



# Mock JMSS Entrance Exam

## Science Reasoning SAMPLE

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### Question & Answer Book

- You have - Minutes to Complete this Exam.

### Materials Supplied

- Question & Answer Book of 5 pages.
- Multiple-Choice Answer Sheet.

### Instructions

- Follow the Instructions on your Multiple-Choice Answer Sheet.
- At the end of the examination, place your Multiple-Choice Answer Sheet inside the front cover of this book.
- Answers are at the end of the examination

Students are **not** permitted to bring mobile phones and/or any unauthorised electronic devices into the examination room.

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Student's Name: \_\_\_\_\_

Student's Email: \_\_\_\_\_

Date & Time: \_\_\_\_\_

Marks: \_\_\_\_\_

## Section A

### Instructions

- Answer **all** questions on the Multiple-Choice Answer Sheet.
- Read the information provided carefully before answer before answering the questions associated with it.

### Stimulus: Q1-Q3

*Genes are segments of DNA that code for specific traits. Alleles are different versions of a gene. Some alleles are dominant, meaning their trait is always expressed when present, while others are recessive and only expressed when two copies are present.*

Q1. If a plant has one allele for tallness (dominant) and one allele for shortness (recessive), what will be its appearance?

- a) It will be short.
- b) It will be tall.
- c) It will be medium height.
- d) It will have both tall and short segments.

Q2. Both parents have the alleles for short and long tails, where the long tail is dominant. If they have 4 offspring, what is the expected number of offspring that will have short tails?

- a) 0
- b) 1
- c) 2
- d) 3

Q3. Two organisms are created via cloning, a technique which copies all genes. What is the expected difference in appearance of the clones?

- a) There should be big differences as natural variation will still occur.
- b) The clones will vary in characteristics that are not genetic.
- c) The clones should be genetically different, causing differences in appearance.
- d) The clones will have the same characteristics, as they share all genes.

### Stimulus: Q4-Q6

*Matter can exist in different states: solid, liquid, and gas. Changes between these states (phase changes) require energy input or release. For example, melting (solid to liquid) requires heat input, while condensation (gas to liquid) releases heat.*

Q4. On a cold day, why does ice form on the outside of a glass of cold water?

- a) Because the glass gets too cold.
- b) Because the water inside the glass freezes.
- c) Because water vapor in the air releases heat as it condenses and freezes.
- d) Because there is already ice in the air.

Q5. During a hot day, a person gets a drink from a cooler with lots of ice in it. Why is it that the liquid in the cooler gets cold, but the ice does not cool further?

- a) The water is always warmer than the ice, so heat flows into the water.
- b) The water always wants to become ice, which is why heat flows out.
- c) The ice requires all the heat energy during melting, which keeps the liquid colder.
- d) There is more heat in the air, so the cooler ice cannot be cooled further.

Q6. If you place a pot of water on a stove, will the water temperature continue to rise past its boiling point?

- a) Yes, because the heat will still enter the water.
- b) No, because the water is now steam, which is a different phase.
- c) Yes, the water may become superheated.
- d) No, because all heat energy will be used to turn the water to steam.

End of Sample Examination

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# Solutions

## Science Reasoning SAMPLE

We recommend not looking at these until you have finished all the questions in the Mock or are really stuck on a question.

**Q1:**

The plant has one dominant allele (tallness) and one recessive allele (shortness). Since the dominant allele is always expressed when present, the plant will exhibit the dominant trait.

Answer: b) It will be tall.

**Q2:**

Let's use "L" for long tail (dominant) and "l" for short tail (recessive)

Parents are heterozygous (Ll), for each parent:

Draw Punnett Square:

	L	l
L	LL	Ll
l	Ll	ll

Offspring Genotypes:

1/4 are LL (long tail)

2/4 are Ll (long tail)

1/4 are ll (short tail)

Expected short tails from 4 offspring:  $(1/4) * 4 \text{ offspring} = 1 \text{ offspring}$

Answer: b) 1

**Q3:**

Since cloning copies all the genes of the organism, the clones will have identical genetic information. Thus their physical traits will be identical.

Answer: d) The clones will have the same characteristics, as they share all genes.

Note that environment may still cause small differences.

Q4:

The ice on the outside of the glass forms because water vapor in the air (a gas) comes into contact with the cold glass, loses energy, and goes through two phase changes. It first condenses into liquid water and then freezes into ice. Both phase changes release heat.

Answer: c) Because water vapor in the air releases heat as it condenses and freezes.

Q5:

When ice melts, it requires energy in the form of heat to break the bonds holding it in its solid state. This heat is pulled from the surrounding liquid in the cooler, causing the liquid to get colder. The ice will continue to melt and keep the liquid cold until it has absorbed enough energy to completely melt, however at this point the liquid will no longer get colder, it will start to warm to the environment.

Answer: c) The ice requires all the heat energy during melting, which keeps the liquid colder.

Q6:

Once water reaches its boiling point, any additional heat will be used to convert liquid water into steam, a gas. The temperature of the water will not rise higher until all liquid water has been converted to steam.

Answer: d) No, because all heat energy will be used to turn the water to steam.