

Reproduction and inheritance practice questions

35 questions • 110 marks • mark scheme at the back

For Pearson Edexcel International GCSE Biology 4BI1 and Science (Double Award) 4SD0. **Biology only** is not in the Double Award and is only examined on Paper 2.

Name

Total / 110

Sexual and asexual reproduction, and reproduction in plants Spec 3.1-3.7

1 Which statement about asexual reproduction is correct? [1 mark]

- A. ☐ It involves two parents
- B. ☐ It involves the fusion of gametes
- C. ☐ The offspring are genetically identical to the parent
- D. ☐ It produces a lot of variation

2 Describe what happens in fertilisation and what happens to the zygote afterwards. [3 marks]

3 A wind-pollinated flower has anthers that hang outside the flower and a large feathery stigma. Explain how these two features help the flower to be pollinated. [4 marks]

4 Describe how fertilisation takes place in a flowering plant after a pollen grain has landed on the stigma. [3 marks]

- 5** A student sets up three test tubes of cress seeds to investigate the conditions needed for germination. Tube 1 has damp cotton wool at room temperature. Tube 2 has dry cotton wool at room temperature. Tube 3 has damp cotton wool in a refrigerator. All three tubes are kept in the dark. Only the seeds in tube 1 germinate. State what the student can conclude and give two variables that should be kept the same. **[4 marks]**

[illegible]

- 6** Explain why a germinating seed can grow even though it is buried in soil and cannot yet photosynthesise. **[3 marks]**

[illegible]

- 7** Compare the structure of an insect-pollinated flower with a wind-pollinated flower and explain how each is adapted for pollination. **[6 marks]**

[illegible]

- 8** A gardener takes cuttings from a rose plant that has large red flowers. State what the gardener can expect about the new plants and explain why. **[3 marks]**

Human reproduction **Spec 3.8-3.13**

- 9** Where does fertilisation usually take place in a woman? **[1 mark]**

- A. ☐ Ovary
B. ☐ Oviduct
C. ☐ Cervix
D. ☐ Vagina

- 10** Describe the functions of the testes, the sperm duct and the prostate gland. **[3 marks]**

- 11** State the roles of oestrogen and progesterone in the menstrual cycle. **[2 marks]**

- 12** **Biology only** **[3 marks]**

Describe the roles of FSH and LH in the menstrual cycle.

13 Explain how the placenta provides for the needs of the developing embryo, and how the amniotic fluid protects it. **[4 marks]**

[illegible]

14 Name one hormone that causes secondary sexual characteristics in boys and state two changes it causes. **[3 marks]**

15 Describe the changes to the lining of the uterus during one menstrual cycle and explain how oestrogen and progesterone control these changes. **[6 marks]**

[illegible]

DNA, genes and protein synthesis Spec 3.14–3.18B

16 Which statement correctly describes a gene? [1 mark]

- A. ☐ The entire DNA of an organism
- B. ☐ A section of a DNA molecule that codes for a specific protein
- C. ☐ A structure in the nucleus made of many chromosomes
- D. ☐ A single base in a DNA molecule

17 Describe how genes, chromosomes and the nucleus are related.

[3 marks]

18 In a human body cell, where are chromosomes found?

[1 mark]

- A. ☐ Ribosomes
- B. ☐ Cell membrane
- C. ☐ Nucleus
- D. ☐ Mitochondria

19 **Biology only**

[3 marks]

A section of one strand of a DNA molecule has the base sequence A T T G C A. (a) Write the base sequence of the complementary strand. (1) (b) Describe the structure of a DNA molecule. (2)

20 **Biology only**

[4 marks]

The template strand of a gene has the base sequence T A C C T T G C A. (a) Write the sequence of mRNA that is made from this gene. (2) (b) State the anticodons of the tRNA molecules that pair with the first two codons. (2)

Answer =

25 Human height shows a wide range of values. Explain why this is not a characteristic that can be explained by a simple monohybrid cross. **[2 marks]**

26 In rabbits, black fur (B) is dominant to brown fur (b). Two heterozygous black rabbits are crossed. (a) Draw a genetic diagram to show the genotypes of the possible offspring. (3) (b) Give the probability that an offspring has brown fur. (1) **[4 marks]**

Answer =

27 In a family, parents 1 and 2 do not have a genetic disorder. They have three children: child 3 (a daughter) has the disorder, child 4 (a son) does not and child 5 (a daughter) does not. (a) State whether the disorder is caused by a dominant or a recessive allele. Give a reason. (2) (b) Using the letters D and d, give the genotypes of parents 1 and 2 and explain your answer. (2) **[4 marks]**

28 Describe how the sex of a baby is determined at fertilisation. Use a genetic diagram or describe the gametes in your answer. **[3 marks]**

Cell division, variation and evolution Spec 3.28-3.39

29 Which statement explains why brothers and sisters are not genetically identical? [1 mark]

- A. ☐ They are made by mitosis
- B. ☐ Fertilisation is random, so any sperm can fuse with any egg
- C. ☐ Each parent only passes on one chromosome
- D. ☐ They have different numbers of chromosomes

30 State two uses of mitosis in a human. [2 marks]

31 Compare mitosis and meiosis, in terms of the number of cells produced, the number of chromosomes in each human cell, and genetic variation. [4 marks]

32 Two identical twins were brought up in different places. One twin is 5 kg heavier than the other. (a) Suggest why the twins have the same eye colour. (1) (b) Suggest why the twins have different body masses. (2) [3 marks]

33 State what is meant by the term mutation. [2 marks]

34

Biology only

[5 marks]

(a) Name one factor that can increase the rate of mutation. (1) (b) Explain how a mutation in a gene can change the phenotype. (3) (c) State what effect most mutations have on the phenotype. (1)

35

Some bacteria are resistant to an antibiotic. Explain how the number of resistant bacteria can increase in a population when the antibiotic is used, and explain why this makes infections difficult to control. [6 marks]

Mark scheme

One mark for each point unless a maximum is given. Words in brackets are not needed for the mark.

1. [1]

C C (1)

2. [3]

- nucleus of a male gamete fuses with the nucleus of a female gamete (1)
- to form a zygote (1)
- the zygote divides (by cell division) and develops into an embryo (1)

3. [4]

- anthers hang outside the flower / on long filaments (1)
- so pollen is easily blown away / carried by the wind (1)
- feathery stigma has a large surface area (1)
- so it can catch pollen from the air (1)
- allow stigma hangs outside the flower so it can catch pollen

4. [3]

- a pollen tube grows from the pollen grain (1)
- down through the style to the ovary / into the ovule (1)
- the nucleus of the male gamete fuses with the nucleus of the female gamete (egg cell) (1)

5. [4]

- water is needed for germination (1)
- a warm / suitable temperature is needed for germination (1)
- same type / number of seeds (1)
- same amount of cotton wool / same time / same light (1)
- allow any sensible control variable

6. [3]

- the seed contains stored food / starch / oil (1)
- enzymes break down the food reserves (1)
- to release energy by respiration / provide materials for growth until leaves can photosynthesise (1)

7. [6]

Level 3 5-6	A detailed and accurate comparison of both flower types, with several structures described and the adaptations clearly explained in terms of pollination. Both types are covered in balance.
Level 2 3-4	Some accurate description of structures and some explanation, but the answer may be unbalanced or have limited explanation of how each feature helps pollination.
Level 1 1-2	A few simple statements about the flowers, with little or no explanation. The comparison may be missing.

Indicative content

- insect-pollinated: large, brightly coloured, scented petals to attract insects
- insect-pollinated: nectaries make nectar as food for insects
- insect-pollinated: anthers and stigma inside the flower so insects brush against them
- insect-pollinated: pollen is sticky or spiky so it sticks to insects; stigma is sticky
- wind-pollinated: small, dull petals (no need to attract insects), no nectar or scent
- wind-pollinated: anthers hang outside on long filaments so wind can blow pollen away
- wind-pollinated: pollen is light and made in large amounts
- wind-pollinated: large feathery stigma outside the flower to catch pollen from the air

8. [3]

- the new plants will have large red flowers / will be the same as the parent (1)
- they are genetically identical to the parent / clones (1)
- because they are produced by asexual reproduction / only one parent / no gametes involved (1)

9. [1]

B B (1)

10. [3]

- testes make sperm / testosterone (1)
- sperm duct carries sperm (to the urethra) (1)
- prostate gland adds fluid / nutrients to the sperm (to make semen) (1)

11. [2]

- oestrogen repairs / builds up the lining of the uterus (1)
- progesterone maintains the lining of the uterus (1)

12. [3] **Biology only**

- FSH causes an egg to mature (in the ovary) (1)
- FSH stimulates the ovaries to make oestrogen (1)
- LH causes ovulation / release of the egg (1)

13. [4]

- oxygen and nutrients (glucose / amino acids) diffuse from the mother's blood into the embryo's blood (1)
- carbon dioxide and urea diffuse from the embryo's blood into the mother's blood (1)
- villi give a large surface area for diffusion (1)
- amniotic fluid absorbs shocks / cushions the embryo against knocks (1)
- mother's and embryo's blood are close together but do not mix (1)
- Max 4

14. [3]

- testosterone (1)
- one change from: facial hair grows / voice deepens / muscles develop / shoulders broaden / pubic hair grows / sperm production begins (1)
- a second, different change from the same list (1)

15. [6]

Level 3 5-6	A clear and accurate description of the lining breaking down, being repaired and then maintained, with the roles of both oestrogen and progesterone correctly linked to these stages and the timing included.
Level 2 3-4	Some accurate description of the changes and at least one hormone correctly linked, but the answer may lack detail or timing.
Level 1 1-2	A few simple statements about the cycle, with little or no link to the hormones.

Indicative content

- menstruation: the lining breaks down and is lost through the vagina, about days 1 to 5
- repair: the lining is repaired and thickens, about days 5 to 14
- oestrogen is made in the ovaries and causes the repair and growth of the lining
- ovulation around day 14: an egg is released
- maintenance: the lining stays thick, about days 14 to 28
- progesterone is made in the ovaries and maintains the lining
- if there is no pregnancy the progesterone level falls, so the lining breaks down and a new cycle begins

16. [1]

B B (1)

17. [3]

- the nucleus contains chromosomes (1)
- genes are located on the chromosomes (1)
- each gene is a section of DNA that codes for a specific protein (1)
- allow chromosomes are made of DNA / one long DNA molecule

18. [1]

C C (1)

19. [3] **Biology only**

- T A A C G T (1)
- two strands coiled to form a double helix (1)
- strands linked by (a series of) paired bases (1)
- allow A with T and C with G for the third marking point

20. [4] **Biology only**

- first codon A U G (1)
- second and third codons G A A C G U (1)
- first anticodon UAC (1)
- second anticodon CUU (1)
- allow ecf from (a)

21. [6] Biology only

Level 3 5-6	A clear, correct and well-organised account of both transcription and translation, in the right order, using most of the terms (mRNA, ribosome, tRNA, codon, anticodon) accurately.
Level 2 3-4	A mostly correct account of both stages, or a detailed account of one stage, with some of the terms used. Some steps may be missing or out of order.
Level 1 1-2	A few relevant points, for example that mRNA carries a copy of the gene to a ribosome. Little detail or sequencing.

Indicative content

- transcription in the nucleus: a copy of the gene is made as mRNA (single strand, complementary bases, U instead of T)
- mRNA leaves the nucleus and attaches to a ribosome
- mRNA is read in codons, groups of three bases, each coding for one amino acid
- tRNA molecules each carry a specific amino acid to the ribosome
- the anticodon of tRNA pairs with the complementary codon on mRNA
- amino acids are joined in order to make a polypeptide, which folds to form a protein

22. [1]

C C (1)

23. [3]

- a dominant allele is expressed (in the phenotype) when one copy is present / in the heterozygous state (1)
- a recessive allele is only expressed when two copies are present / no dominant allele present (1)
- so a heterozygous individual shows the dominant characteristic (1)
- allow homozygous recessive for two copies

24. [3] Biology only

- codominance (1)
- both alleles are expressed in the phenotype (of the heterozygous animal) (1)
- reject blending / mixing of the alleles for the second marking point
- 1 red : 2 roan : 1 white (1)
- allow 1 RR : 2 RW : 1 WW if phenotypes are clearly linked

25. [2]

- it is controlled by many genes / polygenic inheritance (1)
- so there is a range of values rather than two clear categories / not one gene with a dominant and a recessive allele (1)

26. [4]

- gametes B or b from each parent (1)
- offspring BB, Bb, Bb, bb (1)
- phenotypes: 3 black : 1 brown (1)
- probability = $\frac{1}{4}$ / 0.25 / 25% (1)

27. [4]

- recessive (1)
- two parents without the disorder have a child with it (1)
- both parents are Dd / heterozygous (1)
- each parent must have passed on one recessive allele (d) to child 3, but they do not have the disorder themselves (1)

28. [3]

- females are XX and males are XY (1)
- all eggs carry an X chromosome (1)
- half the sperm carry X and half carry Y; whether an X or Y sperm fertilises the egg decides the sex (1)
- allow correct Punnett square for full credit

29. [1]

B B (1)

30. [2]

- growth (1)
- repair (1)
- allow replacing damaged cells
- ignore asexual reproduction

31. [4]

- mitosis produces two cells and meiosis produces four cells (1)
- mitosis: each cell has 46 chromosomes / diploid; meiosis: 23 chromosomes / haploid (1)
- mitosis produces cells that are genetically identical (1)
- meiosis produces cells that are genetically different (1)

32. [3]

- they have the same alleles / genes / are genetically identical (1)
- difference caused by the environment (1)
- for example different diet / different amount of exercise (1)

33. [2]

- a (rare,) random change (1)
- in genetic material / DNA that can be inherited (1)
- allow change in the base sequence of DNA for the second marking point

34. [5] Biology only

- ionising radiation / gamma rays / X-rays / ultraviolet rays / chemicals in tobacco (1)
- mutation changes the base sequence of the gene (1)
- this changes the sequence of amino acids in the protein (1)
- the protein has a different shape / does not work, changing the phenotype (1)
- no effect (1)
- ignore harmful for (c)

35. [6]

Level 3 5-6	A clear, logical explanation that links variation, selection, survival, inheritance and the increase in the resistant population, and explains why infections become difficult to control.
Level 2 3-4	An explanation with some of the key steps in order, but with a missing link, or the effect on infection control is not explained.
Level 1 1-2	A few relevant points, such as that some bacteria survive the antibiotic. Little or no use of the idea of natural selection.

Indicative content

- a mutation produces an allele that gives resistance to the antibiotic (variation)
- the antibiotic kills non-resistant bacteria; the resistant bacteria survive (selection pressure)
- the resistant bacteria reproduce, with less competition, and pass on the resistance allele
- over time the proportion of resistant bacteria increases
- the antibiotic no longer works against the infection, so it is difficult to control / can spread to other people