AP® BIOLOGY
2013 SCORING GUIDELINES

Question 7

In an experiment, rats averaging 300 g of body mass were tested several times over a three-month period. For each individual rat, urine was collected over a three-hour period after ingestion of 10 mL of liquid (water, 1 percent ethyl alcohol solution, or 5 percent ethyl alcohol solution). The volume of urine was then measured, and the results were averaged for all individuals within each experimental group. The data are shown in the table below.

THREE-HOUR URINE OUTPUT FOLLOWING FLUID INGESTION

Fluid ingested (10 mL)	Water	1% Ethyl Alcohol	5% Ethyl Alcohol
Average urine output (mL)	3.5	3.8	4.7

(a) **Pose** ONE scientific question that the researchers were most likely investigating with the experiment. (**1 point**)

Appropriate questions include but are not limited to the following:

- How does alcohol consumption affect urine output in rats (or any mammal)?
- How does alcohol consumption affect regulation of the kidney?

(b) **State** a hypothesis that could be tested to address the question you posed in part (a). (**1 point**)

Appropriate hypotheses include but are not limited to the following:

- Alcohol consumption increases urine output in rats.
- Alcohol consumption increases water retention/reabsorption in rat kidneys.
- Alcohol consumption reduces urine output in rats.
- Alcohol consumption has no effect on urine output in rats.

NOTE: This point may be earned without earning the point in part (a)

(c) Using the data in the table, **describe** the effect of ethyl alcohol on urine production. (**1 point**)

- Alcohol consumption increases urine output.

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(c) Using the data in the table, **describe** the effect of ethyl alcohol on urine production.

ANSWER PAGE FOR QUESTION 7

A question regarding this experiment could be; What effects does differing concentrations of Ethyl Alcohol have on the amount of urine output on a population of rats.

Because alcohol acts as an antidiuretic, there would be more output of urine, the higher the concentration of alcohol.

The rats that ingested the higher concentration of Ethyl Alcohol produced more urine.

7B,

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ANSWER PAGE FOR QUESTION 7

a) Does concentration of an ethyl alcohol solution consumption affect ~~concentration~~ volume of urine?

b) Concentration of an ethyl alcohol solution consumption does affect ~~concentration~~ volume of urine because a 5% ethyl alcohol solution produces 4.7 mL of urine.

c) The more concentrated the solution of ethyl alcohol, 5%, the more urine is produced, 4.7mL, according to the data in the table.

7C, 1

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(a) **Pose** ONE scientific question that the researchers were most likely investigating with the experiment.

(b) **State** a hypothesis that could be tested to address the question you posed in part (a).

(c) Using the data in the table, **describe** the effect of ethyl alcohol on urine production.

ANSWER PAGE FOR QUESTION 7

a) How is are different levels of ethyl alcohol dependent on urine output?

b) Different levels of ethyl alcohol are dependent on urine output.

c) The more ethyl alcohol present, the higher the urine output levels.

AP® BIOLOGY
2013 SCORING COMMENTARY

Question 7

Question 7 was written to the following Learning Objectives in the AP Biology Curriculum Framework: 2.10, 2.22, 2.23, 2.24, 2.25, 4.8, and 4.14.

Overview

Question 7 asks students to engage in scientific questioning about the complex properties of biological systems. Students were presented with a description of an experiment in which researchers measured the volume of urine excreted by rats that had been fed solutions containing different concentrations of ethyl alcohol. Students were asked to pose a scientific question that the researchers could have been investigating in the experiment. Students were then asked to state a testable hypothesis that would address the scientific question they posed. Finally, students were asked to use data from the experiment to describe the relationship between ethyl alcohol consumption and urine production.

Sample: 7A
Score: 3

The response earned 1 point in part (a) for posing a scientific question that focused on the effect of differing concentrations of ethyl alcohol on urine output in rats.

The response earned 1 point in part (b) for stating a hypothesis that urine output would increase when higher concentrations of alcohol were consumed.

The response earned 1 point in part (c) for describing more urine produced by rats that have ingested the higher concentrations of ethyl alcohol.

Sample: 7B
Score: 2

The response earned 1 point in part (a) for posing a scientific question about whether consumption of an ethyl alcohol solution affects the volume of urine produced.

The response earned 1 point in part (c) for describing more urine produced by the higher concentrations of ethyl alcohol used in the experiment.

Sample: 7C
Score: 1

The response earned 1 point in part (c) for describing that the more ethyl alcohol is present, the higher the urine output levels.