Unit 23 · Endocrinology

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

K · 4

1. sella turcica
2. infundibulum
3. tropic
4. acromegaly
5. goiter
6. calcitonin
7. insulin
8. aldosterone

Each carries 0.5 mark.

2 Label the diagram

K · 3

1. hypothalamus
2. portal veins
3. anterior lobe
4. neurosecretory cells
5. infundibulum
6. posterior lobe

Each carries 0.5 mark.

3 Multiple choice

i. **a.** the supra-optic and paraventricular nuclei of the anterior region — K · 1

Both are made by neurosecretory cells in the **supra-optic and paraventricular nuclei**. They are only stored in and released from the posterior pituitary.

ii. **c.** one raises blood calcium and the other lowers it — U · 1

Parathormone raises blood calcium; **calcitonin lowers** it. Two hormones with opposite effects on one quantity are antagonists. Calcitonin is made by the thyroid's C cells, parathormone by the parathyroids.

iii. **b.** Sympathetic nerves trigger it within seconds, and its adrenaline prepares the body to fight or run. — U · 1

Sympathetic nerves make the medulla release **adrenaline** within seconds: a faster, stronger heartbeat, more blood to the muscles and more sugar in the blood, for **fight, flight or fright**.

iv. **b.** ADH — A · 1

This is **diabetes insipidus**: without **ADH** the collecting ducts stay waterproof and the water is lost in the urine. Lack of insulin causes diabetes mellitus, with sugar in the urine.

v. **c.** Graves' disease — A · 1

These are the signs of too much thyroid hormone: **Graves' disease** (exophthalmic goiter). Myxedema and Hashimoto's disease are underactive thyroid; a simple goiter is from lack of iodine.

4 Short answers

a. K · 2

ANSWER

Any two: hormones are carried **in the blood** to act **far away** on target cells, enzymes act **where they are made** (in a cell or a gut juice); hormones may be **proteins, steroids or amino acid derivatives**, enzymes are nearly all **proteins**; hormones are **used up** and broken down after acting, enzymes are **not used up** in the reaction; hormones **control** processes, enzymes **speed up** chemical reactions.

MARKING SCHEME

✓ A first correct difference.
✓ A second correct difference.

Science Playground, Katunje, Bhaktapur
Book a class visit: https://science-playground.com/booking

b. MARKING SCHEME U · 2

✓ Prolactin (anterior pituitary): milk production.
✓ Oxytocin (posterior pituitary): milk ejection.

c. MARKING SCHEME A · 2

✓ Mountain soils and food lack iodine, so little T_3/T_4 is made.
✓ Continued TSH makes the thyroid swell.

d. MARKING SCHEME U · 3

✓ Zona glomerulosa: mineralocorticoids (aldosterone).
✓ Zona fasciculata: glucocorticoids (cortisol).
✓ Zona reticularis: sex corticoids (androgens).

5 Long answers

a. ANSWER U · 4

- **Insulin**, from the **beta cells**, released when blood sugar **rises** after a meal: makes cells **take up glucose** and use it; makes the liver and muscles store it as **glycogen**; turns extra glucose into **fat**; helps make protein. It is the only hormone that **lowers** blood sugar.
- **Glucagon**, from the **alpha cells**, released when blood sugar **falls** between meals: makes the liver break **glycogen** down to glucose (glycogenolysis) and make new glucose from amino acids (gluconeogenesis), **raising** blood sugar.
- They are **antagonists**: whichever way blood sugar moves, the opposite hormone is released, keeping fasting blood sugar at about **70–100 mg per 100 mL**.
- Too little insulin, or cells that don't respond to it, gives **diabetes mellitus**.

MARKING SCHEME

✓ Insulin from beta cells: glucose uptake, glycogen and fat storage, lowers blood sugar.
✓ Glucagon from alpha cells: glycogenolysis and gluconeogenesis, raises blood sugar.
✓ They act as antagonists, keeping blood sugar at about 70–100 mg per 100 mL.
✓ Lack of insulin (or response to it) causes diabetes mellitus.

b. ANSWER A · 4

- The **hypothalamus** releases **TRH**, which makes the **anterior pituitary** release **TSH**.
- TSH makes the **thyroid** grow and release **T_3 and T_4**.
- When there is enough thyroid hormone in the blood, it acts back on the hypothalamus and pituitary and **slows** their release of TRH and TSH (negative feedback); when it falls, they release more. So the level stays steady.
- If the thyroid is removed there is no T_3 or T_4 to hold them back, so **TSH rises** a lot (doctors read a high TSH as an underactive thyroid).

MARKING SCHEME

✓ Hypothalamus TRH → pituitary TSH.
✓ TSH → thyroid releases T_3 and T_4.
✓ Enough T_3/T_4 slows TRH and TSH release (negative feedback), keeping the level steady.
✓ With the thyroid removed, TSH rises.

Science Playground, Katunje, Bhaktapur
Book a class visit: https://science-playground.com/booking

6 Think

ANSWER HA · 3

The **cretin**: the thyroid makes too little T_3 and T_4, so nothing holds back the pituitary, and **TSH is high**. (The dwarf's problem is too little **growth hormone**.)
The cretin has **intellectual disability** (the brain didn't develop), short limbs, a thick tongue and a low metabolic rate.
The pituitary dwarf is short but **well proportioned**, with **normal intelligence**.

MARKING SCHEME

- ✓ The cretin, since low thyroid hormone leaves TSH unchecked.
- ✓ The cretin: intellectual disability, short limbs, low metabolism.
- ✓ The dwarf: well proportioned, normal intelligence (too little GH).

7 Activity: Read a salt packet

(not marked)

WHAT STUDENTS SHOULD FIND

Salt sold for eating in Nepal must be **iodized** and carries the **two-children logo**, so people who can't read can recognize it. Salt is used by **everyone, every day, in small and fairly steady amounts**, so it carries the small daily need of iodine (about 150 micrograms) to the whole population. The thyroid needs **iodine** to make T_3 and T_4.

Marks by level	Knowledge	Understanding	Application	Higher ability	Total
Marks	10	11	8	3	**32**

Science Playground, Katunje, Bhaktapur
Book a class visit: https://science-playground.com/booking