



K4D Reproduction and Inheritance: Exam Drill

AQA AQA KS3 Biology - Reproduction and Inheritance · Calculator allowed · about 75 minutes

Name: _____ Date: ____ / ____ / ____

Answer ALL questions. Show all your working.

1 State one reason why living organisms reproduce.

(1)

2 Name the male gamete and the female gamete in humans.

(a) Male gamete

(1)

(b) Female gamete

(1)

3 Match each part of the female reproductive system to its main role. 1) Ovary 2) Fallopian tube 3) Uterus

(1) Ovary - role

(1)

(2) Fallopian tube - role

(1)

(3) Uterus - role

(1)

- 4** Describe what happens during fertilisation in humans. Your answer should include where fertilisation usually happens and what the immediate result is.

(4)

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- 5** A pea plant with purple flowers (P) is crossed with a pea plant with white flowers (p). Purple is dominant. Use a simple genetic cross to answer the parts below. Show the parents and the possible genotypes and phenotypes of the offspring.

- (a)** If the purple parent is heterozygous (Pp) and the white parent is homozygous recessive (pp), write the genotypes of the two parents. (1)

- (b)** Complete a Punnett square and give the genotypes of the offspring with their probabilities. (2)

- (c)** Give the expected flower colours of the offspring and their probabilities. (1)

- 6** Extended response: A student proposes an investigation to show how a particular environmental factor affects plant variation. The student plans to grow two groups of genetically identical radish plants: Group A in full sunlight and Group B in partial shade. They will measure the length of the main root after 4 weeks. Discuss how the student should design a fair investigation, what results might show about variation caused by environment, and one limitation of the investigation. You will be assessed on using scientific ideas, planning a fair test and evaluating the method.

(6)

- 7** State whether the following are examples of genetic variation or environmental variation.
1) Eye colour in humans 2) Scars from a cut 3) Height differences between two siblings raised in different diets

(1) Eye colour (1)

(2) Scars from a cut (1)

(3) Height differences due to different diets (1)

- 8** Study the family tree information below. A family has a genetic condition caused by a recessive allele r . Parents X and Y have no symptoms but they have a child Z who displays the condition. Use this information to answer the parts.

Part a: What must the genotype of child Z be? Part b: What are the possible genotypes of parents X and Y? Part c: If X and Y have another child, what is the probability this child will be a carrier but not display the condition? Assume both parents are carriers.

(a) Genotype of child Z (1)

(b) Possible genotypes of parents X and Y (2)

(c) Probability the next child is a carrier but not affected (from two carriers $Rr \times Rr$) (1)

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- 9** A student measured the height of 6 seedlings each day for 5 days. The mean heights (in cm) are shown in the table: Day 1: 2.0, Day 2: 3.1, Day 3: 4.0, Day 4: 4.8, Day 5: 5.3.

a) Calculate the average growth rate in cm per day between Day 1 and Day 5. Give your answer to two decimal places. b) What type of graph would be best to show this change over time?

(a) Average growth rate between Day 1 and Day 5 in cm per day (3)

(b) Best type of graph to show change over time (1)

- 10** A student wants to test whether watering frequency affects the number of flowers on a bean plant. Identify one variable the student should keep the same to make the test fair and explain why keeping it the same is important.

(3)

- 11** Explain how both mutations and environmental factors can influence variation in a population. Give one example for a mutation and one example for an environmental factor.

(5)

- 12** In peas, round seeds (R) are dominant to wrinkled seeds (r). A pea plant that shows round seeds is crossed with a plant showing wrinkled seeds. The offspring are 50% round and 50% wrinkled. What was the genotype of the round parent? Explain your answer briefly.

(3)

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Question 1

- **B1** to produce more organisms / to make offspring cao
- Answer: **To produce more organisms (to make offspring).**

Question 2

- (a) **B1** sperm (sperm cell) cao
- (a) Answer: **Sperm**
- (b) **B1** egg (ovum) cao
- (b) Answer: **Egg (ovum)**

Question 3

- (1) **B1** produces eggs / releases ova cao
- (1) Answer: **Produces eggs / releases ova**
- (2) **B1** carries egg to the uterus / site where fertilisation often occurs (accept either)
- (2) Answer: **Carries egg to the uterus; site where fertilisation often occurs**
- (3) **B1** nurtures and supports a developing embryo / site of foetus development cao
- (3) Answer: **Nurtures and supports a developing embryo; site of foetus development**

Question 4

- **M1** sperm meets egg / sperm fuses with egg in the Fallopian tube
- **A1** fertilisation usually in the Fallopian tube / oviduct cao
- **A1** nuclei combine or sperm nucleus enters egg (zygote formed) cao
- **A1** result is a fertilised egg / zygote that begins to divide (embryo) cao
- Answer: **Sperm meets and fuses with the egg in the Fallopian tube; the nuclei combine to form a fertilised egg (zygote) that begins to divide to form an embryo.**

Question 5

- (a) **B1** Pp and pp cao
- (a) Answer: **Pp and pp**
- (b) **M1** Punnett square showing Pp and pp offspring (P from one parent on one axis, p and p on the other)
- (b) **A1** offspring genotypes: 50% Pp, 50% pp cao
- (b) Answer: **Offspring genotypes: 50% Pp, 50% pp**
- (c) **B1** 50% purple (Pp), 50% white (pp) cao
- (c) Answer: **50% purple, 50% white**

Question 6

- **Level 3** (5-6): Detailed answer that describes a fair experimental design controlling variables, predicts clear results linking environment to variation, and evaluates a limitation with a suggestion to improve. Uses correct scientific ideas about environmental variation and reproducibility.
- **Level 2** (3-4): Answer gives a reasonable plan with some controls, a simple prediction about differences caused by light, and mentions at least one limitation. Scientific ideas are partly developed.
- **Level 1** (0-2): Basic or incomplete ideas: may state a simple prediction or an uncontrolled method with little explanation.
- **Indicative content:**
 - Fair test: use genetically identical seeds, same soil type, same watering schedule, same pot size, same temperature, random assignment to groups, sufficient sample size (e.g. 10+ plants each) and repeat the experiment.
 - Measurements: measure main root length after 4 weeks with a ruler to nearest mm, same person measuring or blind measurement to reduce bias, record individual values and calculate mean and range.
 - Prediction: plants in partial shade may have longer roots or shorter roots depending on whether they invest in root growth to search for water; more likely shade causes longer stems and possibly shallower roots but environmental response must be justified.
 - Data interpretation: compare means and ranges, consider whether differences are larger than natural variation; use standard presentation (table and bar chart) and consider anomalous results.
 - Limitation and improvement: small sample size, uncontrolled pests or microclimate; improve by increasing replicates, rotating pot positions, or measuring additional traits like shoot length.
 - Scientific ideas: environmental variation causes differences in phenotype without changes in genotype; results cannot show inheritance changes.

Question 7

- (1) **B1** genetic variation cao
- (1) Answer: **Genetic variation**
- (2) **B1** environmental variation / acquired characteristic cao
- (2) Answer: **Environmental variation**
- (3) **B1** environmental variation cao
- (3) Answer: **Environmental variation**

Question 8

- (a) **B1** rr cao
- (a) Answer: **rr**
- (b) **M1** both parents must carry at least one r allele
- (b) **A1** parents genotypes are most likely Rr and Rr (both carriers) cao
- (b) Answer: **Rr and Rr (both carriers)**
- (c) **B1** 50% (1/2) cao
- (c) Answer: **50%**

Question 9

- (a) **M1** use growth = $5.3 - 2.0 = 3.3$ cm and divide by time 4 days
- (a) **A1** 0.825 rounded to 0.83 cm/day cao
- (a) **A1** units cm/day stated
- (a) Answer: **0.83 cm/day**
- (b) **B1** line graph / line chart cao
- (b) Answer: **Line graph**

Question 10

- **M1** identifies a correct control variable e.g. light level, pot size, plant variety, soil type, or temperature
- **A1** explains that keeping it constant prevents it affecting the number of flowers so the effect of watering can be isolated
- **B1** gives an example reason such as more light could increase flowering so it must be the same between groups

Question 11

- **M1** states that mutation is a change in DNA that can create new alleles
- **A1** gives an example mutation effect, e.g. a mutation causing albinism or altered coat colour in animals
- **M1** states that environmental factors change the way genes are expressed or affect phenotype without changing DNA
- **A1** gives an example environmental effect, e.g. nutrition affecting height or sunlight affecting leaf size
- **A1** links both to population variation by saying these create differences between individuals and can affect survival/reproduction

Question 12

- **M1** states the round parent genotype is Rr (heterozygous)
- **A1** explains that crossing Rr with rr gives $\frac{1}{2}$ Rr (round) and $\frac{1}{2}$ rr (wrinkled)
- **B1** conclusion that this matches the observed 50% round and 50% wrinkled
- Answer: **Rr; because Rr x rr gives 50% Rr (round) and 50% rr (wrinkled).**