

8.1 Classification and the diagnostic laboratory

Name: _____ Class: _____ Date: _____

Total: 23 marks

KEY WORDS Gram stain • PCR

Objective

Walk the classification tree and read a diagnostic report.

1 Key knowledge and worked examples

■ The tree

Culture (24–48 h) → Gram stain (positive purple / negative pink) → shape → catalase, oxidase, biochemistry ✓. The Gram stain is wall chemistry: crystal violet–iodine trapped by thick peptidoglycan.

■ Worked example: reading a report

Gram-positive cocci in clusters; catalase +, coagulase + → *Staphylococcus aureus* ✓. Each line is one fork with one biochemical key. PCR names DNA in ~1–2 h; only culture proves viability and susceptibility.

2 Practice

2.1 Why do Gram-positive cells keep the purple complex? [3]

2.2 Gram-positive cocci in clusters, catalase negative – which genus? [3]

2.3 Name the one thing PCR cannot tell you that culture can. [3]

3 Exam-style questions

3.1 Cerebrospinal fluid from a fictional patient with suspected meningitis: PCR positive for *S. pneumoniae* at 90 minutes; culture still negative at 12 hours.

Explain the chemistry behind the speed difference (amplified nucleic acid vs growing organisms). State what the PCR result cannot tell you (viability, susceptibility). Explain why culture must still be followed to completion. [7]

3.2 Two blood-culture bottles from one fictional patient: bottle A grows coagulase-negative staphylococci at 24 h; bottle B shows no growth at 48 h.

Use contaminant biology to interpret the pair (skin flora vs true bacteraemia usually hits both bottles). State what should be done before any organism is named from a single positive bottle. [7]

Solutions

2.1

- Thick peptidoglycan (many layers, teichoic acids) traps the crystal violet–iodine complex at the decolouriser step.

2.2

- Streptococci – catalase negative rules out staphylococci ✓.

2.3

- Whether the organism is ALIVE and drug-sensitive – viability and susceptibilities come only from culture ✓.

3.1

- PCR amplifies nucleic acid present in the sample, dead or alive, so a template answers in ~1–2 h.
- Culture must grow viable cells to visible colonies – 24–48 h for most bacteria.
- PCR cannot report viability or susceptibility categories ✓.
- Culture yields the isolate for susceptibility testing and the reference-standard identification.

3.2

- Coagulase-negative staphylococci are skin flora – the usual contaminant of venepuncture ✓.
- True bacteraemia typically seeds both bottles; one positive of two points to contamination.
- Repeat the culture with careful skin preparation before naming any organism from a single bottle.