Grade 11 Biology, Explained

Unit 26 · Frog: habits, outside and digestion

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. hibernation → **i.** the winter rest of a frog in moist burrows or mud
2. aestivation → **j.** the summer rest of a frog in the hottest, driest weather
3. amplexus → **b.** the male's grip on the female's back while she lays her eggs
4. tympanum → **g.** the round eardrum behind each eye
5. nuptial pad → **c.** a swelling on the male's first finger in the breeding season
6. pleurodont → **e.** teeth fixed to the inner side of the jaw bone
7. chyme → **f.** the thick, acid liquid food passing out of the stomach
8. micelles → **d.** tiny clusters of bile salts that carry fatty acids

K · 4

Each carries 0.5 mark.

2 Label the diagram

1. vomerine teeth
2. bulge of eye
3. gullet
4. glottis
5. internal nostril
6. Eustachian opening

K · 3

Each carries 0.5 mark.

3 Multiple choice

i. **b.** aquatic — K · 1

The **tadpole** lives wholly in **water** and breathes with gills. Only after metamorphosis does the frog become amphibious.

ii. **b.** glycogen — K · 1

Extra glucose is joined into chains of **glycogen**, "animal starch", and stored in the liver (and muscles).

iii. **c.** enterokinase from the intestinal juice — U · 1

Enterokinase turns the first trypsinogen into trypsin; then trypsin itself activates more. HCl is what activates **pepsinogen** in the stomach. Making enzymes in an inactive form keeps them from digesting the cells that make them.

iv. **b.** because it pours enzymes into a duct and hormones into the blood — U · 1

Its **acini** are **exocrine**, sending pancreatic juice down ducts to the duodenum; its **islets of Langerhans** are **endocrine**, sending insulin, glucagon and somatostatin straight into the blood. The pancreas doesn't make bile: the liver does.

v. **b.** a toad, because of its dry, warty skin and parotoid glands — A · 1

Dry, warty skin, **parotoid glands** and a home away from water all mark a **toad**. A bullfrog's skin is smooth and moist, and it stays near water.

4 Very short answers

a. MARKING SCHEME — K · 1

✓ *Hoplobatrachus tigerinus* (old name *Rana tigrina*).

b. MARKING SCHEME — K · 1

✓ Gastric glands: pepsinogen; oxyntic cells: HCl; goblet cells: mucus.

c. MARKING SCHEME — U · 1

✓ No neck, so the buccal cavity and pharynx are not separate.

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5 Short answers

a. MARKING SCHEME — U · 2

- ✓ Any two of camouflage, squirting urine, slippery skin, diving into water.
- ✓ Any other two.

b. MARKING SCHEME — U · 2

- ✓ Any two differences, e.g. habitat and poison glands.
- ✓ Any two more, e.g. skin, teeth, webbing or egg strings.

c. MARKING SCHEME — A · 2

- ✓ The frog swallows its prey whole, without chewing.
- ✓ The backward-pointing teeth hold the prey so it can't escape.

d. MARKING SCHEME — U · 3

- ✓ Mainly in the duodenum and ileum, whose folds give a large surface; water and salts pass straight through.
- ✓ Glucose, fructose and amino acids enter the blood capillaries and go by the hepatic portal vein to the liver; glycerol is absorbed easily.
- ✓ Fatty acids form micelles with bile salts, are rebuilt into fats in chylomicrons and go into the lymph vessels.

6 Long answers

a. ANSWER — U · 4

Food reaches the stomach and stays some hours. When it arrives, the stomach wall releases **gastrin**, which makes the glands secrete **gastric juice**: water, **pepsinogen** (from the gastric glands) and **hydrochloric acid** (from the oxyntic cells). Peristalsis churns the food and mixes it with the juice.

- **HCl** turns inactive pepsinogen into active **pepsin**, kills bacteria, dissolves salts and softens the food.
- **Pepsin** breaks **proteins** into **peptones and proteoses**.

Pepsinogen (inactive) + HCl → pepsin (active); proteins + pepsin → peptones + proteoses.

The food becomes acid **chyme**, which the pyloric sphincter lets into the duodenum a little at a time. So the stomach stores, mixes and partly digests the food.

MARKING SCHEME

- ✓ Gastrin makes the glands secrete gastric juice: pepsinogen and HCl; peristalsis churns the food.
- ✓ HCl turns pepsinogen into pepsin, kills bacteria and softens the food.
- ✓ Pepsin breaks proteins into peptones and proteoses.
- ✓ The food becomes acid chyme, let into the duodenum by the pyloric sphincter a little at a time.

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b. ANSWER U · 4

The pancreas is a **compound (mixed) gland** because it is both **exocrine** (its enzymes go down ducts) and **endocrine** (its hormones go straight into the blood).

Structure. A flat, branched, cream-colored gland in the mesentery between the stomach and duodenum, crossed by the common bile duct. **Exocrine part**: many **acini**, each a ring of tall secretory cells with large nuclei round a small central space, set in connective tissue with ducts, vessels and nerves; their ducts join the bile duct to form the **hepato-pancreatic duct**. **Endocrine part**: the **islets of Langerhans**, small groups of **alpha, beta and delta cells** among the acini, next to blood capillaries.

Functions.

i. **Pancreatic juice**: trypsinogen (proteins), amylase (starch), lipase (fats).

ii. **Glucagon** (alpha cells) raises blood sugar by turning glycogen into glucose; **insulin** (beta cells) lowers it, helping glucose into cells and its storage as glycogen; **somatostatin** (delta cells) regulates the other two.

MARKING SCHEME

- ✓ Compound: exocrine (enzymes by ducts) and endocrine (hormones into the blood).
- ✓ Exocrine acini of secretory cells; their ducts join the bile duct as the hepato-pancreatic duct.
- ✓ Pancreatic juice: trypsinogen, amylase and lipase.
- ✓ Islets of Langerhans: glucagon (alpha) raises and insulin (beta) lowers blood sugar; somatostatin (delta).

7 Think

ANSWER HA · 3

It is **poikilothermic**: in the cold its body cools and its **metabolism slows right down**, so it needs very little oxygen and food. It breathes **through its moist skin**, taking oxygen from the water in the mud, and lives on the **glycogen and fat** stored before winter. A mammal keeps its body warm, so its metabolism stays high and needs far more oxygen; it breathes only with its lungs, and its skin can't take in enough oxygen, so it would suffocate.

MARKING SCHEME

- ✓ Cold-blooded: its metabolism slows, so it needs little oxygen and food.
- ✓ It breathes through its skin and lives on stored glycogen and fat.
- ✓ A warm-blooded mammal needs much more oxygen and can't breathe through its skin.

8 Activity: Following a meal (Activity 8.11)

(not marked)

WHAT STUDENTS SHOULD FIND

Bucco-pharyngeal cavity: no enzymes, only mucus; the teeth hold the prey and it is swallowed whole. Stomach: gastric juice, pepsin and HCl; proteins to peptones and proteoses. Duodenum: bile, no enzymes, neutralizes the chyme and emulsifies fats; pancreatic juice, trypsin, amylase and lipase. Ileum: succus entericus (peptidases, maltase, sucrase, lactase, lipase) finishes digestion, and food is absorbed. Rectum: water taken back, feces stored. The **mouth** (and the esophagus) do no chemical digestion.

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

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Unit 26 · Frog: blood, breathing and reproduction

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. myogenic
2. sinus venosus
3. thrombocytes
4. shift
5. petrohyal
6. efferentia
7. fat bodies
8. amplexus

K · 4

Each carries 0.5 mark.

2 Label the diagram

1. spiral valve
2. right auricle
3. conus arteriosus
4. left auricle
5. auriculo- ventricular valve
6. ventricle

K · 3

Each carries 0.5 mark.

3 Multiple choice

i. **a.** pericardium — K · 1

The **pericardium**, a two-layered bag with fluid between. The myocardium is the heart's own muscle, the pleura covers our lungs and the meninges the brain.

ii. **a.** the male's kidney — K · 1

Bidder's canal runs along the inner edge of each kidney in the male; the vasa efferentia open into it, and the sperms pass through the kidney from there.

iii. **b.** the sinus venosus — U · 1

The precavals and the postcaval open into the **sinus venosus**, on the back of the heart, which passes the blood into the right auricle. Blood from the lungs goes straight into the left auricle.

iv. **b.** it pushes air into its lungs with its mouth, and an open mouth can't build up pressure — U · 1

A frog **pumps** air into its lungs by raising the floor of its **closed** mouth. With the mouth open, the air just escapes, and the lungs can't be filled. (It can still breathe through its skin.)

v. **a.** P is an artery and Q is a vein — A · 1

Thick, muscular wall and narrow lumen: an artery, built for high pressure. **Thin wall, wide lumen, collapses when empty: a vein.** A capillary's wall is a single layer of cells, far too small to see with the eye.

4 Very short answers

a. MARKING SCHEME — K · 1

✓ Cutaneous, bucco-pharyngeal and pulmonary.

b. MARKING SCHEME — K · 1

✓ The tadpole, with external gills.

c. MARKING SCHEME — U · 1

✓ The frog's is oval, large and nucleated; ours has no nucleus.

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5 Short answers

a. MARKING SCHEME — U · 2

- ✓ Male: sperms pass through the kidney, so the duct carries urine and sperms.
- ✓ Female: eggs go by separate oviducts; the ureter carries only urine.

b. MARKING SCHEME — U · 2

- ✓ Granulocytes have granules and a lobed nucleus; agranulocytes clear cytoplasm and a round or kidney-shaped nucleus.
- ✓ Granulocytes (eosinophils, basophils, neutrophils) from bone marrow; agranulocytes (lymphocytes, monocytes) from the spleen and lymphoid tissue.

c. MARKING SCHEME — A · 2

- ✓ External fertilization in the water as the eggs are laid.
- ✓ Sperms swim in water; eggs and tadpoles develop in water.

d. MARKING SCHEME — U · 3

- ✓ No bronchioles and few alveoli, so a small surface.
- ✓ Filled by pumping with the mouth, not a diaphragm and ribs, and never emptied fully.
- ✓ The blood reaching them is mixed blood from one ventricle.

6 Long answers

a. ANSWER — U · 4

With the mouth and glottis shut and the nostrils open, the **sternohyal** muscles contract and the floor of the mouth goes **down**: the cavity grows, its pressure falls, and air rushes in through the nostrils. The nostrils close (the mentomeckelian bones push up the premaxillae). The **petrohyal** muscles contract and the floor goes **up**, raising the pressure in the mouth. The **glottis opens** and air is forced into the lungs. The glottis then closes, holding the air in the lungs while gases are exchanged. This is **positive-pressure** breathing: the frog has no diaphragm or ribs.

MARKING SCHEME

- ✓ Mouth and glottis shut; sternohyals lower the floor of the mouth and air enters through the nostrils.
- ✓ The nostrils close.
- ✓ Petrohyals raise the floor; the glottis opens and air is pushed into the lungs.
- ✓ The glottis closes, holding the air; positive-pressure breathing, no diaphragm or ribs.

b. ANSWER — U · 4

Ovaries: two large, lobed ovaries, black and white with eggs, each hung near a kidney by a **mesovarium**, with no connection to the kidneys; fat bodies in front of them. **Oviducts**: two long, coiled, white tubes, each with an **oviducal funnel** (ostium) near the heart, a coiled **glandular tube** whose glands make the jelly, and a thin, stretchy **ovisac** at the end where eggs wait. Eggs are swept by cilia into the funnels and down the tubes, picking up jelly. **Cloaca**: the oviducts open into it, and the eggs are laid through the cloacal aperture into the water.

MARKING SCHEME

- ✓ Two lobed ovaries on mesovaria, not joined to the kidneys.
- ✓ Oviducts with funnel (ostium), coiled glandular tube making jelly, and ovisac.
- ✓ Eggs carried by cilia into the funnels and down the oviducts.
- ✓ The oviducts open into the cloaca; eggs laid into the water.

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7 Think

ANSWER HA · 3

A frog is **cold-blooded**, so its metabolism is slow and it needs **far less oxygen** than a warm-blooded mammal; mixed blood carries enough. It also takes in oxygen through its **skin**, and the blood going to the skin and lungs is sent there from the ventricle, so the skin's oxygen is not wasted. Measurements show the ventricle and spiral valve keep the blood partly apart: the lungs and skin get blood with less oxygen and the head more.

MARKING SCHEME

- ✓ Cold-blooded: it needs much less oxygen than a mammal.
- ✓ The skin adds oxygen too.
- ✓ The spiral valve and ventricle keep the streams partly apart (lungs and skin get less-oxygenated blood).

8 Activity: Three ways of breathing

(not marked)

WHAT STUDENTS SHOULD FIND

Cutaneous: the moist skin, all the time, in water and on land, the only way in hibernation and aestivation; oxygen dissolves in the film of water on the skin. Bucco-pharyngeal: the moist lining of the mouth, at rest on land; air drawn in and out through the nostrils by the floor of the mouth moving down and up. Pulmonary: the lungs, when active; air pumped in by the closed mouth through the glottis. **Cutaneous** respiration keeps a hibernating frog alive.

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