# UBMS ACT PREPARATION

Kindly have scratch paper with you to take notes / work along for each problem.

**MATH:**

1)

When $x = \frac{1}{2}$, what is the value of $\frac{8x-3}{x}$ ?

F. $\frac{1}{2}$

G. 2

H. $\frac{5}{2}$

J. 5

K. 10

2)   *Worked these during the session*

Marcus's favorite casserole recipe requires 3 eggs and makes 6 servings. Marcus will modify the recipe by using 5 eggs and increasing all other ingredients in the recipe proportionally. What is the total number of servings the modified recipe will make?

A. 6
B. 8
C. 10
D. 12
E. 15

*Worked these during the session*

3)

A company's profits increased by 12% from 2010 to 2011 and by 18% from 2011 to 2012. By what percent did the company's profits increase from 2010 to 2012?

A. 10%
B. 12%
C. 24%
D. 30%
E. 32%

4)     *Worked during the session*

. What is the slope of the line through (−2,1) and (2,−5) in the standard $(x,y)$ coordinate plane?

A. $\frac{3}{2}$

B. 1

C. −1

D. $-\frac{3}{2}$

E. −4

5)     *Explained the problem - not worked out*

## What is the product of the matrices:

$\begin{bmatrix} x & 2x \\ -y & y \end{bmatrix}$ and $\begin{bmatrix} x & x \\ 3 & y \end{bmatrix}$?

A.

$$\begin{bmatrix} x+6 & x+y \\ -xy+3y & xy+y^2 \end{bmatrix}$$

B.

$$\begin{bmatrix} x^2+6x & x^2+2xy \\ -xy+3y & -xy+y^2 \end{bmatrix}$$

C.

$$\begin{bmatrix} x^2+6x & -xy+3y \\ x^2+2xy & -xy+y^2 \end{bmatrix}$$

D.

$$\begin{bmatrix} x^2 & 2x^2 \\ -3y & y^2 \end{bmatrix}$$

E.

$$\begin{bmatrix} x^2 & -3y \\ 2x^2 & y^2 \end{bmatrix}$$

6)

In $\triangle DEF$, the length of $\overline{DE}$ is $\sqrt{30}$ inches, and the length of $\overline{EF}$ is 3 inches. If it can be determined, what is the length, in inches, of $\overline{DF}$ ?

F.     3
G. $\sqrt{30}$
H. $\sqrt{33}$
J. $\sqrt{39}$
K. Cannot be determined from the given information

7)

The length of a rectangle is 5 inches longer than the width. The perimeter of the rectangle is 40 inches. What is the width of the rectangle, in inches?

F.    7.5
G.    8
H.   15
J.   16
K.   17.5

8)      *Worked this problem during the session.*

Armin is trying to decide whether to buy a season pass to his college basketball team's 20 home games this season. The cost of an individual ticket is $14, and the cost of a season pass is $175. The season pass will admit Armin to any home basketball game at no additional cost. What is the minimum number of home basketball games Armin must attend this season in order for the cost of a season pass to be less than the total cost of buying an individual ticket for each game he attends?

F.   8
G.   9
H.  12
J.  13
K.  20

**PHYSICS:**
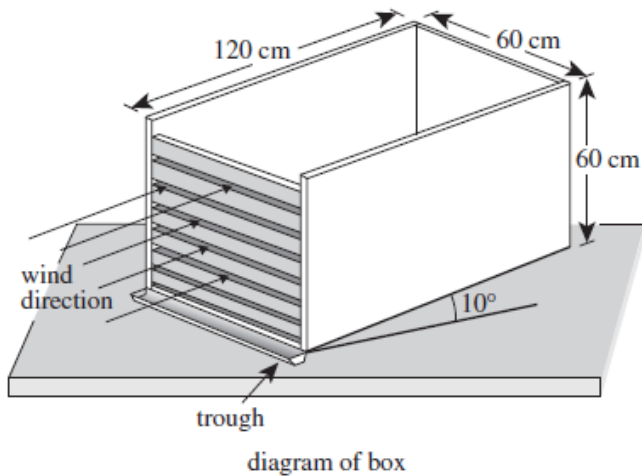
## Passage VI

Three studies examined how the volume of runoff from melting ice is affected by wind speed and by the presence of sand beneath the ice.

In a lab kept at 18°C, runoff was collected from a plastic box containing melting ice. The box was tilted at 10° and had horizontal openings in its lower end. After flowing through the openings, the runoff fell into a trough (see diagram) and was conveyed to a measuring device.



diagram of box

### Study 1

In each of the first 3 of 4 trials, the following steps were carried out:

1. A 30 cm deep layer of a particular clean, dry sand was placed in the box.

2. A 30 cm deep layer of *chipped ice* (density 0.4 g/cm³) was placed in the box on top of the layer of sand.

3. A fan was turned on to blow air at a constant speed onto the trough end of the box.

4. For the next 600 min, the volume of runoff collected over each 20 min period was measured.

The wind speed was 2.5 m/sec, 1.0 m/sec, and 0.5 m/sec in the first, second, and third trials, respectively.

In the fourth trial, all steps except Step 3 were carried out. (The fan was not turned on.)

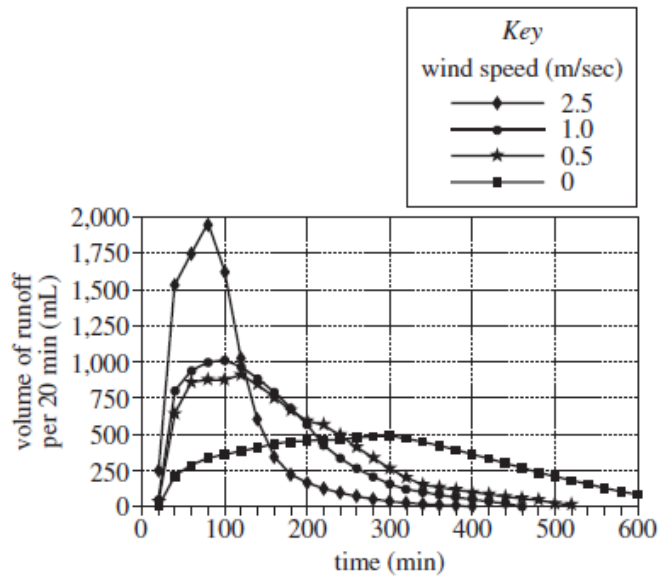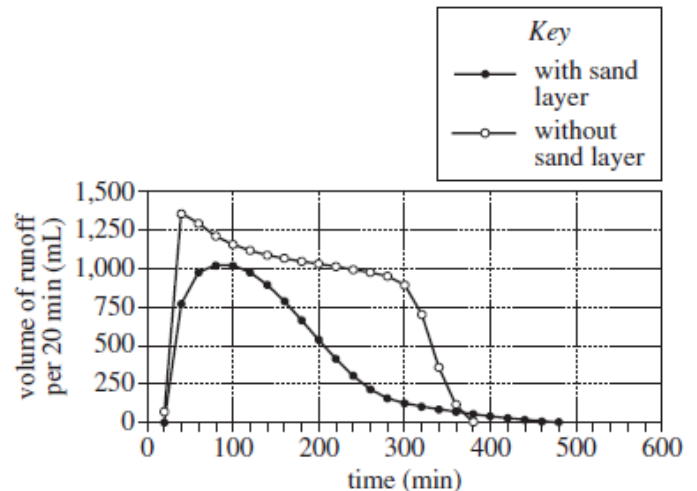The results of the 4 trials are shown in Figure 1.



Figure 1

### Study 2

The second trial of Study 1 was repeated. Then the second trial of Study 1 was again repeated, except that Step 1 was omitted. (No sand layer was placed in the box.) The results of the 2 trials are shown in Figure 2.



Figure 2

34. The researchers conducting the studies chose to use a box made of a type of plastic rather than of wood to ensure that all of the water from the melting ice would flow from the box and into the trough. The researchers most likely made that choice because that type of plastic, unlike wood, is:

   F. porous and permeable, and therefore incapable of absorbing water.
   G. nonporous and impermeable, and therefore incapable of absorbing water.
   H. porous and permeable, and therefore capable of absorbing water.
   J. nonporous and impermeable, and therefore capable of absorbing water.

35. Suppose Study 2 had been repeated, except in a lab kept at −1°C. The total volume of runoff measured over the 600 min in the repeated study would most likely have been:

   A. near or at zero, because −1°C is below the freezing point of water.
   B. near or at zero, because −1°C is above the freezing point of water.
   C. greater than that in the original study, because −1°C is below the freezing point of water.
   D. greater than that in the original study, because −1°C is above the freezing point of water.

36. According to the results of Study 1, for which of the wind speeds did the runoff volume per 20 min decrease to zero from its maximum value *before* 500 min ?

   F. 0 m/sec only
   G. 2.5 m/sec only
   H. 0.5 m/sec and 1.0 m/sec only
   J. 1.0 m/sec and 2.5 m/sec only

37. Compare the results of the 2 trials in Study 2. In which trial did the volume of runoff per 20 min reach a greater maximum value, and in which trial did the volume of runoff per 20 min decrease to zero from the maximum value in the shorter amount of time?

   | | greater maximum | shorter time to zero |
   |---|---|---|
   | A. | with sand layer | with sand layer |
   | B. | with sand layer | without sand layer |
   | C. | without sand layer | with sand layer |
   | D. | without sand layer | without sand layer |

38. The volume of runoff measured at 200 min in Study 1 for the 4 wind speeds is best represented by which of the following graphs?
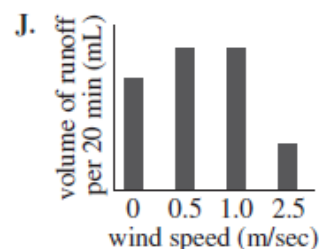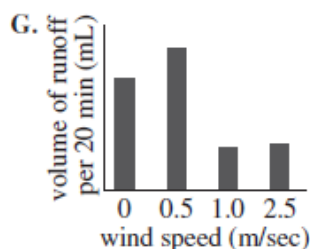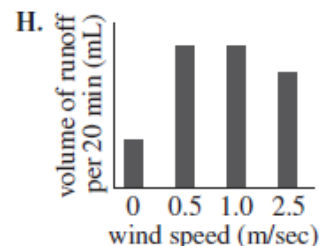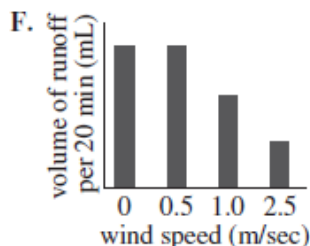


39. Which factor was varied in Study 1 but kept the same in Study 2 ?

   A. Depth of sand layer
   B. Wind speed
   C. Tilt of box
   D. Type of material that melted

40. Based on the diagram and the description of Study 1, which of the following expressions would most likely be used to calculate the *volume* of the sand layer in the plastic box (before chipped ice was placed on top)?

   F. 30 cm × 60 cm × 60 cm
   G. 30 cm × 60 cm × 120 cm
   H. 60 cm × 60 cm × 60 cm
   J. 60 cm × 60 cm × 120 cm