Unit 25 · Earthworm

ANSWER KEY · FOR TEACHERS

Full marks 35

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. cutaneous
2. porphyrin
3. prostomium
4. clitellum
5. perichaetine
6. typhlosole
7. chloragogen
8. protandrous

K · 4

Each carries 0.5 mark.

2 Label the diagram

1. straight lobe
2. nephrostome (funnel)
3. neck
4. distal limb
5. proximal limb
6. terminal duct

K · 3

Each carries 0.5 mark.

3 Multiple choice

i. **b.** 14 — K · 1

The **female** aperture is single and mid-ventral on segment **14**, the first segment of the clitellum. The **male** apertures are a pair on segment **18**; the ovaries themselves are in segment **13**.

ii. **b.** above the pharynx in segment 3 — K · 1

The **cerebral (supra-pharyngeal) ganglia**, the brain, lie on the **dorsal** side, in the groove between the buccal chamber and the pharynx, in segment 3. The sub-pharyngeal ganglia are below the pharynx in segment 4.

iii. **a.** longer and thinner — U · 1

Squeezed round its middle, the segment can't get smaller, because the fluid inside it can't be squeezed, so it gets **longer** as it gets **thinner**. Contracting the longitudinal muscles does the opposite. The two sets of muscles are **antagonistic**: when one contracts, the other relaxes.

iv. **c.** septal — U · 1

Only the **septal** nephridia have an open, ciliated **nephrostome** through which coelomic fluid is drawn in. The pharyngeal and integumentary nephridia are closed and take their wastes only from the blood.

v. **b.** at segment 14, before the sperm — A · 1

The band slides **forward**. It passes the **female aperture on segment 14** first, where the eggs go in, and then the **spermathecal pores on segments 9 to 6**, where the partner's sperm go in. Fertilization then happens in the cocoon. The worm's own sperm from segment 18 are not used: the band never passes back over it.

4 Very short answers

a. MARKING SCHEME — K · 1

✓ *Pheretima posthuma*, Oligochaeta.

b. MARKING SCHEME — K · 1

✓ The clitellum.

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c. MARKING SCHEME U · 1

✓ To keep the skin moist for cutaneous respiration.

5 Short answers

a. MARKING SCHEME U · 2

✓ The coelomic fluid, which can't be compressed, gives the muscles something to push against.

✓ Circular muscles lengthen a segment, longitudinal ones shorten it and the setae grip.

b. MARKING SCHEME A · 2

✓ Partly wrong: it is hermaphrodite but protandrous, so it can't fertilize itself.

✓ Two worms mate and exchange sperm; eggs are fertilized in the cocoon by the partner's sperm.

c. MARKING SCHEME U · 2

✓ Pharyngeal into the pharynx and buccal chamber; integumentary outside through nephridiopores.

✓ Septal into the intestine.

d. MARKING SCHEME U · 3

✓ The middle part of the intestine, segment 27 to the last 23–25, with a typhlosole hanging from its roof.

✓ The typhlosole increases the surface; most digestion and absorption happen here.

✓ The post-typhlosolar region (rectum) has no typhlosole, villi or glands and holds the feces.

6 Long answers

a. ANSWER U · 4

Septal nephridia	Pharyngeal nephridia
on both faces of the septa from 15/16 to the last	in paired tufts in segments 4, 5 and 6
the largest; each separate	in tufts of hundreds of fine branched tubules
open: have a ciliated **nephrostome**	**closed**: no nephrostome
take wastes from the **coelomic fluid** and the blood	take wastes **only from the blood**
each has a body with a straight lobe and a twisted loop	no such parts; tubules join into a common duct
empty into septal excretory canals, then supra-intestinal ducts, then the **intestine**	empty by common ducts into the **pharynx** (4, 5) and the **buccal chamber** (6)
about 80–100 on each septum	three pairs of tufts

Both kinds are **enteronephric**: they pour their wastes into the gut.

MARKING SCHEME

✓ Septal on the septa from 15/16; pharyngeal in tufts in segments 4–6.

✓ Septal open, with a ciliated nephrostome; pharyngeal closed.

✓ Septal take wastes from the coelomic fluid and blood; pharyngeal only from the blood.

✓ Septal empty through septal canals and supra-intestinal ducts into the intestine; pharyngeal by common ducts into the pharynx and buccal chamber.

b. ANSWER

Copulation. In the rainy season (about July to October), at night, two mature worms lie with their **ventral surfaces together**, heads opposite ways, so that the **male apertures** (segment 18) of each lie against the **spermathecal pores** (segments 6–9) of the other. The genital papillae and the accessory glands' secretion hold them together. The area round each male aperture rises into a papilla that enters the other's spermathecal pores, and **sperm and prostatic fluid** pass from each worm to the other. After about an hour they separate. The sperm received are kept in the spermathecae.

Cocoon formation. When the ovaries are ripe:

1. The clitellum secretes a sticky substance, which hardens in air into a band (girdle) round it, and fills it with albumen.

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2. The worm backs out, so the band slides **forward**.
3. Passing segment **14**, the band receives **eggs** through the female aperture.
4. Passing segments **9–6**, it receives the partner's **sperm** from the spermathecae.
5. It slips off the front end and its ends close, making a light yellow, oval **cocoon**.

U · 4

The eggs are **fertilized inside the cocoon** (external fertilization). Usually only one develops; cleavage is holoblastic and unequal, and development is direct: a young worm comes out in about 15–20 days.

MARKING SCHEME

- ✓ Two worms lie ventral sides together, heads opposite ways; segment 18 of each against segments 6–9 of the other; sperm exchanged into the spermathecae.
- ✓ The clitellum secretes a band filled with albumen; the worm backs out and it slides forward.
- ✓ Eggs enter at segment 14, then the partner's sperm at segments 9–6.
- ✓ The band closes into a cocoon; fertilization inside it; development direct, a worm in 15–20 days.

7 Think

ANSWER

HA · 3

Wastes poured into the gut leave with the feces, and the gut can **take back water** from them before they leave, so the worm **saves water**, which matters for an animal that dries out easily. On a dry pavement its skin **dries**; it breathes only through its **moist skin**, so once dry it can't take in oxygen and it suffocates (sunlight also harms it, and it can't burrow away).

MARKING SCHEME

- ✓ Wastes into the gut let water be taken back before the feces leave: saves water.
- ✓ It breathes through its moist skin.
- ✓ On a dry pavement the skin dries and it can't take in oxygen, so it dies.

8 Activity: Where are they? (Activities 8.7 and 8.10)

(not marked)

WHAT STUDENTS SHOULD FIND

Clitellum 14–16; spermathecal pores in the grooves 5/6 to 8/9; female aperture 14; male apertures 18; gizzard 8 (or 8–9); ceca 26; testes 10 and 11; ovaries 13. Lying ventral sides together, heads opposite ways, segment 18 of each worm meets segments 6–9 of the other, so each worm's sperm go straight into the other's spermathecae.

Marks by level	Knowledge	Understanding	Application	Higher ability	Total
Marks	11	18	3	3	**35**

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