# cookie

## Practice paper: mark scheme

# GCSE Biology Higher, practice paper 2 (AQA style)

In the style of AQA GCSE Biology (8461) Paper 2 Higher

Practice paper written by cookie in the style of AQA GCSE Biology (8461) Paper 2 Higher. Not an AQA paper; not affiliated with or endorsed by AQA.

This mark scheme was written by cookie with its practice paper. Each row gives the answer, the marks and how they are given; where an answer is worded differently but means the same, give the mark.

**Key**

- Each line is one marking point, worth one mark unless it says otherwise.
- allow an answer that is also acceptable; do not accept an answer that gets no mark; ignore words that neither gain nor lose the mark
- Extended responses (6 marks) are marked by level: decide the level from the descriptors, then the mark within it.

**Do it online, timed and marked:**
cookie.education/past-papers/gcse/cookie/biology-aqa-style

| Question | Answer and marking | Marks |
|---|---|---|
| **01.1** | **Answer: D**<br>D (synapse)<br>*Do not accept more than one letter.* | **1** |
| **01.2** | **Answer: A receptor in the skin detects the heat; impulses pass along a sensory neurone to the spinal cord (CNS), across a synapse to a relay neurone, then to a motor neurone, which carries impulses to the effector (a muscle), which contracts.**<br>receptor (in the skin) detects the stimulus / heat<br>impulse travels along a sensory neurone to the spinal cord / CNS<br>(impulse passes) through a relay neurone (in the spinal cord)<br>(impulse passes) along a motor neurone to an effector / muscle<br>the muscle contracts (to move the hand away)<br>any three for 3 marks<br>*The neurones must be in the correct order for full marks. Allow 'chemicals diffuse across the synapse' as an extra detail but it does not replace a point. Do not accept 'the brain decides to move the hand'.* | **3** |
| **01.3** | **Answer: 26 cm**<br>26 (cm) | **1** |
| **01.4** | **Answer: 13 cm**<br>(12 + 15 + 11 + 14) ÷ 4 (1)<br>= 13 (cm) (1)<br>*An answer of 13 or 13.0 scores 2 marks. An answer of 15.6 (all five results included) scores 1 mark. Allow an anomalous result carried forward from 01.3 only if a single result is left out and the mean of the other four is correct.* | **2** |
| **01.5** | **Answer: The ciliary muscles contract, the suspensory ligaments loosen, so the lens becomes thicker (more curved) and refracts light more strongly.**<br>ciliary muscles contract (1)<br>suspensory ligaments loosen / slacken (1)<br>lens becomes thicker / more rounded and refracts light (rays) more (strongly) (1)<br>*Do not accept 'the ciliary muscles relax' or 'the lens gets thinner'. Ignore references to the iris or pupil. Allow 'lens bends light more' for refracts light more.* | **3** |
| **02.1** | **Answer: D**<br>D (thyroid gland)<br>*Do not accept more than one letter.* | **1** |
| **02.2** | **Answer: The pancreas detects the rise and releases insulin into the blood; insulin causes glucose to move from the blood into cells; in liver and muscle cells excess glucose is converted to glycogen for storage.**<br>the pancreas (monitors and) releases insulin (1)<br>insulin causes glucose to move from the blood into the (body) cells (1)<br>in liver and muscle cells excess glucose is converted to glycogen (for storage) (1)<br>*Do not accept 'insulin converts glucose into glycogen' for the second mark unless it is clear that cells take up glucose. Do not accept 'glucagon' for the first mark. Do not accept 'glycogen is made in the pancreas'.* | **3** |

**02.3** **Answer: The pancreas releases glucagon; glucagon causes glycogen (in the liver) to be converted into glucose, which is released into the blood.** **2**

the pancreas releases glucagon (1)
(glucagon causes) glycogen to be converted into glucose which is released into the blood (1)
*Do not accept glucogen or glycagon for glucagon (spelling must not be confused with glycogen). Do not accept 'insulin is released'.*

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**02.4** **Answer: Cause: in Type 1 the pancreas does not produce enough insulin; in Type 2 the body cells no longer respond to insulin. Treatment: Type 1 is treated with insulin injections; Type 2 is treated with a carbohydrate-controlled diet and exercise.** **2**

cause: Type 1 – the pancreas fails to produce (sufficient) insulin, whereas Type 2 – the body cells no longer respond to insulin (1)
treatment: Type 1 – insulin injections, whereas Type 2 – a carbohydrate-controlled diet and an exercise regime (1)
*Each mark needs both sides of the comparison, or one side with a clear comparative. Allow 'Type 2 is linked to obesity' as a risk factor only if the cause is also given. Allow medication / drugs for Type 2 treatment.*

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**02.5** **Answer: 28.1%** **2**

(4100 − 3200) ÷ 3200 × 100 or 900 ÷ 3200 × 100 (1)
= 28.1 (%) (1)
*An answer of 28.1 scores 2 marks. 28.125 or 28.13 scores 1 mark (not 3 significant figures). An answer of 22.0 (900 ÷ 4100 × 100) scores 0.*

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**03.1** **Answer: C** **1**

C (liver)
*Do not accept more than one letter.*

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**03.2** **Answer: Blood is filtered in the kidney; all the glucose, some ions and the water the body needs are selectively reabsorbed into the blood; urea, excess ions and excess water are released as urine.** **3**

(the kidney) filters the blood (1)
selective reabsorption of (all) glucose, some ions and (as much) water (as needed) (1)
urea / excess ions / excess water are released as urine (1)
*Allow 'filtration' for the first mark. The second mark needs at least glucose plus one of ions or water. Do not accept 'the kidney makes urea'.*

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**03.3** **Answer: The brain detects that the blood is too concentrated; the pituitary gland releases more ADH into the blood; ADH makes the kidney tubules more permeable so more water is reabsorbed back into the blood, giving a smaller volume of more concentrated urine.** **3**

the brain detects that the (water concentration of the) blood is too low / the blood is too concentrated
the pituitary gland releases more ADH (into the blood)
ADH makes the kidney tubules more permeable to water
so more water is reabsorbed (from the kidney tubules) back into the blood
(so) a smaller volume of more concentrated urine is produced
any three for 3 marks
*Allow hypothalamus for brain. Do not accept 'ADH is released by the kidney' or*

*'ADH is released by the brain' for the pituitary mark. Allow 'this is negative feedback' as context only.*

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**03.4** **Answer: 1440 $cm^3$** **2**

180 × 0.008 or 180 × (100 − 99.2) ÷ 100 = 1.44 ($dm^3$) (1)

= 1440 ($cm^3$) (1)

*An answer of 1440 scores 2 marks. An answer of 1.44 (not converted) scores 1 mark. 178.56 (the volume reabsorbed) scores 0.*

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**04.1** **Answer: B** **1**

B (LH)

*Do not accept more than one letter.*

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**04.2** **Answer: The pituitary gland; FSH causes an egg to mature in the ovary (and stimulates the ovaries to produce oestrogen).** **2**

pituitary (gland) (1)

causes maturation of an egg (in the ovary) / stimulates the ovaries to produce oestrogen (1)

*Do not accept 'causes the release of an egg' (that is LH). Allow 'egg develops in the ovary'.*

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**04.3** **Answer: The implant releases progesterone slowly over months or years, which inhibits the maturation and release of eggs.** **2**

the implant releases progesterone slowly / over a long time (months or years) (1)

(progesterone) inhibits the maturation and / or release of eggs (1)

*Allow 'stops ovulation' for the second mark. Allow 'thickens the mucus at the cervix so sperm cannot reach the egg' for the second mark. Do not accept 'kills sperm'.*

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**04.4** **Answer: 325** **2**

2500 × 13 ÷ 100 or 25 × 13 (1)

= 325 (1)

*An answer of 325 scores 2 marks. Do not accept a decimal number of women.*

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**04.5** **Answer: The mother is given FSH and LH to make several eggs mature; the eggs are collected and fertilised by the father's sperm in the laboratory; the fertilised eggs develop into embryos; one or two embryos are inserted into the mother's uterus. IVF gives infertile couples a chance of their own child, but success rates are not high, it is emotionally and physically stressful and expensive, multiple births are a risk and unused embryos raise ethical issues.** **6**

Level 3 (5–6 marks): A detailed and coherent description of the main steps of IVF in a logical order, and a balanced evaluation that gives both advantages and disadvantages.

Level 2 (3–4 marks): Some correct steps of IVF are described, with at least one advantage or disadvantage given; the description may lack detail or be out of order, or the evaluation may be one-sided.

Level 1 (1–2 marks): Simple statements about IVF, or only advantages or disadvantages given, with little or no description of the process.

0 marks: No relevant content.

Indicative content:

the mother is given FSH and LH (hormones) to stimulate the maturation of several eggs

the eggs are collected from the mother
the eggs are fertilised by sperm from the father in the laboratory
the fertilised eggs develop into embryos
at the stage when they are tiny balls of cells, one or two embryos are inserted into the mother's uterus (womb)
advantage: allows an infertile couple to have a baby that is genetically their own
advantage: embryos can be screened for some genetic disorders before they are inserted
disadvantage: it is very emotionally and physically stressful
disadvantage: success rates are not high
disadvantage: it can lead to multiple births, which are a risk to both the babies and the mother
disadvantage: it is expensive
disadvantage: ethical issues, e.g. what happens to unused embryos
*To reach Level 3 the answer must describe giving hormones, fertilisation outside the body and inserting embryos into the uterus, and give at least one advantage and one disadvantage. Do not accept 'the baby grows in a test tube'.*

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**05.1** **Answer: B** **1**

B (ethene)
*Do not accept more than one letter.*

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**05.2** **Answer: To end seed dormancy (or to promote flowering, or to increase fruit size).** **1**

end seed dormancy / promote flowering / increase fruit size
*Allow 'make seeds germinate'. Do not accept 'weedkiller' or 'rooting powder' (auxin uses).*

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**05.3** **Answer: Auxin moves to (collects on) the shaded side of the shoot; auxin stimulates cell elongation in shoots; so cells on the shaded side elongate more and the shoot bends towards the light.** **3**

auxin moves to / is more concentrated on the shaded side (of the shoot) (1)
(in shoots) auxin stimulates cell elongation / growth (1)
cells on the shaded side elongate / grow more (than the lit side) so the shoot bends towards the light (1)
*Do not accept 'auxin is destroyed by light'. Do not accept 'cells divide more' for elongation. Ignore 'phototropism' on its own.*

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**05.4** **Answer: Auxin collects on the lower side of the root because of gravity; auxin inhibits elongation, so the lower side grows less than the upper side and the root bends downwards.** **2**

(due to gravity) auxin collects on the lower side of the root (1)
cells on the lower side elongate less / upper side elongates more, so the root bends down (1)
*Allow 'gravitropism' or 'geotropism' as context only. Do not accept 'cells on the lower side grow more'.*

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**05.5** **Answer: 22.2 mm** **2**

increases 20, 23, 22, 26, 20 or (130 − 19) or 26.0 − 3.8 (1)
mean = 111 ÷ 5 = 22.2 (mm) (1)
*An answer of 22.2 scores 2 marks. An answer of 26 or 26.0 (the mean length on day 5) scores 0.*

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**06.1** **Answer: A** **1**

A (23)

*Do not accept more than one letter.*

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**06.2** **Answer: Meiosis produces four daughter cells, mitosis two; cells from meiosis have half the number of chromosomes; cells from meiosis are genetically different from each other.** **2**

meiosis produces four (daughter) cells, mitosis produces two

meiosis halves the chromosome number / cells have a single set of chromosomes, mitosis keeps the full number

cells produced by meiosis are genetically different, mitosis produces genetically identical cells

meiosis has two divisions, mitosis one

meiosis produces gametes, mitosis produces body cells (for growth / repair)

any two for 2 marks

*Each difference must be a comparison or clearly imply one. Do not accept 'meiosis makes sex cells and mitosis makes clones' unless the meaning is clear.*

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**06.3** **Answer: 0.25 (25%, 1 in 4)** **3**

gametes from each parent F and f (1)

offspring genotypes FF, Ff, Ff, ff (1)

probability = 0.25 / 25% / 1 in 4 / 1/4 (1)

*Allow a genetic diagram other than a Punnett square. Do not accept 1 : 3 or 1 : 4 as a probability. Allow the probability mark ft from an incorrect set of offspring genotypes.*

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**06.4** **Answer: For: it prevents a child being born with (and suffering from) cystic fibrosis. Against: embryos that are destroyed could have developed into a baby / it is expensive / it could lead to people choosing characteristics of their children.** **2**

for: prevents suffering / a child being born with the disorder / reduces costs of treating the disorder (1)

against: destroys embryos / embryos have a right to life / expensive / could lead to designer babies / implies people with the disorder are less valued (1)

*Ignore 'it is unnatural' unless explained. Do not accept 'it cures cystic fibrosis'.*

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**06.5** **Answer: 0.5 (50%, 1 in 2)** **1**

0.5 / 50% / 1 in 2 / 1/2

*Do not accept 1 : 1 or 1 : 2 or 25%.*

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**06.6** **Answer: It helps scientists find genes linked to diseases (and understand and treat inherited disorders).** **1**

search for genes linked to different types of disease / understand and treat inherited disorders

*Allow 'to develop new treatments for genetic disorders'. Ignore 'tracing human migration' (not medicine).*

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**07.1** **Answer: A** **1**

A (Archaea)

*Do not accept more than one letter.*

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**07.2** **Answer: Rosa** **1**

Rosa

*Do not accept canina or Rosa canina.*

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**07.3** **Answer: A random mutation gives some bacteria resistance; the antibiotic kills the bacteria that are not resistant; resistant bacteria survive and reproduce, passing on the allele, so the resistant strain increases and spreads. Doctors should not prescribe antibiotics inappropriately, patients should complete the course, and the use of antibiotics in farming should be restricted.** **6**

Level 3 (5–6 marks): A clear, logically linked explanation of how resistance develops by natural selection, including mutation, survival and reproduction, and at least two correct ways to slow the development of resistant strains.
Level 2 (3–4 marks): Some steps of natural selection are given, though links may be missing, and at least one way to slow the development of resistant strains; or a full explanation of natural selection with no ways to slow it.
Level 1 (1–2 marks): Simple relevant statements, e.g. 'bacteria mutate' or 'don't take too many antibiotics', with little or no linking.
0 marks: No relevant content.
Indicative content:
bacteria reproduce rapidly
a (random) mutation in a gene of a bacterium
produces a bacterium that is resistant to the antibiotic
when the antibiotic is used, the non-resistant bacteria are killed
the resistant bacteria survive and reproduce
the allele / gene for resistance is passed on to the offspring
so the population of the resistant strain rises (natural selection)
the resistant strain spreads because people are not immune to it and there is no effective treatment
e.g. MRSA
doctors should not prescribe antibiotics inappropriately, e.g. for non-serious or viral infections
patients should complete their course of antibiotics so all the bacteria are killed and none survive to mutate and form resistant strains
the agricultural use of antibiotics should be restricted
develop new antibiotics (slows the problem but does not stop resistance developing)
*Do not accept 'the bacteria become immune' or 'the antibiotic causes the mutation' as part of a Level 3 answer. Ignore references to vaccination unless linked to fewer infections and so less antibiotic use.*

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**07.4** **Answer: 50%** **2**

(1860 − 1240) ÷ 1240 × 100 or 620 ÷ 1240 × 100 (1)
= 50 (%) (1)
*An answer of 50 scores 2 marks. An answer of 33.3 (620 ÷ 1860 × 100) scores 0.*

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**07.5** **Answer: Early forms of life were soft-bodied, so they left few traces behind (and traces were destroyed by geological activity).** **1**

early forms of life were soft-bodied (so left few traces) / traces have been destroyed by geological activity
*Allow 'they had no bones or shells'. Ignore 'they were too long ago' on its own.*

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**07.6** **Answer: The human insulin gene is cut out using enzymes; a plasmid is cut with the same enzyme; the gene is inserted into the plasmid (vector); the plasmid is put into a bacterium, which is grown in large numbers and makes insulin.** **3**

the (human) insulin gene is cut out (of a chromosome) using enzymes
a plasmid / vector is cut open (with the same enzyme)
the insulin gene is inserted into the plasmid / vector
the plasmid / vector is inserted into a bacterium
the bacteria are grown / reproduce (in a fermenter) and produce insulin
any three for 3 marks
*Allow 'restriction enzymes' and 'ligase'. Allow virus as a vector. Do not accept 'the insulin is inserted into the bacterium' for the gene.*

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**08.1** **Answer: B** **1**

B (light intensity)
*Do not accept more than one letter.*

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**08.2** **Answer: Divide the field into a grid and use random numbers as coordinates to place each quadrat; count the daisies inside each quadrat; use a large number of quadrats and calculate the mean.** **3**

place quadrats at random (1)
e.g. using a random number generator to give coordinates on a grid (1)
count the number of daisies in each quadrat / use a large number of quadrats and calculate a mean (1)
*Do not accept 'throw the quadrat over your shoulder' for the method of randomising, but it may score the first mark. Allow 'decide in advance how to count plants on the edge of the quadrat' for the third mark.*

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**08.3** **Answer: 73 600** **3**

mean = 46 ÷ 10 = 4.6 (per quadrat) (1)
4.6 ÷ 0.25 = 18.4 (per $m^2$) or 4000 ÷ 0.25 = 16 000 (quadrats in the field) (1)
18.4 × 4000 = 73 600 (1)
*An answer of 73 600 scores 3 marks. Allow 18 400 (mean × 4000, area of quadrat not used) for 2 marks. Allow 46 × 4 × 4000 ÷ 10 as an alternative method.*

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**08.4** **Answer: As the distance from the tree increases, the percentage cover of grass increases; the increase levels off from about 8 m.** **2**

(as distance from the tree increases) percentage cover (of grass) increases (1)
levels off / increases only slightly beyond 8 m, or a correct use of data, e.g. 5% at 0 m rising to 85% at 10 m (1)
*Allow the reverse argument (closer to the tree, less grass).*

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**08.5** **Answer: Less light reaches the ground near the tree so the grass carries out less photosynthesis; the tree's roots compete with the grass for water and mineral ions.** **2**

less light (near the tree) so less photosynthesis (so less growth) (1)
competition with the tree (roots) for water / mineral ions (1)
*Allow 'less rain reaches the ground under the tree' for the second mark. Allow 'the tree competes with the grass for light' or 'the tree shades the grass' for the first mark. Ignore 'competition for space'.*

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**09.1** **Answer: B** **1**

B (photosynthesis)

*Do not accept more than one letter.*

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**09.2** **Answer: 3.1** **2**

1000 ÷ 320 (1)

= 3.1 (1)

*An answer of 3.1 scores 2 marks. 3.125 or 3.13 scores 1 mark (not 2 significant figures).*

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**09.3** **Answer: From 15 °C to 35 °C the time falls (rate increases) because the molecules have more kinetic energy and collide more often; above 35 °C (the optimum) the lipase starts to denature, so the active site changes shape and the rate falls; at 55 °C the lipase is denatured so no fatty acids are produced.** **3**

from 15 °C to 35 °C the rate increases because the molecules (of lipase and lipid) have more energy / move faster / collide more often (1)

above (about) 35 °C the lipase / enzyme is denatured / the active site changes shape (1)

so the lipid no longer fits the active site / no fatty acids are produced at 55 °C (1)

*Allow 'optimum temperature is about 35 °C' as part of the second mark. Do not accept 'the enzyme is killed'. Ignore 'the enzyme works best' without reference to rate.*

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**09.4** **Answer: 9%** **2**

216 ÷ 2400 × 100 (1)

= 9 (%) (1)

*An answer of 9 or 9.0 scores 2 marks. An answer of 0.09 scores 1 mark.*

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**09.5** **Answer: Not all of the plant material is eaten (e.g. roots); some ingested material is egested as faeces; much glucose is used in respiration and lost as carbon dioxide and water.** **2**

not all the producer is eaten / e.g. roots or woody parts are not eaten

some ingested material is egested as faeces / not all is absorbed

(much) glucose is used in respiration (by the producers or consumers) / biomass is lost as carbon dioxide and water

some is excreted as urea / in urine

any two for 2 marks

*Do not accept 'energy is used in respiration' as a reason for loss of biomass unless it refers to glucose or biomass. Ignore 'heat is lost' on its own.*

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**09.6** **Answer: Draining and digging peat lets microorganisms decay it (and it may be burned), releasing carbon dioxide, a greenhouse gas, which contributes to global warming; the bog habitat is destroyed, so species that live there are lost and biodiversity is reduced.** **4**

peat decays / is broken down by microorganisms (when drained) or is burned (1)

so carbon (that was stored in the peat) is released as carbon dioxide (1)

carbon dioxide is a greenhouse gas, contributing to global warming / climate change (1)

the habitat is destroyed / reduced so species that live there are lost, reducing biodiversity (1)

*Allow 'anaerobic conditions are lost' as part of the first mark. Ignore methane. Do not accept 'ozone layer' for the third mark.*

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**Total: 100 marks**