

North Carolina Science Olympiad

Metric Mastery

Division B

2013 Regional Test

Station 1

Kris gets a good job after he graduates from NC State University, and soon his company sends him on a business trip to Germany.

1. He is using Skype to talk with his friend and mentions that the temperature is 5° . She observes precipitation through the window. Is the precipitation likely to be snow or rain?
2. Kris's friends in Germany have trouble understanding how large the United States is. The entire country of Germany is only $357,012 \text{ km}^2$. The state of North Carolina, is how many km^2 ?
 - a. $126,387 \text{ km}^2$
 - b. $359,651 \text{ km}^2$
 - c. $457,125 \text{ km}^2$
3. Kris gets a company car so he can drive himself to the plant each day. He likes to sightsee on the weekend. When he drives 50 kph, where is he likely driving?
 - a. The Autobahn (highway)
 - b. In town
 - c. Near a school

Station 2

Convert these amounts from the given unit to the requested one.

1. Express 5.0 grams as kilograms.
2. Express 690 kHz as GHz.
3. Express 5000 kW as W.
4. Express 457 mL as L.
5. Express 100 cm as m.

Station 3

1. If the temperature is 0°C is this cold or hot or average room temperature?
2. If the temperature is 10°C is this cold or hot or average room temperature?
3. If the temperature is 20°C is this cold or hot or average room temperature?
4. If the temperature is 30°C is this cold or hot or average room temperature?
5. If the temperature is 40°C is this cold or hot or average room temperature?

Station 4

1. Express 1 cubic centimeter of water in milliliters.
2. Express 1 liter of water in cm^3 .
3. What is the approximate volume of a teacher's desk in m^3 ?
4. The volume of a box 3 meters tall X 3 meters wide X 3 meters long, in m^3 .
5. The same volume in cm^3 .

Station 5

Estimate the following distances in meters:

1. The height of a doorknob.
2. The height of a one story building.
3. The height of a door.
4. The length of a tennis court.
5. The length of 11 football fields laid end-to-end.
(end zones not included)

Station 6

Look at the containers of beverages. For the purposes of this test, consider corn syrup to be sugar.

1. How many mL of clear beverage are there?
2. How many L of dark beverage are there?
3. How many mL of sugar-free beverage are there?
4. How many L of beverages containing sugar are there?
5. How many L of clear sugar-free beverage are there?

Station 7

Measure the object. Provide answers to the nearest mm.

1. What is the height of the object?
2. What is the width of the object?
3. What is the depth of the object?
4. What is the total volume of the object in mm^3 ? Assume the sides are vertical.

Station 8

Estimate.



1. What is the length of the red line in mm?
2. What is the length of the green line in m to the nearest hundredth?
3. What is the total length of both lines in whole cm?

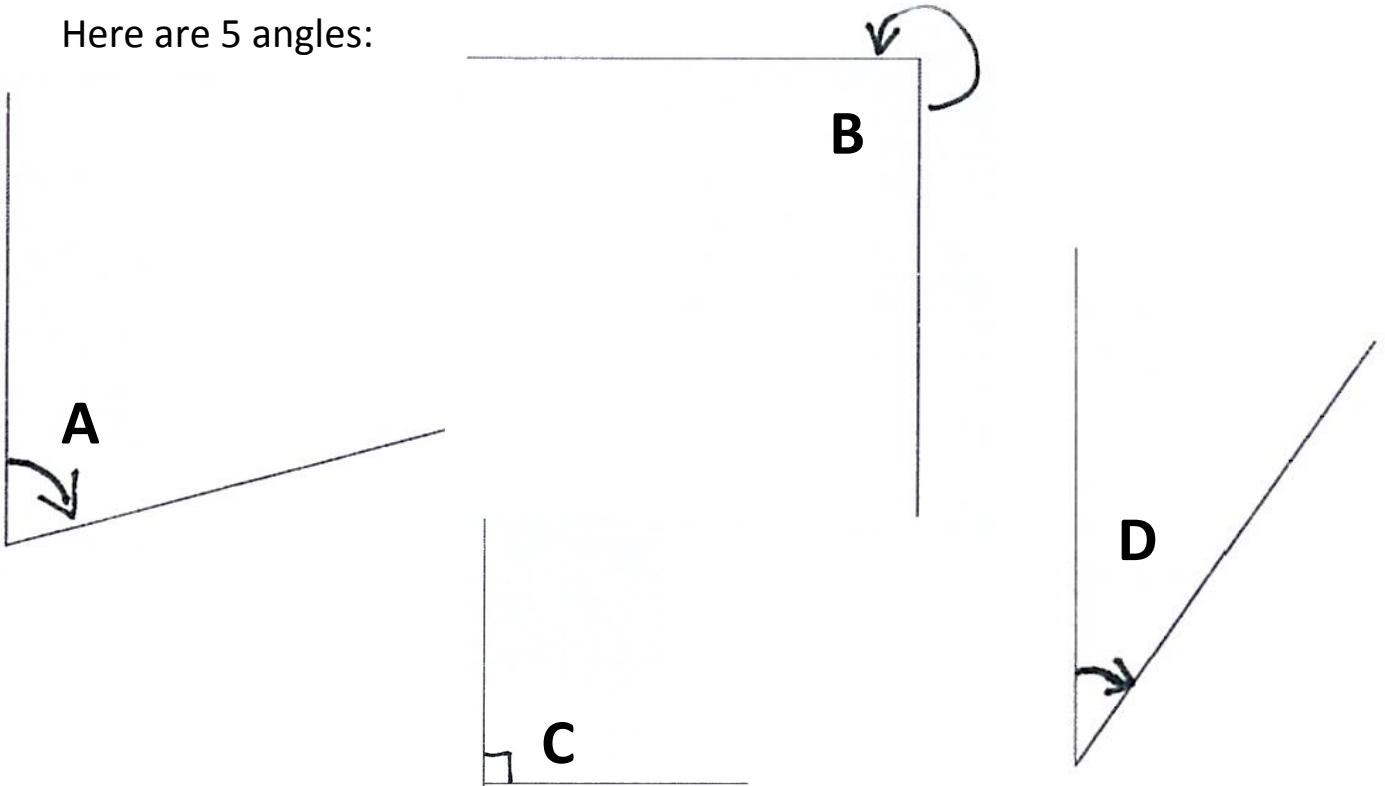
Station 9

Here is a cylinder. Provide the following measurements:

1. The inside diameter of the base in cm.
2. The height in mm.
3. The volume in cm^3 .

Station 10

Here are 5 angles:



For each angle, state whether it is Obtuse, Acute or Right.

1. A.
2. B.
3. C.
4. D.

For each figure, measure the angle indicated:

5. A.
6. B.
7. C.
8. D.

Station 11

Measure the following parts of items A and B:

1. The inside diameter of the washer A, in mm. (to the tenths)
2. The outer diameter of washer A, in cm. (to the hundredths)
3. The inside diameter of the washer B, in cm. (to the tenths)
4. The outer diameter of washer B, in mm. (to the hundredths)

Station 12

Convert these amounts from the given unit to the requested one.

1. Express 12 cm as mm.
2. Express 57 μm as mm.
3. Express 42 nm as cm.
4. Express 2.4 GHz as MHz.
5. Express 14 km as m.

Station 13

1. Average human body temperature, in °C, is _____.
2. The melting point of ice, in °C, is _____.
3. Comfortable room temperature, in °C, is
 - a. 10°
 - b. 20°
 - c. 30°

Station 14

Estimate or calculate the following areas in m^2 unless otherwise noted:

1. The area of a twin bed.
2. The area of a thumbnail.
3. The area of a football field.
4. A wall 3m wide by 2m tall.
5. The area of a thumbnail, in cm^2 .

Station 15

Measure this butterfly.

1. What is the length of the body from the bottom tip to between the base of the antenna, in cm to the nearest tenth?
2. What is the distance across the wings from left to right, measuring at the notches between the upper & lower wings, in mm?
3. What is the maximum distance across the lower wings, from left to right, in cm to the nearest tenth?

Station 16

Measure the CD as indicated:

1. What is the diameter of the disk, in cm?
2. What is the diameter of the hole, in cm?
3. What is the area of the hole, in cm^2 ?
4. What is the area of the plastic, in cm^2 ?

Station 17

Estimate as indicated, in mm (to the closest whole mm)

1. The inside diameter of the small loop.
2. The inside diameter of the large loop.
3. The outside diameter of the straw (straight portion).
4. The inside diameter of the straw (straight portion).

Station 18

Weigh the items.

1. What is the mass of item A in mg?
2. What is the mass of item B in g?
3. What is the total in kg?
4. What is the difference in g?

Station 19

Answer the following:

1. What is the weight in grams of one liter of pure water?
2. A 500 g ball lands in water and exactly half of it floats. How much water is displaced, in cm^3 ?
3. If you inflate a balloon with 1 liter of helium, approximately how large is it?
 - a. The size of an orange.
 - b. The size of a cantaloupe.
 - c. The size of a beach ball.
4. How many liters of water does a 75 kg person displace when he is floating beneath the surface of the water?

Station 20

1. A 5 cm long model car is travelling 100 cm/sec. What is the equivalent speed of a 5 m car, if speed is scaled up exactly as size is? Express your answer in km/hr.

**2013 NC Regional Exam
B-Division Metric Mastery Event**

Response Sheet

Participants: Name 1: _____

Name 2: _____

School: _____

(circle one) Varsity JV1 JV2 JV3 JV4

Please enter full names, including for the school, to be sure proper credit is given.

Station 1

1. _____
2. _____
3. _____

Station 2

1. _____
2. _____
3. _____
4. _____
5. _____

Station 3

1. _____
2. _____
3. _____
4. _____
5. _____

Station 4

1. _____
2. _____
3. _____
4. _____
5. _____

Station 5

1. _____
2. _____
3. _____
4. _____
5. _____

Station 6

1. _____
2. _____
3. _____
4. _____
5. _____

Station 7

1. _____
2. _____
3. _____
4. _____

Station 8

1. _____
2. _____
3. _____

Station 9

1. _____
2. _____
3. _____

Station 10

1. _____
2. _____
3. _____
4. _____
5. _____
6. _____
7. _____
8. _____

Station 11

1. _____
2. _____
3. _____
4. _____

Station 12

1. _____
2. _____
3. _____
4. _____
5. _____

Station 13

1. _____
2. _____
3. _____

Station 14

1. _____
2. _____
3. _____
4. _____
5. _____

Station 15

1. _____
2. _____
3. _____

Station 16

1. _____
2. _____
3. _____
4. _____

Station 17

1. _____
2. _____
3. _____
4. _____

Station 18

1. _____
2. _____
3. _____
4. _____

Station 19

1. _____
2. _____
3. _____
4. _____

Station 20

1. _____

**2013 NC Regional Exam
B-Division Metric Mastery Event**

Answer Key

Participants: Name 1: _____

TIEBREAKERS: #11, #18, #6, #10

Questions that list only one answer must be exact and give units. Questions that give a range are estimation questions, and anything in the range is correct. They must also give units. Questions are 1 point each.

Station 1

1. Rain
2. A (126,387 km²)
3. B (in town)

Station 2

1. 0.005 kg
2. 0.00069 GHz
3. 5,000,000 W
4. 0.457 L
5. 1 m

Station 3

1. Cold
2. Cold
3. Average
4. Hot
5. Hot

Station 4

1. 1 mL
2. 1000 cm³
3. 1-2 m³
4. 27 m³
5. 27,000,000 cm³

Station 5

1. 0.7 - 1.3 m
2. 3.0 - 4.5 m
3. 1.8 - 2.2 m
4. 20 - 25 m
5. 950 - 1050 m

Station 6

1. 1064 mL
6. 4.89 L
7. 2890 mL
8. 3.064 L
9. 0 L

Station 7

1. 53 mm
2. 203 mm
3. 128 mm
4. 1,377,152 mm³

Station 8

1. 145 - 165 mm
2. 0.15 - 0.17 m
3. 30 - 32 cm

Station 9

1. 7.0 cm
2. 99 mm
3. 380.8 cm²

Station 10

1. Acute
2. Obtuse
3. Right
4. Acute
5. 75° (accept 73 – 77)
6. 270°(accept 268-272)
7. 90°(exactly)
8. 35° (accept 33-37)

Station 11

1. 20.9 mm
2. 5.11 cm
3. 1.4 cm
4. 35.00 mm

Station 12

1. 120 mm
2. 0.057 mm
3. 0.0000042 cm
4. 2400 MHz
5. 14,000 m

Station 13

1. 37° C
2. 0° C
3. B (20)

Station 14

1. 1.5 – 2.0 m²
2. 0.00007 - 0.00013 m²
3. 4800 - 5200 m²
4. 6 m²
5. 0.9 - 1.2 cm²

Station 15

1. 9.8 cm
2. 180 mm
3. 25.6 cm

Station 16

1. 12 cm
2. 1.5 cm
3. 1.8 cm²
4. 111.2 cm²

Station 17

1. 22 - 26 mm
2. 30 - 34 mm
3. 4 - 6 mm
4. 2 - 4 mm

Station 18

1. 83,000 mg
2. 80.7 g
3. 0.164 kg
4. 2.3 g

Station 19

1. 1000 g
2. 250 cm³
3. B (cantaloupe)
4. 75 L

Station 20

1. 360 km/hr