

# **IESO 2018 Thailand: Practical Test 1**

Time: 50 minutes

Rocks / Minerals & Fossils

**This is a timed examination session. Start at the question that is assigned to you in the beginning, You must spend 2.5 minutes (150 seconds) per question. Once you hear the sound signal, move to the next question by following the arrow.**

**Q1:** Which sample(s) has the highest specific gravity?

- a) Sample a
- b) Sample b
- c) Sample c
- d) Samples a and c
- e) They all have the same specific gravity

**Q2:** Which of the following is correct about the observed material?

- a) lichen fossil
- b) fern fossil
- c) inorganic deposit
- d) leaf fossil
- e) trace of an animal

**Q3:** Which of the following descriptions is correct about the observed material?

- a) petrified hard wood fossil
- b) petrified palm wood fossil
- c) felsic igneous rock
- d) quartzite
- e) hornfels

**Q4:** Which rock was deposited in a calm environment?

- a) Sample a
- b) Sample b
- c) Sample c
- d) Sample d
- e) Sample e

**Q5:** Which of the following statements is correct about the rock sample you observed?

- a) formed during volcanic eruption
- b) fast cooling of magma
- c) slow cooling of magma
- d) formed during evaporation
- e) short distance transportation

**Q6:** Which rock sample was deposited during evaporation?

- a) Sample a
- b) Sample b
- c) Sample c
- d) Sample d
- e) Sample e

**Q7:** Which rock was deposited in a deep-marine environment?

- a) Sample a
- b) Sample b
- c) Sample c
- d) Sample d
- e) Sample e

**Q8:** Which of these sand specimens is derived from a river environment?

- a) Sample a
- b) Sample b
- c) Sample c
- d) Sample d
- e) Sample e

**Q9:** Which of these sand specimens contains the highest percentage of quartz?

- a) Sample a
- b) Sample b
- c) Sample c
- d) Sample d
- e) Sample e

**Q10:** Sediment and source rock identification: which rock sample below is the source of the observed sediment / soil specimens?

- a) Sample a
- b) Sample b
- c) Sample c
- d) Sample d
- e) Sample e

**Q11:** Sediment and source rock identification: which rock sample below is the source of the observed sediment / soil specimens?

- a) Sample a
- b) Sample b
- c) Sample c
- d) Sample d
- e) Sample e

**Q12:** Which rock formed at the highest temperature?

- a) Sample a
- b) Sample b
- c) Sample c
- d) Sample d
- e) Sample e

**Q13:** Which fossil does not have any of its original composition preserved?

- a) Sample a
- b) Sample b
- c) Sample c
- d) Sample d
- e) Sample e

**Q14:** Match each product (Product 1, 2, 3) to its corresponding raw material (Material a, b, c, d, e, and f) in question 14A, 14B, 14C. You need to answer all three sub-questions in 2.5 minutes.

**Q14A:** What is the raw material for Product 1

- a) Material a
- b) Material b
- c) Material c
- d) Material d
- e) Material e
- f) Material f

**Q14B:** What is the raw material for Product 2

- a) Material a
- b) Material b
- c) Material c
- d) Material d
- e) Material e
- f) Material f

**Q14C:** What is the raw material for product 3

- a) Material a
- b) Material b
- c) Material c
- d) Material d
- e) Material e
- f) Material f

**Q15:** Match each raw material (Material 1, 2, 3) to its corresponding product (Product a, b, c, d, e, and f) in question 15A, 15B, 15C. You need to answer all three sub-questions in 2.5 minutes.

**Q15A:** What is the product from raw material 1

- a) Product a
- b) Product b
- c) Product c
- d) Product d
- e) Product e
- f) Product f

**Q15B:** What is the product from raw material 2

- a) Product a
- b) Product b
- c) Product c
- d) Product d
- e) Product e
- f) Product f

**Q15C:** What is the product from raw material 3

- a) Product a
- b) Product b
- c) Product c
- d) Product d
- e) Product e
- f) Product f

**Q16:** The rock you are examining comprises a number of minerals. The four essential minerals are

- a) quartz, muscovite, plagioclase, and amphibole
- b) quartz, muscovite, plagioclase, and tourmaline
- c) quartz, muscovite, K-feldspar, and pyroxene
- d) quartz, muscovite, K-feldspar, and tourmaline
- e) quartz, muscovite, plagioclase, and biotite

**Q17:** There are two distinctive planes in this rock specimen. Which choice below can possibly best explain the rock features? (There might be more than one correct answer.)

- a) Both planes are primary features.
- b) Both planes are secondary features.
- c) One plane is primary and the other is a secondary feature.
- d) One plane is a joint plane and the other is a fault plane.
- e) One plane is bedding and the other is cleavage.

**Q18:** The ultimate chemical weathering product of which mineral below is clay minerals?

- a) Sample a
- b) Sample b
- c) Sample c
- d) Sample d
- e) Sample e
- f) Sample f

# IESO 2018 Thailand: Practical Test 2

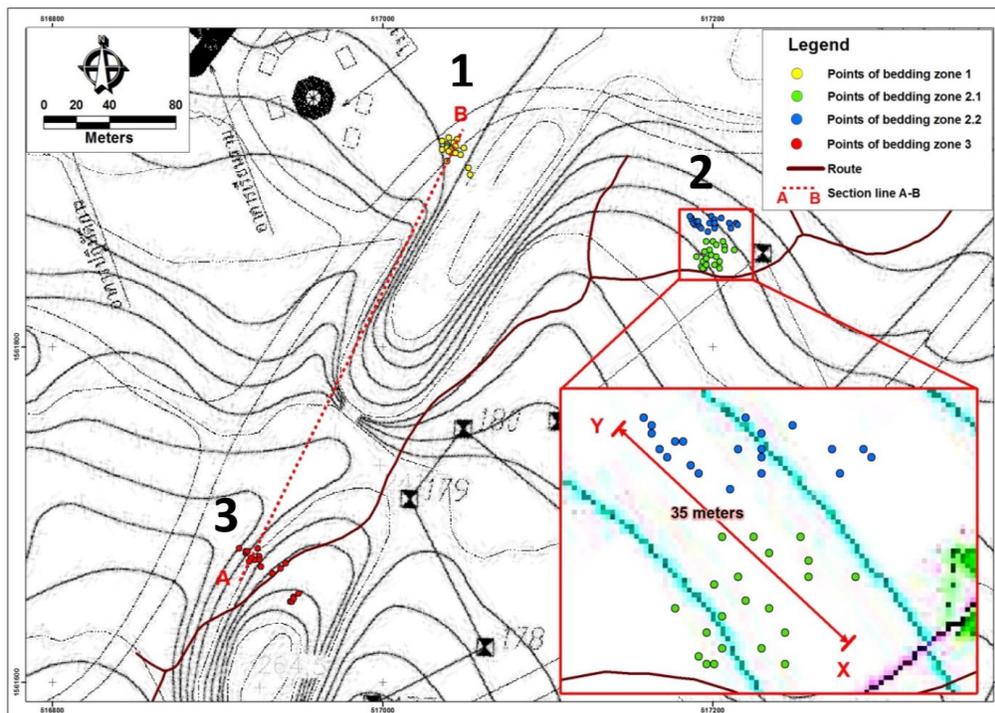
## Field Geology Examination

In this part of the examination, you will perform measurements at three stations (stations 1, 2, and 3). The three stations are indicated in **Figure 1** on the next page. Each student is provided with a Brunton compass. You have 10 minutes per station to perform the measurements.

Each student will start at a different station as directed by examination assistants. Make sure you know your station before you proceed with the exam.

### Please note the following:

- 1) Write your answer (measurements) in the answer sheet.
- 2) The data collected in Practical Test 2 will be analyzed in Practical Test 3 right after.
- 3) Permissible errors in your measurements:
  - a) Full mark for value within  $\pm 5$  degrees of the correct value.
  - b) Half mark for value within 6 – 10 degrees of the correct value.
  - c) No mark for value more than 10 degrees away from the correct value.



**Figure 1.** A topographic map of the study area scale 1:1,500 showing contour intervals of approximately 30 cm and the three study stations 1, 2, and 3.

**Station 1: Rock types and attitudes (Orientation)**

**Q1:** What can you conclude about the type of the rock?

- a. It is a sedimentary rock.
- b. It is a plutonic rock.
- c. It is a volcanic rock.
- d. It is a metamorphic rock.

**Q2:** Use your kit to identify the rock here (Choose one option from the list below)

- a. Basalt
- b. Chert
- c. Clay
- d. Dolomitic limestone
- e. Gabbro
- f. Gneiss
- g. Granite
- h. Marl
- i. Sandstone
- j. Schist

**Q3:** What is the strike and dip of the strata marked at the spot marked on the outcrop at this station?

**Station 2: Rock types and attitudes (Orientation)**

**Q4:** What can you conclude about the type of the rock?

- a. It is a sedimentary rock.
- b. It is a plutonic rock.
- c. It is a volcanic rock.
- d. It is a metamorphic rock.

**Q5:** Use your kit to identify the rock here (Choose one option from the list below)

- a. Basalt
- b. Chert
- c. Clay
- d. Dolomitic limestone
- e. Gabbro
- f. Gneiss
- g. Granite
- h. Marl
- i. Sandstone
- j. Schist

**Q6:** What is the strike and dip of the strata marked at the spot marked on the outcrop at this station?

**Station 3: Rock types and attitudes (Orientation)**

**Q7:** What can you conclude about the type of the rock?

- a. It is a sedimentary rock.
- b. It is a plutonic rock.
- c. It is a volcanic rock.
- d. It is a metamorphic rock.

**Q8:** Use your kit to identify the rock here (Choose one option from the list below)

- a. Basalt
- b. Chert
- c. Clay
- d. Dolomitic limestone
- e. Gabbro
- f. Gneiss
- g. Granite
- h. Marl
- i. Sandstone
- j. Schist

**Q9:** What is the strike and dip of the strata marked at the spot marked on the outcrop at this station?

# IESO 2018 Thailand: Practical Test 3

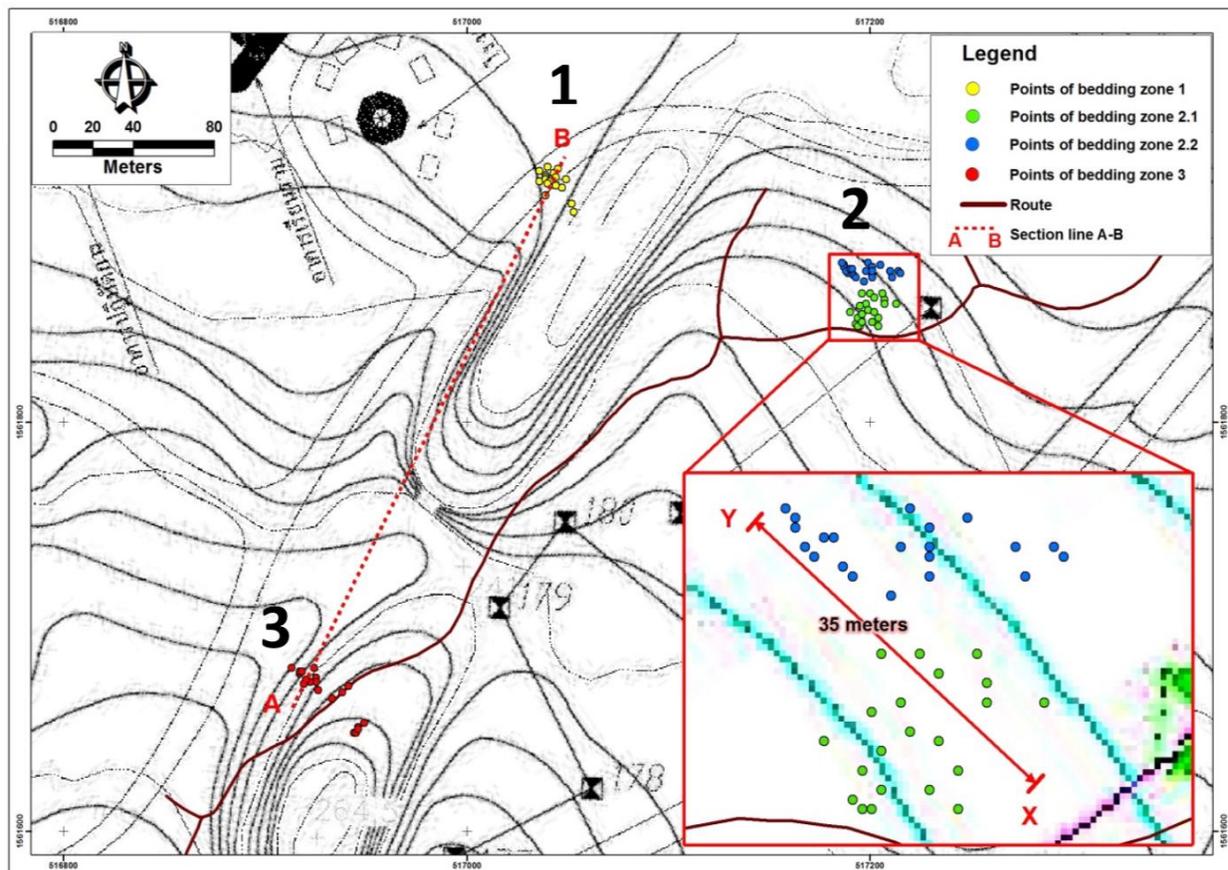
## Field Geology Exercise

### Part I: True Thickness

In this part, you will calculate the true thickness using your measurements at three stations (stations 1, 2, and 3) in Practical Test 2. The three stations are indicated in **Figure 1**.

### Part II: Cross Section

In this part, you will use the data that you made in **Part I** to find the structure and relative ages of the beds. (One point for a correct answer)



**Figure 1.** A topographic map of the study area scale 1:1,500 showing contour intervals of approximately 30 cm and the three study locations 1, 2, and 3.

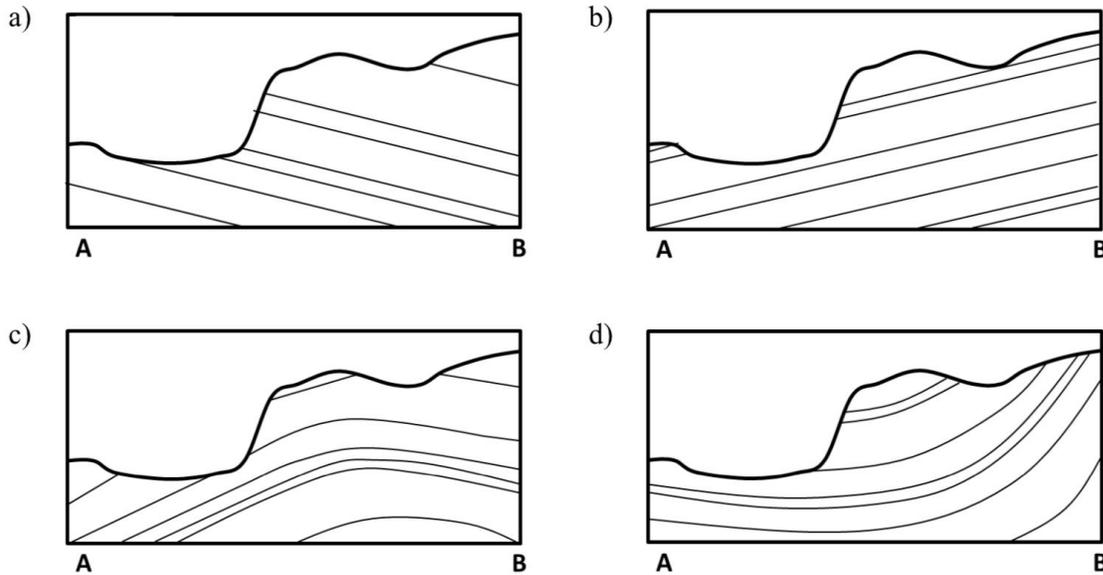
**Part I. True Thickness**

**Q10:** Calculate the cumulative true thickness of the strata from point X to point Y of **Station 2** using the dip angle from your own measurements in Practical Test 2. You can assume that the apparent thickness of strata from X to Y is 35 meters (see **Figure 1**). Note that true thickness is measured perpendicular to the bedding plane.

**Part II. Cross section**

Please refer to your measurements/observations in Practical Test 2 and answer the following questions.

**Q11:** Choose the option that depicts the correct geological profile along line A-B shown in **Figure 1**.



**Q12:** Which station has the youngest stratum along the profile A-B?

- a) Station 1
- b) Station 3
- c) Both stations have the same stratum.

## IESO 2018 Thailand: Practical Test 4

In this test there are two sections: **Section A** and **Section B**. Students are required to finish the exam within **1 hour**. Please answer in the answer sheet by marking X in the box(es) corresponding to your answer(s) or fill in the corresponding data.

### Section A: How will melting ice caps affect sea level?

In this practical test, we will use a simple model to study what happens when ice caps melt away possibly due to the effect of global warming.

#### Equipment

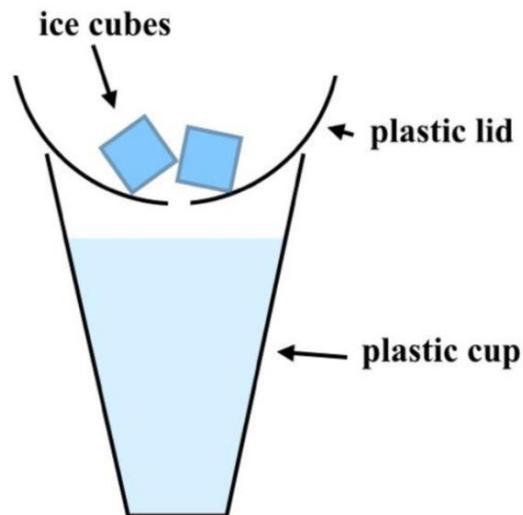
- 2 plastic cups
- 1 plastic lid (used as a funnel)
- 1 syringe with scale
- 1 bottle of purified water
- 1 marker
- 1 paper cup filled with ice cubes

**To save time, Part 1 and Part 2 should be performed simultaneously!**

#### Part 1: Melting of ice cubes supported by a funnel

Fill the plastic cup to about  $\frac{2}{3}$  with water. Mark the height of the water level on the side of the plastic cup using a marker provided. Put the funnel (plastic lid) on the plastic cup and put 2-3 ice cubes on the plastic lid as shown in **Figure 1**. Wait until all the ice melts.

**Q1:** Use the syringe to measure the increase in water volume. Write this volume on your answer sheet.



**Figure 1.** Setup with ice cubes on a plastic lid.

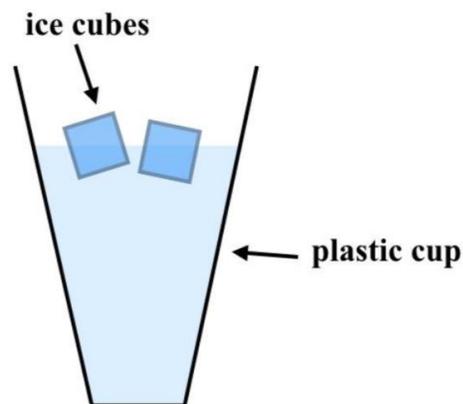
**Q2:** The density of ice is  $0.92 \text{ g/cm}^3$ , and water is  $1.00 \text{ g/cm}^3$ . Estimate the mass and the volume of ice before melting.

### Part 2: Melting floating ice cubes

In this part, you will perform a similar experiment but without the plastic lid (funnel).

Fill the other plastic cup to about  $\frac{2}{3}$  with water. Put 2-3 ice cubes into the water as shown in Figure 2. Mark the height of the water level on the side of the cup using a marker provided. Wait until all the ice melts.

**Q3:** Use the syringe to measure the increase in water volume. Write this volume on your answer sheet.



**Figure 2.** Setup with ice cubes put directly into water.

Based on what you observed in the two cases, answer **Q4** and **Q5**.

**Q4:** From which location will the melting of the ice cap *least* affect the sea level?

- The Arctic Ocean
- Antarctica
- Greenland

The masses of the ice caps at the three locations are as follows:

- The Arctic Ocean:  $1.6 \times 10^{19} \text{ kg}$
- Greenland:  $1.4 \times 10^{19} \text{ kg}$
- Antarctica:  $2.0 \times 10^{19} \text{ kg}$

We can assume that the area of all the oceans, together with the coastal areas which can be severely affected by flooding, if all the caps melt, is about 70% of the Earth's surface.

**Q5:** If all the ice caps suddenly melted, how much would global sea level rise? Use the average value of the Earth's radius (6,371 km) in your calculation. (One correct answer)

- a. 100 m
- b. 200 m
- c. 300 m
- d. 400 m
- e. 500 m

**Q6:** We can also assume that the average depth of all the oceans is about 4,000 m with the average salinity of about 35 parts per thousand. What would the ocean salinity be with a great sudden meltdown as envisioned in the previous question? Assume the present ocean area is about 70% of the Earth's surface.

- a. 50 parts per thousand
- b. 44 parts per thousand
- c. 34 parts per thousand
- d. 30 parts per thousand
- e. 25 parts per thousand

## Section B: Chromium Pollution

Potassium dichromate ( $K_2Cr_2O_7$ ) is a substance used in printing, dyeing, and metal-plating. The chromium ion,  $Cr^{+6}$ , is among the most polluting salts found in contaminated rivers. A small amount of  $Cr^{+6}$  can lead to skin burns, gastric ulcers, shock, or even sudden death. In the long term,  $Cr^{+6}$  can also cause a skin condition that causes wounds to heal more slowly. It can also cause osteoporosis and cancers. However, the amount of  $Cr^{+6}$  is negligible to cause any health risk. **For your own safety, please wear the rubber gloves and mask provided.**

### Part 1: Getting to Know Chromium Pollution

You are given three water samples in three different bottles labeled “a”, “b” and “c”.

You also receive three packs of diphenylcarbazide or ChromaVer® 3 Chromium Reagent as shown in **Figure 3**.



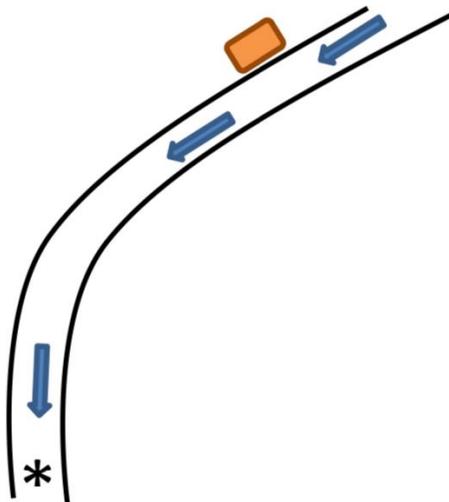
**Figure 3. Chromium reagent (left) and water samples with indicators (right)**

The Chromium Reagent contains 0.5 mg of diphenylcarbazide. Water samples containing  $\text{Cr}^{+6}$  will change color to purple-red when the Chromium Reagent is added. The hue intensity depends on the concentration of  $\text{Cr}^{+6}$  in the water sample.

**Q7:** Put one pack of chromium reagent into each of the water samples. Wait three minutes. Then rank the three samples (a, b, and c) from least to most intense color. Record your answer on the answer sheet.

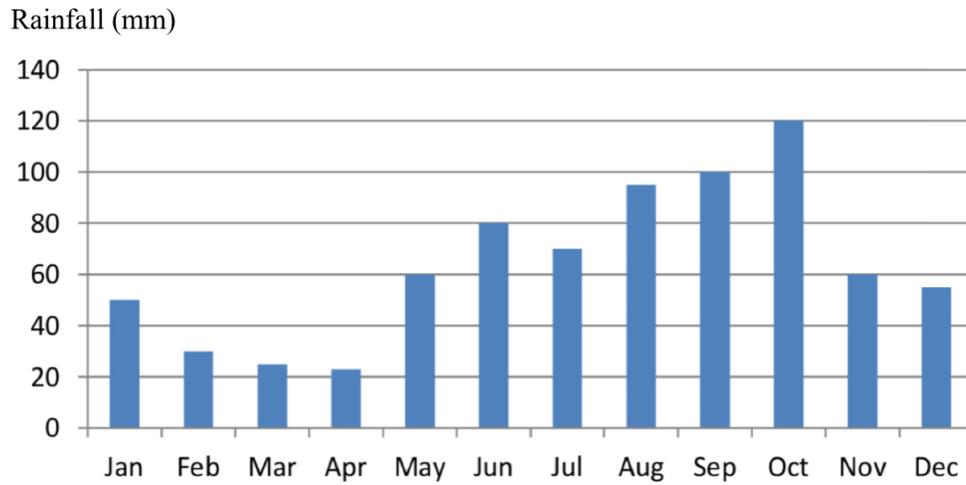
### Part 2: Seasonal Concentration of Chromium Pollution

Suppose that the three samples you received were collected in three different months (April, July, and October) from the same location marked \* in the river in **Figure 4** below. The location was downstream from a factory that was releasing  $\text{Cr}^{+6}$  continuously at a constant rate. The orange box in the figure denotes the factory which directly released  $\text{Cr}^{+6}$  into the river. Assume that the rate of release does not vary from month to month.



**Figure 4.** The orange box is the factory which directly released  $\text{Cr}^{+6}$  into the river at a constant rate. The blue arrows indicate the direction of the river flow. The \* marks the location where the three samples were taken in three different months.

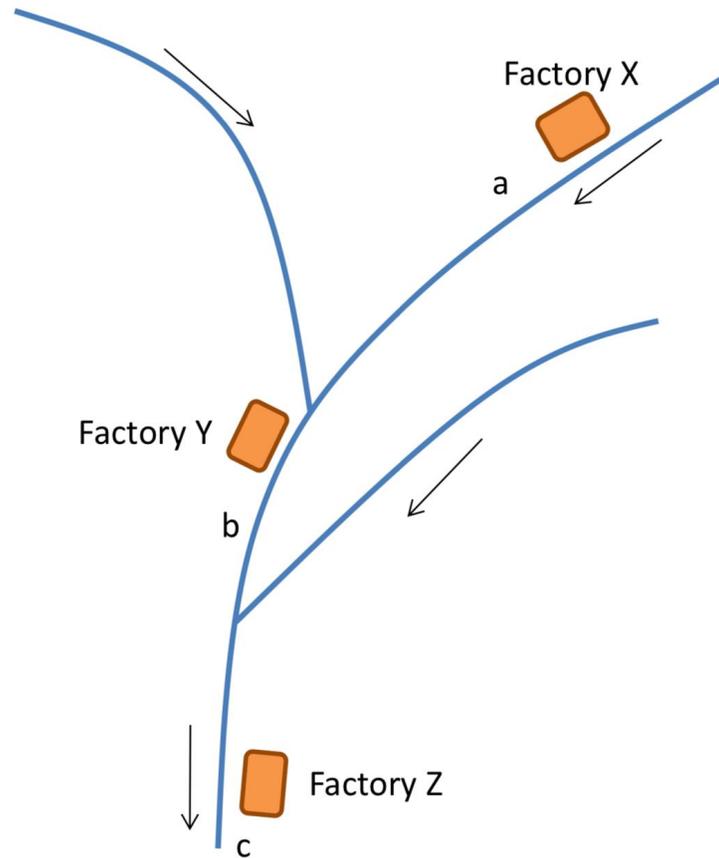
**Q8: Figure 5** shows the monthly rainfall in the area the samples were collected. Based on the color intensities and the amount of rainfall in each month, indicate in your answer sheet which month each sample was collected.



**Figure 5.** Monthly rainfalls in the same area

**Part 3: Who is polluting our river? Find the culprit.**

In a completely different scenario, suppose that the three samples (a, b, and c) were actually taken at the same time but from different locations as indicated by the letters a, b, and c in **Figure 6**.



**Figure 6.** Samples were collected from three locations (a, b, and c) at the same time. The blue curves are river branches and their flow directions are indicated by black arrows. Orange boxes are the three factories in this river basin.

It is suspected that one of the factories (X, Y, or Z) is a potential source of chromium pollution in this river basin. Assume there is no other chemical interaction that can remove  $\text{Cr}^{+6}$  from the water.

**Q9:** Based on the color intensity from the previous experiment, which factory is the most likely source releasing  $\text{Cr}^{+6}$  into the river? (Choose only one answer.)

**When you finish, do not throw away the water samples. They will be disposed of properly by the staff later.**