Unit 17 · Introduction to Biology

ANSWER KEY · FOR TEACHERS

Full marks 34

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. morphology → **f.** the external form of organisms
2. histology → **a.** tissues
3. karyology → **h.** the nucleus, especially its chromosomes
4. limnology → **e.** fresh water and what lives in it
5. herpetology → **j.** reptiles and amphibians
6. malacology → **c.** mollusks
7. euthenics → **i.** improving human well-being through better living conditions
8. epidemiology → **d.** how diseases spread through populations, and how to control them

K · 4

Each carries 0.5 mark.

2 Label the diagram

1. light energy
2. glucose + oxygen $C_6H_{12}O_6 + 6O_2$
3. carbon dioxide + water $6CO_2 + 6H_2O$
4. energy (ATP)

K · 2

Each carries 0.5 mark.

3 Multiple choice

i. **d.** fish — K · 1

Greek *ichthys*, fish. (Fruit is pomology, the heart cardiology, disease pathology.)

ii. **b.** Theophrastus — K · 1

Theophrastus, Aristotle's student, who described about 500 kinds of plants. Aristotle is the father of biology and of zoology, Hippocrates of medicine; Linnaeus gave us binomial nomenclature.

iii. **b.** anatomy — U · 1

Anatomy is internal structure. Morphology is external form, physiology is function. Histology studies tissues, one level of internal structure, so anatomy is the broader, better answer.

iv. **a.** X-ray diffraction — U · 1

X-ray diffraction works by the physics of X-rays scattering off the atoms of a crystal; it revealed the structure of DNA. The others work mainly by chemistry and biology.

v. **d.** vermiculture — A · 1

Vermiculture (Latin *vermis*, worm): raising earthworms, which turn waste into vermicompost. Apiculture is beekeeping.

4 Very short answers

a. MARKING SCHEME — K · 1

✓ *Bios* life and *logos* study.

b. MARKING SCHEME — K · 1

✓ An animal that carries a germ from person to person without falling ill, with one example.

c. MARKING SCHEME — U · 1

✓ Biology and sociology.

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5 Short answers

a. MARKING SCHEME — U · 2

- ✓ Anatomy studies the internal structure of organisms (e.g. the heart's four chambers and valves).
- ✓ Physiology studies the functions and processes (e.g. how the heart pumps blood).

b. MARKING SCHEME — U · 2

- ✓ Any one role, e.g. statistics decides whether a result is real or chance (biostatistics).
- ✓ Any second, e.g. models predict population growth or the spread of a disease, or Mendel's 3 : 1 ratio from counting.

c. MARKING SCHEME — A · 2

- ✓ $787 \div 277 \approx 2.84$, about 3 : 1.
- ✓ The pattern (laws of inheritance) came only from counting and arithmetic: biology needs mathematics.

d. MARKING SCHEME — U · 3

- ✓ Altitude and temperature, e.g. sal below about 1,000 m, fir and birch at 3,000–4,000 m.
- ✓ Rainfall, e.g. the wet east richer than the dry west and the rain shadow (Mustang, Dolpa); or barriers such as mountains and seas.
- ✓ Biogeography studies these factors and why species are where they are.

6 Long answers

a. ANSWER — U · 4

The life processes of plants and animals are chemical reactions; the field where biology and chemistry meet is **biochemistry**.

a. Living things are made of organic (carbohydrates, proteins, lipids, nucleic acids) and inorganic (water, minerals) compounds.
b. Energy is carried in the body by chemicals such as glucose and ATP.
c. Photosynthesis, respiration and all of metabolism are chains of chemical reactions: $C_6H_{12}O_6 + 6\,O_2 \rightarrow 6\,CO_2 + 6\,H_2O +$ energy.
d. The genetic material, DNA and RNA, is chemical.
e. Enzymes and hormones are chemicals.

MARKING SCHEME

- ✓ Life's processes are chemical reactions; the meeting field is biochemistry. Living things are made of organic and inorganic compounds.
- ✓ Energy is carried by chemicals such as glucose and ATP.
- ✓ Photosynthesis, respiration and metabolism are chains of chemical reactions.
- ✓ DNA and RNA, enzymes and hormones are chemicals.

b. ANSWER — A · 4

Agriculture is applied biology.

- **Improved and hybrid varieties**: plant breeders use genetics to cross and select varieties with higher yields and resistance to diseases and drought.
- **Earthworms** improve the soil's fertility and porosity; raising them is vermiculture, which gives vermicompost.
- **Bees** and other insects pollinate fruit trees, mustard, buckwheat and vegetables; **bacteria and fungi** return nutrients to the soil, and nitrogen-fixing bacteria in the roots of beans and peas feed them nitrogen.
- **Pests**: knowing their life cycles lets farmers fight them by integrated pest management (natural enemies, crop rotation, resistant varieties, pesticides only where needed), and farm sustainably.

MARKING SCHEME

- ✓ Improved and hybrid varieties by plant breeding.
- ✓ Earthworms and vermiculture (soil fertility, porosity, vermicompost).
- ✓ Pollinators, or decomposing and nitrogen-fixing bacteria.
- ✓ Integrated pest management or sustainable agriculture.

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7 Think

ANSWER HA · 3

Both harm **living things**, and biology is the science that understands how. Radiation damages **DNA**: biologists study how cells repair the damage, why some develop cancer, and how to use radiation safely in X-rays and in treating cancer. Hunger is a problem of food: biologists breed better crops and livestock, protect them from pests and diseases, and work out the nutrition people need. The aim is **human well-being and solving global problems**.

MARKING SCHEME

- ✓ Radiation damages DNA (biologists study repair, cancer, safe use).
- ✓ Hunger: better crops and livestock, protection from pests, nutrition.
- ✓ The aim: human well-being and solving global problems.

8 Activity: Biology from breakfast to bedtime

(not marked)

WHAT STUDENTS SHOULD FIND

Breakfast: rice, wheat, milk, curd (plants and animals: botany, zoology, and microbiology for the bacteria that make curd; agronomy for the crops). A medicine or vaccine: pathology, immunology, microbiology (penicillin from a mold). Clothes: cotton (botany), wool or silk (zoology; sericulture). A field or garden: horticulture, agronomy, entomology for the bees and pests. An animal: ornithology for a bird, entomology for an insect, mammalogy for a dog. Most moments need more than one branch, which is why biology is divided into many branches that work together.

Marks by level	Knowledge	Understanding	Application	Higher ability	Total
Marks	10	14	7	3	**34**

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