

PRACTICE WORKSHEET + FULL ANSWER KEY

Cells, inheritance and evidence

Senior secondary biology. Work through the sections in order, or choose the one that matches this week's topic.

QUESTIONS	SECTIONS	ANSWER KEY	WORKING SPACE
104	10	At the back	Ruled

Name _____ Class _____ Date _____

Before you start

Biological explanations connect a structure or process to its function. Use the question's evidence and distinguish a mechanism from a simple description of a pattern.

WORKED EXAMPLE

Two heterozygous parents have genotype Bb. What is the chance of bb offspring?

- Each parent can pass B or b.
- The combinations are BB, Bb, Bb and bb.
- One of four combinations is bb: probability 1/4 for each offspring under this model.

Use this method as your model. Set out your own working the same way.

Common mistakes to avoid

- Assuming dominant means common
- Changing more than one experimental variable at once

There are 104 questions across 10 sections. Write in the ruled space, then mark your work against the answer key at the back. Topics covered: Cell processes, Genetic crosses, Experimental design.

SECTION A Cells and transport

Link every structure to its function, and name the process that moves the substance.

1

State a function of the cell membrane.

2

State the function of mitochondria.

3

State the function of the nucleus.

4

Name two structures found in a plant cell but not an animal cell.

5

Define diffusion.

6

Define osmosis.

7

Define active transport and give one difference from diffusion.

8

Explain why root hair cells have a large surface area.

9

Predict what happens to a plant cell placed in a very dilute solution.

10

Predict what happens to a red blood cell placed in pure water.

11

Explain why large organisms need transport systems.

SECTION B Energy and body systems*Write balanced equations where you can, and name the enzyme or organ involved.*

12

Write the balanced equation for aerobic respiration.

13

State two differences between aerobic and anaerobic respiration in humans.

14

Write the balanced equation for photosynthesis.

15

Name the independent variable when testing how light intensity affects photosynthesis.

16

Name one limiting factor of photosynthesis other than light.

17

Explain why enzyme activity falls above the optimum temperature.

18

Name the enzyme that breaks down starch and state its product.

19

Explain how alveoli are adapted for gas exchange.

20

State one role of the liver.

21

Explain how insulin lowers blood glucose.

22

Define homeostasis and give one example.

SECTION C Genetics and inheritance*Draw a Punnett square before you state a probability, and use the correct genetic terms.*

23

Two heterozygous parents have genotype Bb. Find the chance of bb offspring.

24

For a Bb × bb cross, find the expected proportion of bb offspring.

25

Define genotype and phenotype.

26

Explain why dominant does not mean common.

27

Complete a Punnett square for Aa × Aa and give the phenotype ratio.

28

Both parents carry a recessive condition. Find the chance that a child is a carrier.

29

State the number of chromosomes in a human body cell and in a gamete.

30

Name the type of cell division that produces gametes.

31

State one difference between mitosis and meiosis.

32

Define an allele.

33

Explain how sex is determined in humans.

SECTION D Ecology and evolution

Explain a mechanism, not just a pattern, and say what the evidence shows.

34 Define a population and a community.

35 Explain why energy transfer between trophic levels is inefficient.

36 Name the independent variable in a study of light intensity and plant distribution.

37 Describe how a quadrat is used to estimate abundance.

38 Explain why quadrats should be placed randomly.

39 Explain natural selection in four steps.

40 Explain why antibiotic resistance spreads in a bacterial population.

41 Explain why an antibiotic will not treat a viral infection.

42 State one role of decomposers in a nutrient cycle.

43 Name two human activities that reduce biodiversity.

44 Explain one piece of evidence for evolution.

SECTION E Experimental design and evidence

Name the variable, the control and the limitation for every investigation you describe.

45 Why should an experiment include repeats?

46 Explain the purpose of a control group.

47 Name one variable to control when investigating enzyme activity and pH.

48 Explain why changing two variables at once weakens a conclusion.

49 A student records 4.2, 4.1, 4.3 and 8.9 cm³. Identify the anomaly and say what to do.

50 Explain why a sample of five plants may be insufficient.

51 Define a placebo and explain its purpose.

52 Explain why ethical approval matters in human studies.

53 Explain the difference between correlation and causation in biology.

54 Write a conclusion for data where photosynthesis rate rises then levels off with light intensity.

SECTION F Enzymes and digestion

Name the enzyme, its substrate and its product, then state the conditions it needs.

55 Define an enzyme.

56 Explain the lock-and-key model.

57 State the effect of pH on enzyme activity.

58 Name the enzyme that digests protein and state its product.

59 Name the enzyme that digests fat and state its products.

60

State two roles of bile in digestion.

61

Name the organ where most absorption happens and give one adaptation.

62

Explain why the stomach is acidic.

63

Describe the test for starch and its positive result.

64

Describe the test for glucose and its positive result.

SECTION G Nervous system, hormones and response

Trace the pathway from stimulus to response and name each component.

65

Name the parts of a reflex arc in order.

66

Explain why a reflex is fast.

67

Name the gap between two neurones and explain how a signal crosses it.

68

Name the hormone that lowers blood glucose and where it is made.

69

Name the hormone released in a stressful situation and give one effect.

70

Explain negative feedback with one example.

71

State two differences between nervous and hormonal responses.

72

Name the part of the brain that coordinates balance and movement.

73

Explain how the body responds to being too cold.

74

Name the organ that regulates the body's water balance.

SECTION H Microbes, disease and immunity

Separate the pathogen, the defence and the way spread is prevented.

75 Name four types of pathogen.

76 Explain three ways white blood cells defend the body.

77 Define an antigen.

78 Explain how a vaccine produces immunity.

79 Explain what herd immunity means.

80 Name one way to reduce the spread of a communicable disease.

81 Explain why an antibiotic course should be finished.

82 Name one non-communicable disease and one risk factor for it.

83 Explain the role of the skin in defence.

84 Distinguish between a communicable and a non-communicable disease.

SECTION I Plant biology and transport

Explain the mechanism, not just the name of the tissue.

85 Name the tissue that transports water in a plant.

86 Name the tissue that transports dissolved sugars.

87 Define transpiration.

88 Name two factors that increase the rate of transpiration.

89 State the function of stomata and of guard cells.

90

Explain why a wilting plant recovers after watering.

91

Name the mineral needed for chlorophyll and the symptom of its deficiency.

92

Name the mineral needed for protein synthesis in plants.

93

Describe an experiment showing that light is needed for photosynthesis.

94

Explain why a leaf is broad and thin.

SECTION J Mixed review and data analysis

Describe the pattern, then explain the biology that causes it.

95

A graph shows enzyme activity peaking at 40 °C. Explain the shape.

96

A student counts 8 bubbles per minute at 10 cm from a lamp and 2 at 20 cm. Explain.

97

State that relationship using the inverse square law.

98

Convert 0.5 mm to micrometres.

99

A cell image is 50 mm wide at 500 times magnification. Find the real width.

100

State the magnification formula.

101

Explain why results should be recorded to a consistent number of decimal places.

102

Explain why a biological experiment should state its temperature.

103

A study finds coffee drinkers live longer. State one limitation.

104

Write a hypothesis for an investigation into fertiliser and plant growth.

Answer key

Work each section before you check it. These are model answers: an equivalent method, or a different well-supported interpretation, can be just as correct.

SECTION A - CELLS AND TRANSPORT

1. It controls which substances enter and leave the cell.
2. They are the site of aerobic respiration, releasing energy as ATP.
3. It contains DNA and controls the cell's activities.
4. A cell wall and chloroplasts; a large permanent vacuole also counts.
5. The net movement of particles from a higher to a lower concentration, down a concentration gradient.
6. The net movement of water across a partially permeable membrane, from a dilute to a more concentrated solution.
7. Movement against a concentration gradient using energy from respiration; diffusion is passive.
8. It increases the rate of water and mineral uptake.
9. Water enters by osmosis and the cell becomes turgid; the cell wall prevents it bursting.
10. Water enters by osmosis and the cell may burst, because it has no cell wall.
11. Their surface area to volume ratio is too small for diffusion alone to supply every cell quickly enough.

SECTION B - ENERGY AND BODY SYSTEMS

12. $C_6H_{12}O_6 + 6O_2 \rightarrow 6CO_2 + 6H_2O$.
13. Aerobic respiration uses oxygen and releases much more energy; anaerobic respiration produces lactate and releases less.
14. $6CO_2 + 6H_2O \rightarrow C_6H_{12}O_6 + 6O_2$.
15. Light intensity.
16. Carbon dioxide concentration, or temperature.
17. The active site changes shape as the enzyme denatures, so fewer substrate molecules can bind.
18. Amylase; it produces maltose, which is later broken down to glucose.
19. A large surface area, thin walls, a moist surface and a rich blood supply maintain a steep diffusion gradient.
20. For example processing absorbed nutrients, breaking down toxins, or producing bile.
21. It causes cells, particularly liver and muscle cells, to take up glucose and store it as glycogen.
22. Maintaining a stable internal environment, for example regulating body temperature.

SECTION C - GENETICS AND INHERITANCE

23. 1/4 for each offspring.
24. 1/2.

25. Genotype is the combination of alleles; phenotype is the observable characteristic.
26. Dominance describes how alleles interact in a heterozygote, not how frequent an allele is in a population.
27. Genotypes 1 AA : 2 Aa : 1 aa, giving a 3:1 phenotype ratio.
28. 1/2.
29. 46 in a body cell and 23 in a gamete.
30. Meiosis.
31. Mitosis produces two genetically identical diploid cells; meiosis produces four genetically varied haploid cells.
32. A different version of the same gene.
33. XX gives female and XY gives male; the sperm carries either an X or a Y chromosome.

SECTION D - ECOLOGY AND EVOLUTION

34. A population is one species in an area; a community is all the populations living there.
35. Energy is lost through respiration, movement, heat and undigested material.
36. Light intensity.
37. Place quadrats randomly, count the species in each, find the mean per quadrat and scale up to the total area.
38. It reduces bias, so the sample better represents the whole area.
39. Variation exists; some variants survive better in that environment; survivors reproduce; the advantageous alleles become more common over generations.
40. Resistant bacteria survive treatment and reproduce, so the resistance allele becomes more common.
41. Antibiotics target bacterial structures and processes that viruses do not have.
42. They break down dead material and return mineral nutrients to the soil.
43. For example deforestation and pollution; over-harvesting also counts.
44. For example the fossil record shows change over time, and DNA similarity indicates shared ancestry.

SECTION E - EXPERIMENTAL DESIGN AND EVIDENCE

45. To judge variability and reduce the effect of a single unusual measurement.
46. It gives a comparison in which the independent variable is not applied, so any effect can be attributed to that variable.
47. For example temperature, enzyme concentration or substrate concentration.

- 48. You cannot tell which of the two changes caused the effect.
- 49. 8.9 cm^3 is anomalous; check the method, repeat the measurement and exclude it from the mean with a stated reason.
- 50. Natural variation between individuals can dominate the result, making the mean unreliable.
- 51. A treatment with no active ingredient, used to separate the effect of expectation from the effect of the treatment.
- 52. Participants must give informed consent, be protected from harm and be free to withdraw.
- 53. Correlation shows two variables changing together; causation requires a controlled test and a plausible mechanism.
- 54. The rate increased with light intensity until another factor became limiting, after which extra light gave no further increase.

SECTION F - ENZYMES AND DIGESTION

- 55. A biological catalyst, usually a protein, that speeds up a reaction without being used up.
- 56. The substrate fits the enzyme's active site, which has a complementary shape.
- 57. Each enzyme has an optimum pH; away from it the active site changes shape and activity falls.
- 58. Protease; it produces amino acids.
- 59. Lipase; it produces fatty acids and glycerol.
- 60. It emulsifies fats into small droplets to increase surface area, and it neutralises stomach acid.
- 61. The small intestine; villi give a very large surface area.
- 62. The acid kills many microbes and gives protease its optimum pH.
- 63. Add iodine solution; it turns blue-black.
- 64. Heat with Benedict's solution; it turns from blue to brick red.

SECTION G - NERVOUS SYSTEM, HORMONES AND RESPONSE

- 65. Stimulus, receptor, sensory neurone, relay neurone, motor neurone, effector, response.
- 66. It does not need conscious processing by the brain.
- 67. The synapse; a neurotransmitter diffuses across it.
- 68. Insulin, made in the pancreas.
- 69. Adrenaline; it raises heart rate.
- 70. A change triggers a response that reverses it, for example sweating when body temperature rises.
- 71. Nervous responses are fast and short-lived; hormonal responses are slower and longer-lasting.
- 72. The cerebellum.
- 73. Blood vessels constrict, shivering generates heat and hairs stand up to trap a layer of air.
- 74. The kidney.

SECTION H - MICROBES, DISEASE AND IMMUNITY

- 75. Bacteria, viruses, fungi and protists.
- 76. They engulf pathogens, produce antibodies and produce antitoxins.
- 77. A molecule on the surface of a pathogen that the immune system recognises.
- 78. It introduces a harmless form of the antigen, so memory cells form and respond quickly to a later infection.
- 79. When enough of a population is immune the pathogen cannot spread easily, which protects those who are not immune.
- 80. Hand washing, isolating infected people, or vaccination.
- 81. Stopping early can leave the more resistant bacteria alive to multiply.
- 82. For example type 2 diabetes, with obesity as a risk factor.
- 83. It forms a physical barrier and produces antimicrobial secretions.
- 84. A communicable disease can pass from one organism to another; a non-communicable one cannot.

SECTION I - PLANT BIOLOGY AND TRANSPORT

- 85. Xylem.
- 86. Phloem.
- 87. The loss of water vapour from a plant's leaves, mainly through the stomata.
- 88. Higher temperature, more wind, lower humidity or brighter light.
- 89. Stomata allow gas exchange; guard cells open and close them to control water loss.
- 90. Water enters by osmosis and the cells become turgid again, supporting the plant.
- 91. Magnesium; without it leaves turn yellow, called chlorosis.
- 92. Nitrate.
- 93. Destarch a plant, cover part of a leaf, leave it in light, then test with iodine; only the exposed part turns blue-black.
- 94. A broad surface captures more light and a thin leaf gives a short diffusion path for gases.

SECTION J - MIXED REVIEW AND DATA ANALYSIS

- 95. Activity rises with temperature as collisions increase, then falls sharply as the enzyme denatures.
- 96. Light intensity falls with distance, so the rate of photosynthesis falls.
- 97. Intensity is proportional to $1/d^2$, so doubling the distance quarters the intensity.
- 98. 500 micrometres.
- 99. 0.1 mm, which is 100 micrometres.
- 100. Magnification = image size divided by actual size.

- 101.** It reflects the precision of the instrument and makes comparison fair.
- 102.** Temperature affects reaction and metabolic rates, so it must be controlled and reported.
- 103.** It is observational, so confounding factors such as income or activity could explain the pattern.
- 104.** For example: plants given nitrate fertiliser will grow taller than untreated plants over four weeks.

Review and next steps

Mark your work against the answer key, record your score for each section, then answer the three questions below. Bring this page to your next lesson so your tutor can start from what actually blocked you.

Which question did you find hardest, and what exactly stopped you?

Rewrite the corrected working for that question here.

Which section do you want to practise again before your next lesson?

Score record

SECTION	QUESTIONS	NUMBER CORRECT	PRACTISE AGAIN?
A. Cells and transport	11		
B. Energy and body systems	11		
C. Genetics and inheritance	11		
D. Ecology and evolution	11		
E. Experimental design and evidence	10		
F. Enzymes and digestion	10		
G. Nervous system, hormones and response	10		
H. Microbes, disease and immunity	10		
I. Plant biology and transport	10		
J. Mixed review and data analysis	10		
Total	104		

Keep going with one-to-one support.

This is an original Noble Educators topic sample, not a complete syllabus and not an official exam paper. Check the topic, level and any required methods with your school or tutor.

Book a free demo lesson at nobleeducators.com/contact