1.4 Reproduction and Inheritance: 30-minute Pack

Calculator allowed · about 30 minutes

Name: _____ Date: ____ / ____ / _____

Answer ALL questions. Show all your working.

1 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)

2 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)**

3 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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4 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)**

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5 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)

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6 Read the family 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.

(a) What must the genotype of child Z be? **(1)**

(b) What must the genotypes of parents X and Y be? **(2)**

(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 (Rr x Rr). **(1)**

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7 A fetus develops inside its mother's uterus for around nine months.

(a) Name the organ that allows food, oxygen and waste to be exchanged between mother and fetus. **(1)**

(b) Explain how substances pass between the mother's blood and the fetus's blood at this organ. **(1)**

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Mark scheme · 1.4 Reproduction and Inheritance: 30-minute Pack

Question 1

states the round parent genotype is Rr (heterozygous) **M1**

explains that crossing Rr with rr gives 1/2 Rr (round) and 1/2 rr (wrinkled) **A1**

conclusion that this matches the observed 50% round and 50% wrinkled **B1**

Answer: **Rr; because Rr x rr gives 50% Rr (round) and 50% rr (wrinkled).**

Question 2

(1) produces eggs / releases ova cao **B1**

(1) Answer: **Produces eggs / releases ova**

(2) carries egg to the uterus / site where fertilisation often occurs (accept either) **B1**

(2) Answer: **Carries egg to the uterus; site where fertilisation often occurs**

(3) nurtures and supports a developing embryo / site of foetus development cao **B1**

(3) Answer: **Nurtures and supports a developing embryo; site of foetus development**

Question 3

sperm meets egg / sperm fuses with egg in the Fallopian tube **M1**

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 **A1**

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 4

(a) Pp and pp cao **B1**

(a) Answer: **Pp and pp**

(b) Punnett square with P and p from the Pp parent on one axis and p and p from the pp parent on the other, giving two Pp and two pp offspring boxes **M1**

(b) offspring genotypes: 50% Pp, 50% pp cao **A1**

(b) Answer:Parents: Pp x pp.

Gametes	P	p
p	Pp	pp
p	Pp	pp

Offspring genotypes: 2/4 = 50% Pp and 2/4 = 50% pp.

(c) 50% purple (Pp), 50% white (pp) cao **B1**

(c) Answer: **50% purple, 50% white**

Question 5

Level 3 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. **5-6**

Level 2 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. **3-4**

Level 1 Basic or incomplete ideas: may state a simple prediction or an uncontrolled method with little explanation. **0-2**

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 6

(a) rr cao **B1**

(a) Answer: **rr**

(b) each parent passed an r allele to Z, and each has no symptoms so has at least one R allele **M1**

(b) both parents are Rr (both carriers) **A1**

(b) Answer: **Rr and Rr (both carriers)**

(c) 50% (1/2) cao **B1**

(c) Answer: **50%**

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Question 7

(a) placenta cao **B1**

(a) Answer: **Placenta**

(b) substances diffuse across the placenta; the mother's and fetus's blood do not mix, oe **B1**

(b) Answer: **Oxygen and nutrients diffuse from the mother's blood into the fetus's blood, and waste products diffuse the other way, across the placenta, without the two blood supplies mixing**

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