SUMMER HOMEWORK

BIOLOGY

YR 12 INTO YR 13 TRANSITION BOOKLET

OCR A BIOLOGY A (H420)

Name: _____

BEAL SIXTH FORM

ONE SIXTH FORM - TWO SITES - THREE PATHWAYS

BIOLOGY

This transition work MUST be completed before your first Year 13 Biology lesson. It will be checked and used to identify the knowledge, mathematical and practical skills that need strengthening in September.

The aim is to consolidate Year 12 learning and prepare you for the increased synoptic demand of the full A Level course.

What do you do in your second year?

Exam board: OCR A Biology A (H420). The full A Level has three written papers and a separately reported Practical Endorsement.

Content Overview	Assessment Overview	
Content is split into six teaching modules: • Module 1 – Development of practical skills in biology • Module 2 – Foundations in biology • Module 3 – Exchange and transport • Module 4 – Biodiversity, evolution and disease • Module 5 – Communication, homeostasis and energy • Module 6 – Genetics, evolution and ecosystems All written components include synoptic assessment.	Biological processes (01) 100 marks 2 hours 15 minutes Modules 1, 2, 3 and 5	**37%**
	Biological diversity (02) 100 marks 2 hours 15 minutes Modules 1, 2, 4 and 6	**37%**
	Unified biology (03) 70 marks 1 hour 30 minutes Modules 1 to 6	**26%**
	Practical Endorsement (04) Non-exam assessment Reported separately	**PASS**

At the end of Year 13 you will complete:

- Biological processes: 2 hours 15 minutes, 100 marks, 37%.
- Biological diversity: 2 hours 15 minutes, 100 marks, 37%.
- Unified biology: 1 hour 30 minutes, 70 marks, 26%.
- Practical Endorsement: reported separately; your practical records must be complete.

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Summer Transition Work - ESSENTIAL

1. Open the current OCR A Biology A (H420) specification and read the Module 5 and Module 6 learning outcomes. Use the QR code or the official OCR link below.

OCR A Biology A specification (H420)
Current document used for this booklet: version 4.1 (2026).

2. Complete every First attempt box independently. Do not copy from notes before attempting the question.

3. Check each response using your Year 12 folder, your textbook and the OCR specification. Add corrections and stronger detail in the final column using a different colour.

4. Show full working for calculations, include units and use an appropriate number of significant figures.

5. Bring the completed booklet to your first Biology lesson. It may be used alongside a transition assessment in September.

Summer Transition Work - RECOMMENDED

Read around one biological issue that links to Modules 5 or 6. Suitable sources include Biology Review, New Scientist, Scientific American or a university science-news page. Be prepared to explain the evidence, limitations and wider implications of one article.

Required resources

- Your complete Year 12 Biology folder and practical records.
- A new section or folder for Modules 5 and 6, with dividers.
- Scientific calculator, ruler, pencil and coloured pens for corrections.
- Lab coat for practical work.
- Recommended textbook: OCR AS/A Level Biology A, ISBN 9781447990796, or the school-issued equivalent.

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Summer Plan

OCR A BIOLOGY A
YEAR 12 INTO YEAR 13

This booklet is organised into six weekly sections. Complete the tasks gradually rather than leaving the work until the end of the holiday.

For each task, write what you know in the 'First attempt' column. Then use reliable course materials to correct errors and add precise biological detail in the final column.

The final two pages focus on mathematical, practical and Unified Biology skills. These are essential because all three written papers include synoptic assessment.

Week	Task
1	Year 12 synoptic mastery: Modules 1-4 and practical skills
2	5.1.1-5.1.2: Communication, homeostasis and excretion
3	5.1.3-5.1.5: Neuronal, hormonal, plant and animal responses
4	5.2.1-5.2.2: Photosynthesis and respiration
5	6.1.1-6.1.3: Cellular control, inheritance and manipulating genomes
6	6.2.1-6.3.2: Biotechnology, ecosystems and sustainability

Year 12 Synoptic Mastery

Modules 1-4: foundations, practical skills and data

1. Complete the 'First attempt' column without notes.
2. Use your Year 12 folder, textbook and OCR specification to correct and extend your answer.

WEEK 1

Question	First attempt	Any additional detail?
Compare the ultrastructure of a prokaryotic cell, an animal cell and a plant cell. Include ribosome size, DNA, organelles and cell walls. Explain two pieces of evidence for the endosymbiotic theory.		
A chloroplast is 54 mm long on a micrograph and 5.4 µm long in reality. Calculate the magnification. Then convert 0.035 mm into µm and nm.		
Explain how phospholipids, proteins, glycoproteins and cholesterol give a cell-surface membrane its properties. Predict how increasing temperature affects permeability.		
Explain the induced-fit model. Compare competitive and non-competitive inhibition and predict what happens when substrate concentration is increased.		
Explain why ATP is described as an immediate energy source. Link ATP hydrolysis to active transport, muscle contraction and phosphorylation.		
Plan how a colorimeter and calibration curve could determine the concentration of an unknown reducing-sugar solution. Include serial dilution, blanking, repeats and graph choice.		

Year 12 Synoptic Mastery

Modules 1-4: exchange, transport, immunity and statistics

1. Complete the 'First attempt' column without notes.
2. Use your Year 12 folder, textbook and OCR specification to correct and extend your answer.

WEEK 1

Question	First attempt	Any additional detail?
Explain how surface-area-to-volume ratio affects exchange. Apply this to alveoli, the ileum and plant roots.		
Trace one oxygen molecule from an alveolus to the matrix of a respiring muscle-cell mitochondrion. Include ventilation, diffusion, haemoglobin and tissue fluid.		
At rest, heart rate = 72 beats min-1 and stroke volume = 68 cm3. During exercise the values are 156 and 110. Calculate both cardiac outputs and the percentage increase.		
Compare the cohesion-tension mechanism in xylem with translocation in phloem. Include sources, sinks, hydrostatic pressure and supporting evidence.		
Explain clonal selection and clonal expansion in primary and secondary immune responses. Include T helper cells, B cells, plasma cells and memory cells.		
Select and justify the best test for each: correlation between height and mass; difference between two mean enzyme rates; observed and expected phenotype ratios. State one null hypothesis.		

Communication and Homeostasis

5.1.1: maintaining a stable internal environment

1. Complete the 'First attempt' column without notes.
2. Use your Year 12 folder, textbook and OCR specification to correct and extend your answer.

WEEK 2

Question	First attempt	Any additional detail?
Define homeostasis, stimulus, receptor, coordination centre and effector. Draw a general negative-feedback loop.		
Compare negative feedback with positive feedback. Explain why positive feedback is useful in blood clotting or childbirth but cannot maintain a stable internal environment.		
Explain thermoregulation in an endotherm when core temperature rises. Include receptors, hypothalamus, skin arterioles, sweat glands, muscles and behaviour.		
Explain how an ectotherm regulates temperature using behavioural responses. Predict how cloud cover could affect its activity.		
A patient cools from 39.4°C to 37.0°C in 40 min, then oscillates between 36.7 and 37.3°C. Calculate mean cooling rate and explain the oscillation around the set point.		
Compare signalling between adjacent cells and distant cells. Explain how receptors and complementary signalling molecules produce specificity.		

Excretion and Osmoregulation

5.1.2: the liver, kidney and medical diagnosis

1. Complete the 'First attempt' column without notes.
2. Use your Year 12 folder, textbook and OCR specification to correct and extend your answer.

WEEK 2

Question	First attempt	Any additional detail?
Describe the gross structure and histology of the liver. Explain its roles in glycogen storage, detoxification and converting ammonia to urea.		
Draw and label a nephron, including the renal corpuscle, PCT, loop of Henle, DCT, collecting duct and associated blood vessels.		
Explain ultrafiltration at the glomerulus and selective reabsorption in the proximal convoluted tubule. Link each process to structure.		
Explain how osmoreceptors, the posterior pituitary gland and ADH control blood water potential. Predict urine after dehydration and after drinking excess water.		
Compare haemodialysis and kidney transplantation. Consider frequency, diet, rejection, infection, cost and quality of life.		
A patient's GFR falls from 118 to 42 cm3 min-1. Calculate the percentage decrease. Explain two consequences and why GFR is clinically useful.		

Neuronal Communication

5.1.3: receptors, action potentials and synapses

1. Complete the 'First attempt' column without notes.
2. Use your Year 12 folder, textbook and OCR specification to correct and extend your answer.

WEEK 3

Question	First attempt	Any additional detail?
Explain how a Pacinian corpuscle acts as a transducer. Link membrane deformation to a generator potential and action-potential frequency.		
Compare sensory, relay and motor neurones. Explain how myelination and nodes of Ranvier increase transmission speed.		
Explain how the resting potential is established and maintained. Include the sodium-potassium pump, potassium leak channels and membrane permeability.		
Describe depolarisation, repolarisation and hyperpolarisation. Explain the role of voltage-gated Na+ and K+ channels.		
Explain the all-or-nothing principle, refractory period and how stimulus intensity is encoded by impulse frequency.		
Describe transmission across a cholinergic synapse. Explain temporal and spatial summation and the difference between excitatory and inhibitory synapses.		

Hormonal, Plant and Animal Responses

5.1.4-5.1.5: coordination and response

1. Complete the 'First attempt' column without notes.
2. Use your Year 12 folder, textbook and OCR specification to correct and extend your answer.

WEEK 3

Question	First attempt	Any additional detail?
Compare endocrine and neuronal communication in terms of pathway, speed, duration, specificity and response.		
Describe the adrenal cortex and medulla and the functions of their hormones. Explain how adrenaline coordinates the fight-or-flight response.		
Explain control of insulin secretion in pancreatic beta cells, including potassium channels, depolarisation and calcium channels. Then explain insulin and glucagon action.		
Compare Type 1 and Type 2 diabetes: cause, risk factors and treatment. Evaluate one potential treatment involving stem cells or genetically engineered insulin.		
Explain phototropism, gravitropism, apical dominance, seed germination and stomatal closure using named plant hormones.		
Describe the sliding-filament model. Include sarcomeres, actin, myosin, Ca2+, troponin, tropomyosin, ATP and creatine phosphate.		

Photosynthesis

5.2.1: capturing light energy and fixing carbon

1. Complete the 'First attempt' column without notes.
2. Use your Year 12 folder, textbook and OCR specification to correct and extend your answer.

WEEK 4

Question	First attempt	Any additional detail?
Draw and label a chloroplast. Explain how thylakoid membranes, grana, stroma and chloroplast DNA are adapted for photosynthesis.		
Describe non-cyclic photophosphorylation from light absorption to ATP and reduced NADP formation. Include photolysis and chemiosmosis.		
Compare cyclic and non-cyclic photophosphorylation. State when cyclic photophosphorylation is useful.		
Describe the Calvin cycle. Include carbon fixation by RuBisCO, GP, TP, reduced NADP, ATP and regeneration of RuBP.		
Explain how light intensity, carbon dioxide concentration and temperature interact as limiting factors. Define compensation point.		
Net CO_2 uptake rises from 2.8 to 7.4 μmol m-2 s-1 as light intensity increases. Calculate percentage increase and explain why the graph may plateau.		

Respiration

5.2.2: transferring energy to ATP

1. Complete the 'First attempt' column without notes.
2. Use your Year 12 folder, textbook and OCR specification to correct and extend your answer.

WEEK 4

Question	First attempt	Any additional detail?
Draw and label a mitochondrion. Explain how cristae and the matrix support aerobic respiration.		
Describe glycolysis and the link reaction, including phosphorylation, oxidation, decarboxylation, ATP and reduced NAD.		
Describe the Krebs cycle without naming every intermediate. Explain decarboxylation, dehydrogenation and substrate-level phosphorylation.		
Explain oxidative phosphorylation using electron carriers, proton pumping, oxygen, ATP synthase and chemiosmosis.		
Compare anaerobic respiration in mammals and yeast. Explain why ATP yield is lower than in aerobic respiration.		
A respirometer records 3.6 cm3 O2 consumed and 2.7 cm3 CO2 produced. Calculate RQ, identify the likely substrate and explain the role of a control tube.		

Cellular Control and Inheritance

6.1.1-6.1.2: gene regulation, variation and evolution

1. Complete the 'First attempt' column without notes.
2. Use your Year 12 folder, textbook and OCR specification to correct and extend your answer.

WEEK 5

Question	First attempt	Any additional detail?
Explain how substitution, insertion and deletion mutations can affect a polypeptide. Distinguish silent, missense and frameshift outcomes.		
Explain regulation of the lac operon when lactose is absent and present. Identify the regulator gene, repressor, operator, promoter and structural genes.		
Compare gene-expression control at transcriptional, post-transcriptional and post-translational levels. Include transcription factors, intron removal and cyclic AMP.		
Explain why homeobox genes are highly conserved. Describe the role of Hox genes, mitosis and apoptosis in body-plan development.		
Observed offspring are 86 purple and 34 white; expected ratio is 3:1. Calculate expected numbers and outline a chi-squared test, including the null hypothesis.		
If 1 in 2500 people has a recessive condition, use Hardy-Weinberg equations to calculate q, p and the carrier frequency. Show all working.		

Manipulating Genomes

6.1.3: sequencing, amplification and genetic technology

1. Complete the 'First attempt' column without notes.
2. Use your Year 12 folder, textbook and OCR specification to correct and extend your answer.

WEEK 5

Question	First attempt	Any additional detail?
Explain the principles of Sanger DNA sequencing and how high-throughput sequencing differs. Detailed machinery of high-throughput methods is not required.		
Explain how bioinformatics and genome-wide comparisons contribute to genotype-phenotype research, epidemiology and evolutionary relationships.		
Describe the principles and uses of DNA profiling. Explain why several variable regions are analysed rather than one.		
Explain PCR, including primers, temperature stages, thermostable DNA polymerase and why amplification is exponential.		
Explain electrophoresis of DNA fragments. Predict how fragment size, charge, gel concentration and time affect band position.		
Describe genetic engineering using restriction enzymes, plasmids, DNA ligase and electroporation. Evaluate somatic versus germ-line gene therapy and one ethical issue.		

Cloning and Biotechnology

6.2.1: organisms and enzymes in industrial processes

1. Complete the 'First attempt' column without notes.
2. Use your Year 12 folder, textbook and OCR specification to correct and extend your answer.

WEEK 6

Question	First attempt	Any additional detail?
Compare natural plant cloning, cuttings, tissue culture and micropropagation. Explain advantages and risks of producing genetically uniform crops.		
Explain artificial embryo twinning and somatic cell nuclear transfer. Evaluate uses and concerns surrounding animal cloning.		
Explain why microorganisms are useful in biotechnology. Compare advantages and disadvantages of bacterial and fungal food production.		
Compare batch and continuous fermentation. Explain how temperature, pH, oxygen, nutrients, mixing and aseptic technique affect yield.		
A culture begins with 1.5 × 10^3 cells and undergoes 14 generations. Calculate N using N = N0 × 2^n. Relate this to the phases of a closed-culture growth curve.		
Describe methods of enzyme immobilisation. Evaluate immobilised enzymes for product purity, enzyme reuse, reaction rate and industrial cost.		

Ecosystems and Sustainability

6.3.1-6.3.2: populations, cycles and resource management

1. Complete the 'First attempt' column without notes.
2. Use your Year 12 folder, textbook and OCR specification to correct and extend your answer.

WEEK 6

Question	First attempt	Any additional detail?
Explain why ecosystems are dynamic. Distinguish biotic and abiotic factors and give named examples that could alter population size.		
A herbivore consumes 18 500 kJ of biomass and stores 2 220 kJ. Calculate transfer efficiency. Explain why energy and biomass are lost between trophic levels.		
Describe the nitrogen and carbon cycles. Include decomposers, Nitrosomonas, Nitrobacter, Azotobacter, Rhizobium, respiration and photosynthesis.		
Explain primary succession from pioneer species to climax community and how human activity can cause deflected succession.		
Design a sampling strategy to compare plant distribution along a trampling gradient. Include quadrats, transects, randomisation, repeats and data analysis.		
Explain carrying capacity, predator-prey cycles and competition. Compare conservation with preservation and evaluate sustainable timber or fishery management.		

Mathematical and Practical Skills

A Level Biology challenge activity

Complete each calculation without notes first. Show every step, use units and record answers to an appropriate number of significant figures. Then check and correct your method.

Question	First attempt	Correction / improvement
Prepare 25.0 cm3 of 1.6%, 1.2%, 0.8% and 0.4% glucose from a 2.0% stock. Calculate the stock and water volumes for each solution. Explain one advantage and one limitation of a serial dilution.		
A 25.0 cm3 measuring cylinder has an uncertainty of ±0.5 cm3. Calculate the percentage uncertainty in one reading. Explain how the uncertainty changes if 5.0 cm3 is measured instead.		
Two enzyme treatments have means of 18.4 ± 1.1 and 21.0 ± 4.8 arbitrary units (mean ± SD). Compare precision and overlap. State whether the data alone prove a significant difference.		
A bacterial culture begins with 3.2 × 10^4 cells and undergoes 11 generations. Use N = N0 × 2^n to calculate the final population. Express the answer in standard form.		
A tangent to a product-time graph passes through (40 s, 1.8 cm3) and (100 s, 5.7 cm3). Calculate the instantaneous rate and state the correct units. Explain why an initial rate is often preferred.		
Plan an investigation into the effect of auxin concentration on mean root length. Include a suitable range, serial dilution, control variables, repeats, randomisation, risk management, graph and statistical test.		

Unified Biology Challenge

Synoptic data analysis and reflection

Researchers compared two maize varieties after 14 days under well-watered and drought conditions. Mean values are shown below.

Variety / condition	Leaf ABA (ng g-1)	Stomatal conductance (mmol m-2 s-1)	Net photosynthesis (µmol m-2 s-1)	Dry biomass (g)
A / watered	18	310	22.4	14.8
A / drought	74	118	9.1	8.5
B / watered	20	298	21.9	14.5
B / drought	61	176	13.8	11.9

Question	First attempt	Any additional detail?
Calculate the percentage decrease in dry biomass for each variety during drought. Which variety appears more drought tolerant?		
Use the data and your biological knowledge to explain the relationship between ABA concentration, stomatal conductance, transpiration and photosynthesis.		
Suggest two physiological or biochemical adaptations that could allow variety B to maintain a higher biomass. Link each suggestion to a named process from Modules 2-5.		
Evaluate this investigation. Suggest improvements, identify an appropriate statistical test and state a suitable null hypothesis.		
Extended response: Evaluate whether genetically engineering crops for drought tolerance is likely to be a more sustainable strategy than increasing irrigation. Include biological, economic, social and ethical considerations.		

Completion and reflection

My strongest Year 12 area is:	
The area I most need to revisit is:	
My specific Year 13 target is:	