenesis, and a correct chart.

b. ANSWER A · 4

Any four:

Spermatogenesis	Oogenesis
in the testes (seminiferous tubules)	in the ovaries
short growth phase; the cell grows little	long growth phase (months); the oocyte grows enormously, storing yolk
meiotic divisions equal	meiotic divisions unequal, giving polar bodies
one primary spermatocyte gives four sperms	one primary oocyte gives one ovum and two or three polar bodies
has spermiogenesis	no such step; in a frog meiosis II ends only after a sperm enters
gamete small, motile, little cytoplasm, no yolk	gamete large, non-motile, much cytoplasm and yolk
millions of sperms	a few thousand eggs a season

MARKING SCHEME

- ✓ A first correct difference.
- ✓ A second correct difference.
- ✓ A third correct difference.
- ✓ A fourth correct difference.

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6 Think

ANSWER HA · 3

The egg must carry all the **food (yolk)** and stores the embryo needs until the tadpole can feed itself; the sperm carries only a nucleus and needs none.
If the oocyte divided equally, the yolk would be shared among **four small cells**, none with enough to develop.
By dividing unequally, the oocyte throws out the **extra sets of chromosomes in tiny polar bodies**, while **one egg keeps nearly all the cytoplasm and yolk**.

MARKING SCHEME

- ✓ The egg must hold the food the embryo needs; a sperm needs none.
- ✓ Equal division would share the yolk among four cells too small to develop.
- ✓ Polar bodies remove the extra chromosomes while one cell keeps all the yolk.

7 Activity: Frog spawn

(not marked)

WHAT STUDENTS SHOULD FIND

Each egg is a small **black-and-white dot** in its own clear ball of **jelly**, the balls stuck together in a mass. From above the eggs look **black** (the animal hemisphere turned up); from the side or below the **creamy white** vegetal half shows. The jelly protects the eggs from drying, germs and knocks, holds them together, keeps them a little warm and makes them taste bad to predators.

Marks by level	Knowledge	Understanding	Application	Higher ability	Total
Marks	11	11	7	3	**32**

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