Unit 2 · Life and Life Process

ANSWER KEY · FOR TEACHERS

Full marks 41

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. mycology
2. bacteriophage
3. septum
4. pseudomycelium
5. coenocytic
6. columella
7. suspensor
8. zygospore

K · 4

Each carries 0.5 mark.

2 Label the diagram

1. head (capsid)
2. tail fibers
3. DNA
4. collar
5. tail (sheath)
6. baseplate

K · 3

Each carries 0.5 mark.

3 Multiple choice

i. **b.** attachment, penetration, biosynthesis, maturation, release — K · 1

The phage must first attach, then inject its DNA; only then can the cell make phage parts (biosynthesis), which are assembled (maturation) before the cell bursts (release).

ii. **b.** septum — K · 1

The septum is the new cross wall that grows inward from the cell's wall and membrane and cuts the cell in two. A columella is in a sporangium, a capsid is a virus's coat, and a bud scar is left on a yeast cell.

iii. **c.** aseptate and multinucleate — U · 1

Mucor's hyphae have no cross walls (aseptate) and contain many nuclei in a continuous cytoplasm: they are coenocytic. Their nuclei are haploid.

iv. **c.** two gametangia of + and − strains — K · 1

Mucor mucedo is heterothallic: a gametangium from a + mycelium fuses with one from a − mycelium, and the fused cell becomes the zygospore.

v. **c.** 8 — A · 1

1 hour = 60 minutes = 3 generations, and $2^3 = 8$. (3 is the number of generations, and 6 is the trap of adding 2 each time instead of doubling.)

4 True or false

i. ✗ **False**: Only the phage's DNA enters; the empty protein coat stays outside.
ii. ✓ **True**
iii. ✗ **False**: A yeast cell is a eukaryote, with a nucleus.
iv. ✓ **True**
v. ✗ **False**: *Mucor* has no rhizoids; those belong to *Rhizopus*.
vi. ✗ **False**: They look alike, and the signs only mean "able to mate with the other one".

U · 3

Each carries 0.5 mark.

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5 Very short answers

a. MARKING SCHEME — K · 1

✓ $N = N_0 \times 2^n$ written.

b. MARKING SCHEME — K · 1

✓ *Rhizobium* named.

c. MARKING SCHEME — U · 1

✓ The fibers fit only the receptors of its own host.

6 Short answers

a. MARKING SCHEME — U · 2

✓ It has no cell, ribosomes, energy-making enzymes or food store, and does nothing outside a living cell.

✓ It can multiply only inside a living host, using the host's machinery.

b. MARKING SCHEME — U · 2

✓ Its thick, tough, warty wall protects it from drying out, cold and damage.

✓ It can rest for months and germinates only when conditions are good again.

c. MARKING SCHEME — U · 2

✓ Equal cells and no parent left in fission; a small bud and a mother that lives on in budding.

✓ Or any second difference (no spindle in fission; mitosis in budding; prokaryote and eukaryote).

d. MARKING SCHEME — A · 2

✓ Molds need water: damp monsoon air suits them, dry winter air doesn't.

✓ Cold slows the mold's growth (it doesn't kill it).

7 Long answer

ANSWER — U · 4

Sexual reproduction happens only between a + and a − mycelium. Hyphae of the two strains grow zygophores towards each other, and their touching tips swell into multinucleate progametangia. A cross wall divides each into a gametangium and a suspensor. The wall between the gametangia dissolves, and + and − nuclei pair and fuse into diploid nuclei. The fused cell becomes a zygospore with a thick, black, warty wall, which can rest through bad conditions. On germination its nuclei undergo meiosis, and a germ sporangium grows out, full of haploid spores, each giving a + or a − mycelium.

MARKING SCHEME

✓ + and − strains needed; zygophores meet and swell into progametangia.

✓ A cross wall gives a gametangium and a suspensor on each side.

✓ The gametangia fuse and nuclei pair and fuse, making a diploid zygospore with a thick wall.

✓ Meiosis on germination gives a germ sporangium with haploid spores.

8 Numerical problems

a. ANSWER — A · 2

$$n = \frac{180}{30} = 6, \qquad N = 500 \times 2^6 = 500 \times 64 = 32{,}000$$

32,000 bacteria.

MARKING SCHEME

✓ $n = 180 \div 30 = 6$ generations.

✓ $N = 500 \times 2^6 = 32{,}000$ bacteria.

b. ANSWER

$$\frac{N}{N_0} = \frac{64{,}000}{1{,}000} = 64 = 2^6$$

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So it doubled 6 times in 120 minutes.

$$\text{generation time} = \frac{120}{6} = 20 \text{ minutes}$$

20 minutes.

MARKING SCHEME

✓ $N/N_0 = 64$.
✓ $64 = 2^6$, so 6 doublings.
✓ Generation time $= 120 \div 6 = 20$ minutes.

c. **ANSWER** A · 3

1 hour = 2 cycles of 30 minutes.
After cycle 1: 150 phages; 1 bacterium killed.
After cycle 2: $150 \times 150 =$ **22,500 phages**; 150 more bacteria killed.
Bacteria killed in all $= 1 + 150 =$ **151**.

MARKING SCHEME

✓ 1 hour = 2 cycles.
✓ $150 \times 150 = 22{,}500$ phages.
✓ Bacteria killed $= 1 + 150 = 151$.

9 Think

ANSWER HA · 3

A virus has no cell, so it can't split. Binary fission is a cell growing and dividing in two, and needs the cell's own machinery to copy its DNA and build new wall. A virus has no ribosomes or enzymes of its own and does nothing at all outside a host. It multiplies only by getting its genetic material into a living host cell, which then makes many new viruses at once (in the lytic cycle, about 100 or more from one bacterium) and is destroyed. Also, whether a virus is "living" at all is debated: it shows signs of life only inside a host cell.

MARKING SCHEME

✓ A virus has no cell, so it can't split; fission needs a cell's own machinery.
✓ It multiplies only by getting its genetic material into a living host, which makes many new viruses at once.
✓ Whether a virus is living at all is debated: it shows signs of life only inside a host.

10 Activity: Mold in a closed box

(not marked)

WHAT STUDENTS SHOULD FIND

Fine white threads spread first in the first day or two. Then upright stalks appear, each with a pinhead that turns from white to black as its spores ripen. Green or blue-green patches are other molds, such as *Penicillium*, whose spores also came from the air.

Marks by level	Knowledge	Understanding	Application	Higher ability	Total
Marks	12	15	11	3	**41**

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