

3.4 Plant disease

Name: _____ Class: _____ Date: _____

Total: 18 marks**KEY WORDS** aphids • chlorosis

Objective

Detect and identify plant disease, explain nitrate and magnesium deficiency, and describe physical, chemical and mechanical defences. Biology only. Original questions for specification 4.3.3.

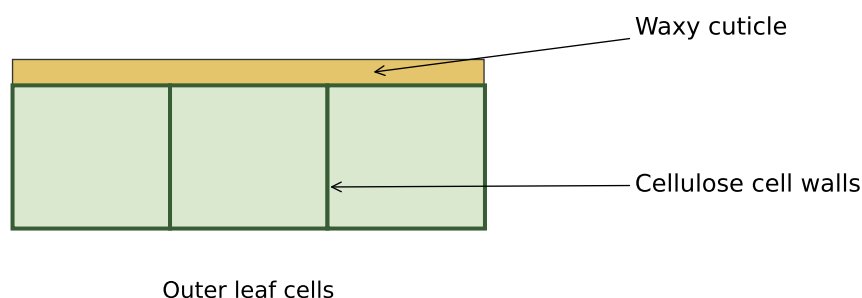
1 Key knowledge and worked examples

Detection and identification (HT): stunted growth, spots, decay, growths, malformed stems/leaves, discolouration and visible pests are signs, not unique diagnoses. Compare the pattern with a gardening manual/website; have a laboratory examine an affected plant/sample; use a suitable monoclonal-antibody kit for a specified pathogen antigen, following its control/instructions.

Named problems: **TMV** (virus), **rose black spot** (fungus), **aphids** (insects).

Deficiency	Mechanism and sign
nitrate ions	less amino-acid/protein synthesis → stunted growth
magnesium ions	less chlorophyll → chlorosis (yellow leaves), reduced photosynthesis

Leaf surface: barriers to pathogen entry



Defences: physical – walls, cuticle, bark; chemical – antibacterial substances, poisons; mechanical – thorns/hairs, touch-induced drooping/curling and mimicry.

Worked example (2 marks, 2025 Q04.8): Yellow leaves without spots **may** result from magnesium shortage (1), because magnesium is needed to make chlorophyll (1). Lack of light is another accepted explanation. The symptom alone does not prove the cause or rule out infection.

2 Practice

2.1 Give three signs of plant disease. [3]

2.2 State the ion whose deficiency causes chlorosis and why. [2]

2.3 Give one physical and one chemical plant defence. [2]

3 Exam-style questions

3.1 A gardener's tomato plants show yellowing leaves and poor growth. Describe two ways to identify the problem. [4]

3.2 Explain how magnesium deficiency reduces growth. [3]

3.3 Rose plants have thorns; some plants droop when touched. For each, name the defence category and explain the benefit. [4]

Solutions

2.1 Any three: stunted growth, spots, decay/rot, growths, malformed stems/leaves, discolouration, visible pests.

2.2 Magnesium ions; magnesium is needed to make chlorophyll; less chlorophyll reduces light absorption for photosynthesis.

2.3 Physical: cellulose cell wall / waxy cuticle / bark. Chemical: antibacterial chemical / poison deterring herbivores.

3.1 Teacher rubric: select two different methods; 1 mark for each method and 1 for its explanation (max 4). (i) Compare with a gardening manual/website (1), matching the pattern of symptoms with described causes (1). (ii) Send an affected plant/sample to a laboratory (1), for examination/testing to identify a pathogen or investigate the cause (1). (iii) Use a suitable monoclonal-antibody kit (1), testing for a particular pathogen antigen and interpreting a valid result using its instructions/control (1). Yellowing alone does not establish magnesium deficiency; absence of spots alone does not rule out infection. A negative kit result only concerns its specific target.

3.2 Magnesium shortage reduces chlorophyll production; less light is absorbed, so photosynthesis is reduced; less glucose is available for biomass and respiration, which releases energy for growth.

3.3 Thorns – a mechanical defence; they deter animals from eating or climbing the plant. Drooping when touched – also mechanical; it discourages grazing insects or makes the plant seem less appetising / knocks pests off.