Unit 28 · Microbial Diseases

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

1. pandemic
2. emerging
3. endemic
4. zoonotic
5. carrier
6. opportunistic
7. acid-fast
8. lysozyme

Each carries 0.5 mark. **K · 4**

2 Label the diagram

1. spike (gp120 + gp41)
2. capsid (p24)
3. fatty envelope
4. RNA (two copies)
5. matrix (p17)
6. reverse transcriptase

Each carries 0.5 mark. **K · 3**

3 Multiple choice

i. **a.** Ebola virus **K · 1**

Ebola virus causes often deadly disease that spreads from person to person: RG-4. Influenza and herpes are RG-2; SARS coronavirus is RG-3.

ii. **c.** HDV can only make its coat with HBV's surface protein, so without HBV it can't infect **U · 1**

HDV is **incomplete**: it borrows HBV's **surface antigen (HBsAg)** for its own coat. A person made immune to HBV by the vaccine never carries HBV, so HDV has nothing to borrow from.

iii. **b.** making gut-lining cells release chloride ions, which water follows into the gut **U · 1**

The toxin keeps the cells' **cyclic AMP** high, which holds their chloride channels open; chloride, then sodium and water, pour into the gut. The cells are unharmed and can still absorb glucose and sodium together, which is why **ORS** works.

iv. **a.** blood culture **A · 1**

In the **first week** the bacteria are in the blood, so a **blood culture** finds them. Antibodies for the Widal test rise only in the second week, and the bacteria reach the stool and urine in numbers later still.

v. **d.** artificial passive **A · 1**

Anti-snake venom is ready-made **antibodies** (made in horses) injected into the body: **artificial passive** immunity. It acts at once, which a bitten person needs, but leaves no memory.

4 Short answers

a. **MARKING SCHEME** **K · 2**

- ✓ Hazard: anything that could cause harm, with an example (a culture of a pathogen).
- ✓ Risk: the chance that it does harm, with an example (a spilled flask).

b. **MARKING SCHEME** **U · 2**

- ✓ Several drugs kill bacteria resistant to any single drug, so resistance can't take hold.
- ✓ DOTS: every dose is watched so patients don't stop early and breed drug-resistant TB.

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c. MARKING SCHEME A · 2

✓ Oral candidiasis (thrush), by *Candida albicans*.
✓ The antibiotic killed the bacteria that keep *Candida* in check, so the person's own yeast overgrew.

d. MARKING SCHEME U · 3

✓ HAV is an RNA virus; HBV a DNA virus.
✓ A spreads by the feco-oral route; B by blood, sex and from mother to baby.
✓ A never becomes chronic; B can become chronic, leading to cirrhosis and liver cancer.

5 Long answers

a. ANSWER U · 4

1. **Acute (primary) infection**, 2 to 6 weeks after infection: a **flu-like illness** (fever, headache, rash, sore throat) that passes; the virus multiplies fast. In the **window period**, from about 2 weeks to 3 months, an antibody test is still negative though the person can pass HIV on.
2. **Clinical latency (asymptomatic stage)**: **years with no symptoms** except swollen lymph nodes (generalized lymphadenopathy); the antibody test is positive, and the virus quietly destroys CD4 cells.
3. **Symptomatic stage** (once the AIDS-related complex): fever and diarrhea each lasting **more than a month**, and loss of more than **10% of body weight** ("slim disease").
4. **AIDS**, the end stage: **fewer than 200 CD4 cells** per microliter of blood, and **opportunistic infections** such as tuberculosis, *Pneumocystis* pneumonia, oral and esophageal candidiasis, and cancers such as Kaposi's sarcoma. Without treatment, AIDS comes on average about 10 years after infection.

MARKING SCHEME

✓ Acute infection: flu-like illness 2–6 weeks after infection; window period.
✓ Clinical latency: years without symptoms, swollen lymph nodes, CD4 cells falling.
✓ Symptomatic stage: long fever and diarrhea, over 10% weight loss.
✓ AIDS: CD4 under 200 per μL, with opportunistic infections (TB, pneumonia, candidiasis, cancers).

b. ANSWER A · 4

Any four:

Humoral immunity	Cell-mediated immunity
carried out by **B lymphocytes**, through the antibodies they make	carried out by **T lymphocytes** themselves
plasma cells release **antibodies** into blood and lymph	T cells **make no antibodies**; they kill infected cells or release **cytokines**
acts on microbes and toxins **outside cells**, in body fluids	acts on microbes **inside cells** and on **tumor cells**
antibodies recognize antigens as they are, **unprocessed**	T cells recognize only antigen **processed and presented** on MHC proteins
does not destroy tumor cells or reject transplants	destroys tumor cells and **rejects transplanted organs**
causes immediate allergies	causes **delayed-type hypersensitivity** (the tuberculin test's swelling)

MARKING SCHEME

✓ A first correct difference.
✓ A second correct difference.
✓ A third correct difference.
✓ A fourth correct difference.

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6 Think

ANSWER HA · 3

For COVID-19: $1 - 1/2.5 = 1 - 0.4 =$ **0.6, or 60%**. For measles, even at the lowest R_0 of 12: $1 - 1/12 \approx$ **0.92, over 90%**.

When that share is immune, each case gives rise to **fewer than one new case**, so the infection fades out and even those who can't be vaccinated (newborns, people with weak immunity) are protected. Measles needs **over 90%** immune, so a small fall in vaccination below that lets each case again infect **more than one** person, and outbreaks return.

MARKING SCHEME

- ✓ 60% for COVID-19 and over 90% for measles, worked out.
- ✓ Above that share each case causes fewer than one new case, so the infection fades out (herd immunity).
- ✓ Measles needs so high a share that a small slip in vaccination lets each case infect more than one person again.

7 Activity: Make oral rehydration solution

(not marked)

WHAT STUDENTS SHOULD FIND

The sugar and salt dissolve completely, giving a **clear**, slightly sweet and salty drink, **no saltier than tears** (too much salt does harm). A packet of Jeevan Jal is better, since it also has **potassium and citrate**. ORS works because the gut-lining cells take up **glucose and sodium together**, and water follows them, even while cholera toxin pours chloride out; the toxin doesn't destroy the gut wall, so the cells can still absorb.

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

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