

CAIE AS Biology 9700/33

OCTOBER/NOVEMBER 2026 PRACTICAL PREDICTION & PRACTICE GUIDE

Question 1: Yeast respiration + ethanoic acid + methylene blue
Question 2: Printed photomicrograph + plan diagram (microscope not supplied)

Important: This is a prediction based on the materials/apparatus listed in the confidential instructions and the additional information that candidates will not be provided with a microscope. Exact concentrations, volumes, temperatures, timings and question wording can still differ in the live paper.

AT A GLANCE

	Most likely focus	Priority preparation
Q1	Effect of ethanoic acid concentration on yeast respiration, monitored using methylene blue decolourisation	Proportional dilution; timing an endpoint; 1/time; enzyme/pH explanation; errors & improvements
Q2	Plan diagram from a printed photomicrograph; likely followed by measurement, magnification, comparison or quantitative image analysis	Plan-diagram rules; scale bars/magnification; ratios/percentages; observable comparisons

Highest-priority past papers: Q1 - 9700/35 O/N 2014 and 9700/33 O/N 2020. Q2 - 9700/32 M/J 2020, 9700/33 O/N 2016 and 9700/34 M/J 2019.

QUESTION 1 - What is most likely coming?

Prediction: A yeast respiration investigation in which ethanoic acid concentration is changed and methylene blue is used as the redox indicator. The dependent variable is very likely the time taken for the blue colour to disappear (or reach a stated colour endpoint). A rate may then be calculated as 1/time.

1. Why the materials point strongly to this

Material / apparatus	What it strongly suggests
Y - 10.0% yeast suspension	Yeast is the respiring organism and provides respiratory enzymes.
G - 0.5% glucose	Glucose is the respiratory substrate.
A - 1.0% ethanoic (acetic) acid	This is the obvious independent variable: different acid concentrations / acidity.
M - 0.05% methylene blue	Redox indicator used to follow yeast respiratory activity.
W - distilled water	Used to prepare dilutions and a 0% acid control.
Six small test-tubes + five beakers	Strongly suggests several treatment concentrations, probably six in total.
Hot water + cold water + thermometer + water-bath	Temperature is controlled while another variable is changed.
Stop-clock / timer	A timed colour endpoint is likely.
One bung	Likely used while a test is running to reduce gas exchange / standardise conditions.

2. Likely biological principle

Methylene blue is blue when oxidised and becomes colourless when reduced. As yeast metabolises glucose, reducing conditions develop and methylene blue loses its blue colour. Therefore, under a standardised method:

- shorter decolourisation time = faster respiratory activity
- longer decolourisation time = slower respiratory activity
- if a rate is required: rate = $1 / \text{time}$ (usually in s^{-1} if time is in seconds)

Ethanoic acid changes the chemical environment of the yeast. Increasing acidity can reduce enzyme activity and therefore reduce respiration. For explanation questions, revise the effect of pH on bonds maintaining enzyme tertiary structure, active-site shape and enzyme-substrate complex formation.

3. Very plausible experimental sequence

1. Prepare a range of ethanoic acid concentrations using A and distilled water.
2. Label separate test-tubes for each concentration.
3. Use the same volume of yeast, glucose and methylene blue for every treatment.
4. Keep the mixtures at the stated temperature using the water-bath.
5. Start timing at the exact point specified by the question (for example, when the final reactant is added).
6. Stop timing at the stated colour endpoint and record the time.
7. Repeat for the remaining acid concentrations and process the results as instructed.

Do not memorise an addition order: The live paper can control exactly when the reaction starts, so students

should follow the printed sequence rather than using a memorised procedure.

4. Dilution skill students should be ready for

A proportional dilution is highly plausible. One neat pattern that fits the supplied 30 cm³ of 1.0% ethanoic acid and the five empty beakers is shown below. This is an inference, not a guaranteed set of concentrations.

Target acid / %	1.0% A / cm ³	W / cm ³	Total / cm ³
1.0	10	0	10
0.8	8	2	10
0.6	6	4	10
0.4	4	6	10
0.2	2	8	10
0.0	0	10	10

For any proportional dilution, students can use $C_1V_1 = C_2V_2$. Example: to make 10 cm³ of 0.6% acid from 1.0% stock, $V_1 = (0.6 \times 10) / 1.0 = 6.0$ cm³, so use 6.0 cm³ acid + 4.0 cm³ water.

QUESTION 1 - Exam skills and likely evaluation points

5. Results table and processing

A sensible table structure would place units in the headings, not repeatedly in the body:

Ethanoic acid concentration / %	Time for endpoint / s	Rate / s ⁻¹ (if required)

Example: if the endpoint takes 80 s, rate = $1/80 = 0.0125$ s⁻¹.

6. Errors and improvements worth revising

- Colour endpoint is subjective, especially because yeast suspension is cloudy. Improvement: use a colorimeter or compare against a standard endpoint consistently.
- Yeast settles. Improvement: mix the stock suspension in the same way immediately before measuring each aliquot.
- Temperature may drift. Improvement: monitor and maintain the water-bath at the stated temperature; allow tubes to equilibrate before starting if instructed.
- Manual mixing and timing introduce reaction-time variation. Improvement: use the same mixing method and start point for all treatments.
- Repeats improve reliability. Repeat each concentration and calculate a mean, identifying anomalies where appropriate.

7. Best Q1 past papers to practise

Priority	Paper	Why it is relevant	What to practise
1	9700/35 O/N 2014 Q1	Closest overall match: yeast + glucose + methylene blue + warm water-bath.	Methylene-blue endpoint; yeast respiration; dilution; recording observations; errors.
2	9700/33 O/N 2020 Q1	Yeast investigation using proportional dilution, timed colour endpoint, water-bath and bung/delivery system.	Proportional dilution; timed endpoint; tables; errors; respiration rate.
3	9700/34 M/J 2021 Q1	Direct investigation of pH on an enzyme in yeast.	Acidity/pH effects on enzymes; timed method; control; sources of error.
4	9700/35 O/N 2014 Q2(b-c)	Same paper also contains a printed photomicrograph and a plan diagram task.	Useful crossover practice for Q2 as well.

Recommended order: If students have limited time, do 9700/35 O/N 2014 Q1 first, then 9700/33 O/N 2020 Q1, then 9700/34 M/J 2021 Q1.

QUESTION 2 - No microscope: what is most likely?

Strongest prediction: If Cambridge has specifically stated that a microscope will not be provided, the normal slide-observation task cannot be used. A printed photomicrograph is therefore a very plausible replacement, with a large plan diagram drawn directly from the image. The rest of Q2 is likely to test image-based practical skills such as measurement, magnification, scale bars, ratios, percentages and observable comparisons.

1. Likely Q2 structure

- Printed photomicrograph of a transverse or longitudinal section of a plant organ (leaf, root or stem) - although animal tissue is also possible.
- Draw a large plan diagram of the whole section or a specified region.
- Add one ruled label line to identify a named tissue.
- Use a scale bar, stated magnification or printed graticule to calculate an actual size.
- Compare the image with a second photomicrograph and record observable differences in a table.
- Possibly calculate a ratio, percentage area or mean measurement from structures shown on the image.

2. Plan diagram: the marks Cambridge repeatedly awards

Past mark schemes show a very consistent pattern. Students should train themselves to check every item below before moving on:

- Large drawing - use a substantial proportion of the space provided.
- No shading.
- No individual cells in a plan diagram: draw tissue boundaries/outlines only.
- Use single, clear, continuous, thin pencil lines; avoid sketchy or doubled outlines.
- Correct overall shape of the organ/region.
- Correct number and distribution of tissue layers / major regions.

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- Correct proportions: relative thicknesses and diameters matter.
- If vascular tissue is visible, show its correct position and subdivisions only where required by the image.
- Use a ruled label line; make the line touch the correct structure and do not cross other label lines.

Critical distinction: A plan diagram is not a cell drawing. If students start drawing individual cell walls, nuclei or cell contents in a plan diagram, they can lose the mark specifically awarded for "no cells".

3. Calculation skills that may accompany the micrograph

Skill	Core method
Magnification given	actual size = image size / magnification; convert units carefully.
Scale bar given	actual structure size = (measured structure / measured scale bar) x scale-bar value.
Eyepiece/graticule printed	Use the stated calibration or first calculate calibration, then multiply by the number of divisions.
Ratio	Measure both quantities in the same units, divide, then simplify to the requested form.
Percentage area	percentage = (part / total) x 100; Cambridge may provide a grid or an estimated area.

4. Observable comparison questions

Students should describe only features visible in the images. Avoid functional explanations unless the question asks for them. Strong comparison rows use the same feature on both sides, for example:

- vascular bundles: numerous and scattered vs fewer and arranged in a ring
- central region: large vs small
- epidermis: thicker vs thinner
- air spaces: many/large vs few/small
- midrib/organ outline: prominent projection vs relatively flat

QUESTION 2 - Best papers for printed-micrograph plan diagrams

These are the most useful practice questions because the plan diagram itself is based on a printed photomicrograph rather than on the candidate drawing the plan directly from a microscope slide.

Priority	Paper / part	Printed-image task	Why it is useful for 2026
1	9700/32 M/J 2020 Q2(b-c)	Printed transverse leaf photomicrograph -> large plan diagram; compare with second micrograph; calculate actual diameter from magnification.	Best all-round rehearsal for a microscope-free image question: drawing + comparison + calculation.
2	9700/33 O/N 2016 Q2(b-c)	Printed longitudinal root photomicrograph -> large plan diagram; label a tissue; image measurements follow.	Same component (33) and a direct printed-micrograph-to-plan-diagram task.
3	9700/34 M/J 2019 Q2(c-d)	Printed transverse leaf photomicrograph -> whole-leaf	Excellent for proportions, tissue boundaries and image-

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Priority	Paper / part	Printed-image task	Why it is useful for 2026
		plan diagram; graticule calibration used for actual width.	based measurement.
4	9700/35 O/N 2014 Q2(b)(ii)-c	Printed animal-organ photomicrograph -> plan diagram of a projection; compare two images; ratio calculation.	Important because the 2026 image need not necessarily be a plant section.
5	9700/31 O/N 2020 Q2(a)(i)	Printed transverse plant-root photomicrograph -> plan diagram of a specified half/region.	Good practice for following a shaded-region instruction rather than drawing the entire organ.
6	9700/33 M/J 2013 Q2(a)	Printed stem photomicrograph with graticule -> measure tissue layers and complete a proportional plan diagram.	Very good for proportions and using a graticule as a drawing aid.

Best 3-paper set: Do 9700/32 M/J 2020 Q2(b-c), then 9700/33 O/N 2016 Q2(b-c), then 9700/34 M/J 2019 Q2(c-d). Together they cover nearly every skill I would expect from a printed-micrograph Q2.

What the mark schemes specifically confirm

For 9700/33 O/N 2016, the plan-diagram mark scheme awards marks for large size with no shading, no cells, correct outlines and proportions, and a correct label line. For 9700/34 M/J 2019, the same core features recur: minimum size, no shading, no cells, correct whole-leaf shape, correct tissue proportions and a correct epidermis label. For 9700/32 M/J 2020, Cambridge again rewards suitable size/no shading, tissue outlines only, correct proportions and tissue distribution, and the required label.

One-hour Q2 practice drill

8. 15 min: draw one plan diagram from a printed photomicrograph.
9. 10 min: self-check against the plan-diagram checklist above.
10. 10 min: do one scale-bar or magnification calculation.
11. 10 min: write three paired observable differences in a table.
12. 15 min: mark the question and redraw only the parts that lost drawing marks.

FINAL REVISION CHECKLIST

Q1 - Yeast / ethanoic acid / methylene blue

- Proportional dilution using $C_1V_1 = C_2V_2$.
- Preparing a 0% control using distilled water.
- Independent, dependent and controlled variables.
- Methylene blue as a redox indicator in yeast respiration.
- How acidity/pH can affect enzyme activity.
- Timing a colour endpoint and recognising subjectivity as an error.
- Rate = 1/time and correct units.
- Results-table headings and graph conventions.
- Repeats, means, anomalies and practical improvements.

Q2 - Printed photomicrograph

- Large plan diagrams with tissue outlines only - no cells and no shading.
- Correct proportions and distribution of tissues.
- Ruled label lines that touch the correct region.
- Scale-bar calculations and magnification formulae.
- Unit conversion: mm to micrometres (x1000) and vice versa.
- Ratios and percentage calculations.
- Paired observable differences using the same feature in each image.
- Ability to draw a specified sector/half rather than automatically drawing the entire organ.

Bottom line: Q1 is very strongly signposted as a yeast-respiration / ethanoic-acid investigation using methylene blue. With no microscope being supplied, Q2 is very likely to shift the usual microscopy marks onto a printed photomicrograph, especially a plan diagram plus image-based measurement/comparison. Treat these as high-confidence preparation targets, not leaked certainty.

Sources used to verify the past-paper recommendations

- 9700/35 O/N 2014 question paper: [open PDF](#)
- 9700/33 O/N 2020 question paper: [open PDF](#)
- 9700/34 M/J 2021 question paper: [open PDF](#)
- 9700/33 O/N 2016 question paper: [open PDF](#)
- 9700/34 M/J 2019 question paper: [open PDF](#)
- 9700/32 M/J 2020 question paper: [open PDF](#)
- 9700/33 O/N 2016 mark scheme: [open PDF](#)
- 9700/34 M/J 2019 mark scheme: [open PDF](#)
- 9700/32 M/J 2020 mark scheme: [open PDF](#)

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