

# Unit 6

## Measurement 3

### Proportion

JEM/ENG

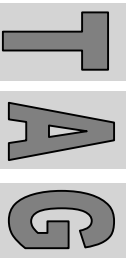
Mesleki Yabancı Dil

(Professional English)

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**Professor**

Ankara Üniversitesi  
Mühendislik Fakültesi  
Jeoloji Mühendisliği Bölümü

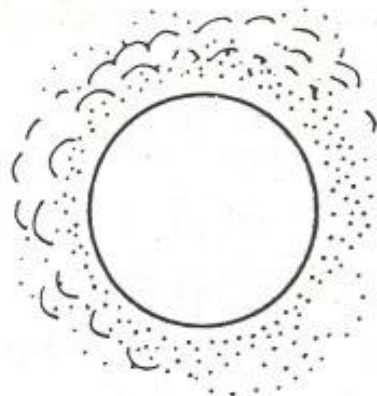


# Measurement 3 - Proportion

## Relative Size

Look at the picture

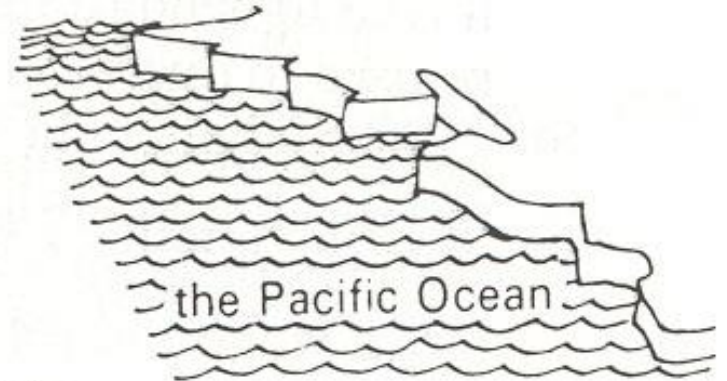
the number or amount of group or part of something when compared to the whole



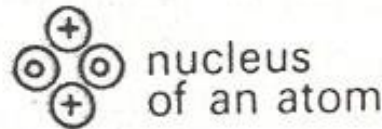
the Sun



a bird



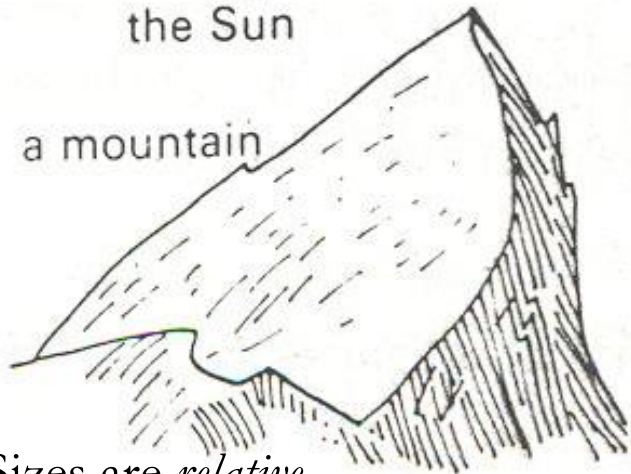
the Pacific Ocean



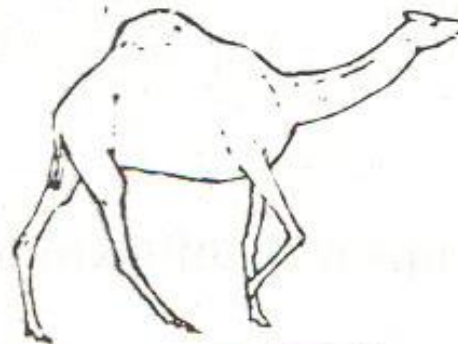
nucleus of an atom



a whale



a mountain



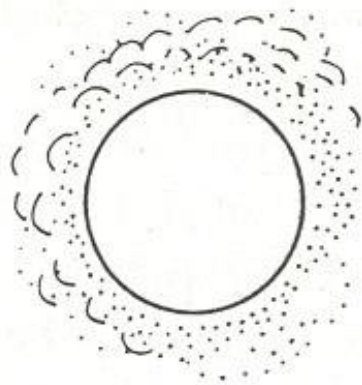
a camel



an amoeba

Sizes are *relative*.

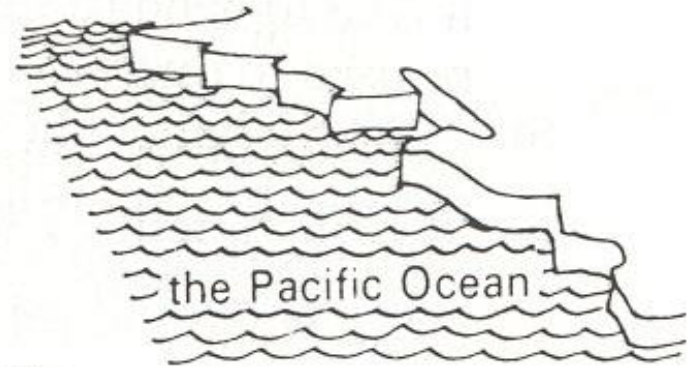
Most objects are big *in proportion to* the size of an atom but small *in proportion to* the size of the sun.



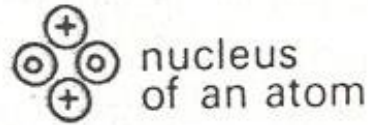
the Sun



a bird



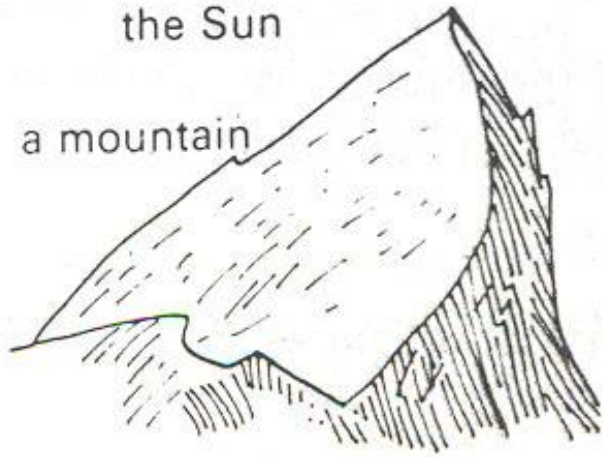
the Pacific Ocean



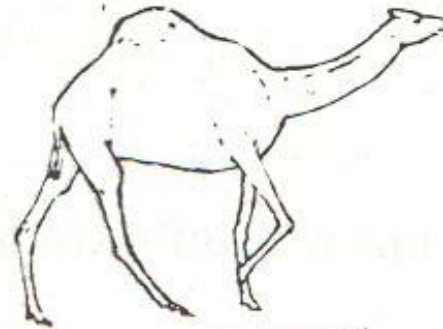
nucleus of an atom



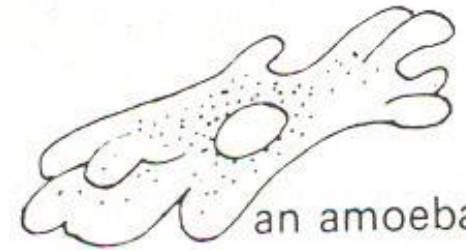
a whale



a mountain



a camel

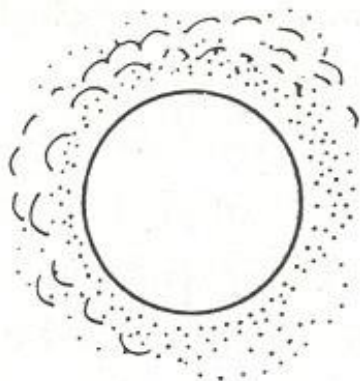


an amoeba

Make sentences like the following:

*Example:*

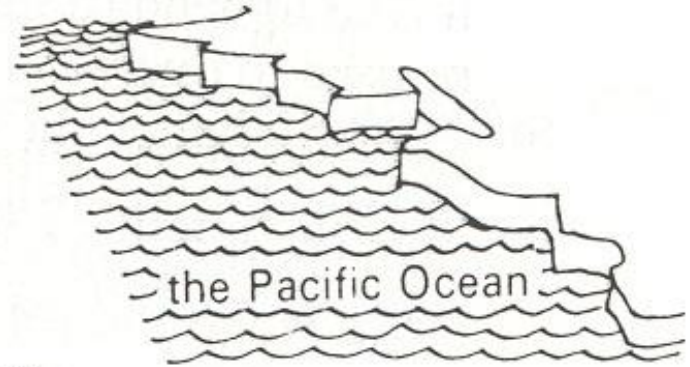
*A camel is big in proportion to the size of an amoeba but small in proportion to the size of a mountain.*



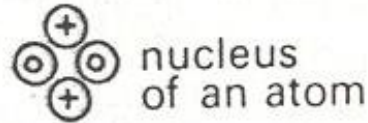
the Sun



a bird



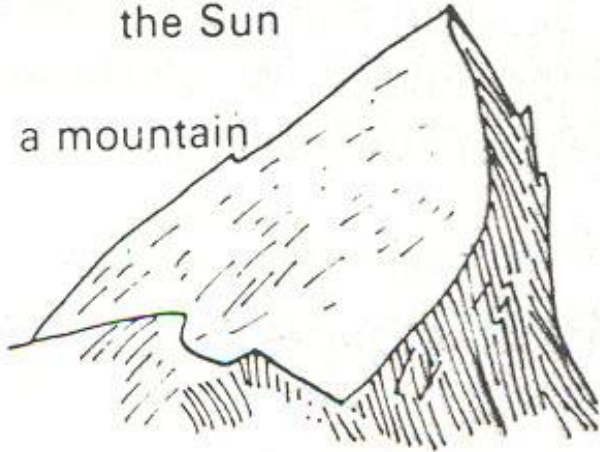
the Pacific Ocean



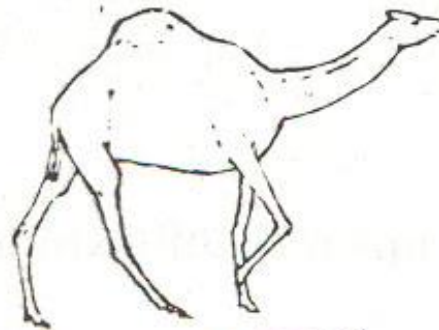
nucleus  
of an atom



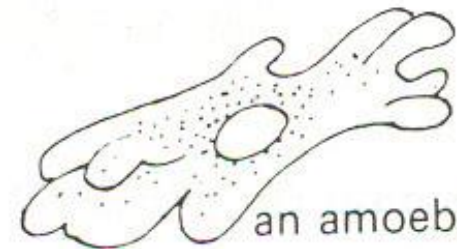
a whale



a mountain



a camel



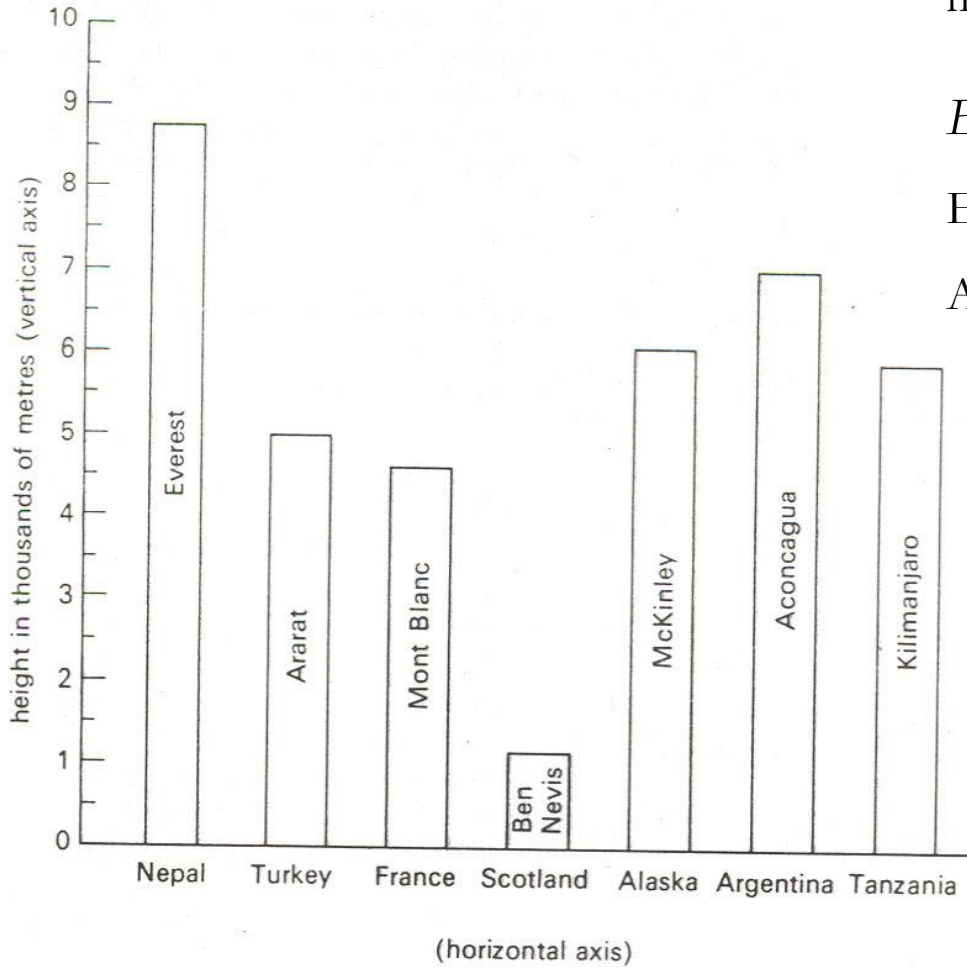
an amoeba

*Example:*

**Is a mountain large or small?**

***Compared with the size of the Sun, a mountain is relatively small.***

Look at this bar-graph



Now compare the heights of the mountains, making sentences from the table below:

*Example:*

Everest is *nearly* nine times *as high as* Ben Nevis.

Aconcagua is *considerably* higher *than* Mont Blanc.

nearly  
approximately

the same high as .....  
twice as high as .....  
x times as high as .....

much  
considerably

higher  
lower than .....

slightly

Look at this table:

Average size of rock fragments  
over 256 mm **boulder**  
150 mm **cobble**  
30 mm **pebble**  
3 mm **granule**  
1.5 mm **sand**  
0.5 mm **silt**  
under 1/256 mm **clay**

Look at this example:

Cobble is *approximately five times as big as* pebble.

Therefore, the ratio of cobble to pebble is *approximately 5:1* (five to one).

Now compare the following:

(a) granule : sand

(b) cobble : sand

(c) granule : silt

(d) Pebble : granule

Look at this table

Abundance of the most common elements by mass		
Crust element %	Sea water element %	Whole Earth element %
Oxygen 49,4	Oxygen 91	Iron 40–50
Silicon 25,8	Hydrogen 5,7	Oxygen 22–28
Aluminium 7,5	Chlorine 2	Silicon 11–15
Iron 4,7	Sodium 1	Magnesium 9
Calcium 3,4	Magnesium 0,1	Nickel 3–6
Sodium 2,6	Sulphur 0,08	Calcium 1–2
Potassium 2,4	Calcium 0,04	Aluminium 1–2
Magnesium 2	Potassium 0,04	
Hydrogen 0,9	Bromine 0,01	
Titanium 0,5	Carbon 0,003	

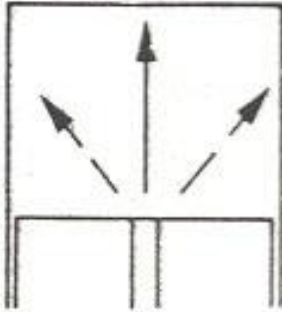
Now answer these questions:

- Which elements constitute approximately 80 % of the Earth's crust?
- What percentage of sea water do oxygen, hydrogen, and chlorine constitute?
- Express the amounts of oxygen in the Earth's crust, in the sea water, and the whole Earth as a ratio.
- Which element has a ratio 90:20:1 in the whole Earth, in the crust, and in the sea water?
- Which element has an approximate ratio of 5:2 in the crust and in the sea water?
- Which element has a ratio of 85:1 in the crust, and in the sea water?
- In sea water compare the amount of chlorine with (i) oxygen (ii) bromine.
- Compare the amount of iron in the whole Earth with the amount of iron in the crust.

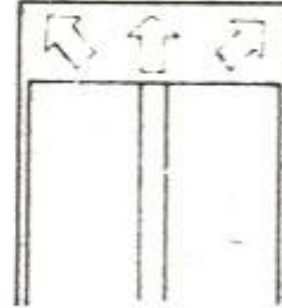
## Direct and inverse proportion

Look and read

$$p \propto \frac{1}{V}$$



great volume/low pressure



small volume/high pressure

Pressure is inversely proportional to volume; i.e. *the greater* the volume, *the lower* the pressure.

*Conversely*, the smaller the volume, the higher the pressure.



Look at this example

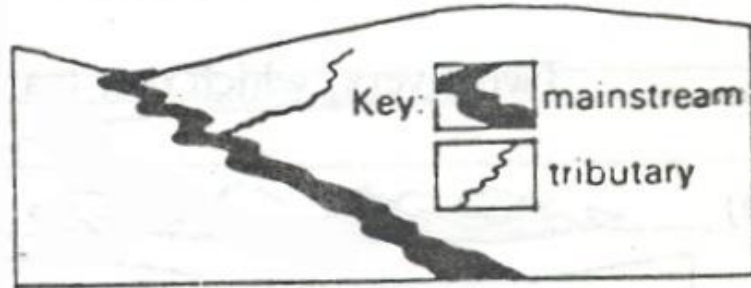
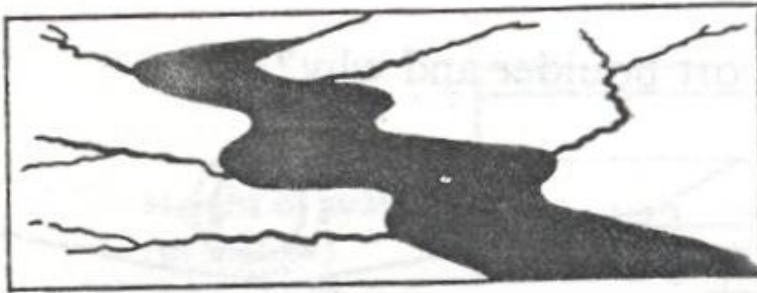
**Valley** - wide /narrow    **speed of water** - slow/fast

The *wider* the valley, the *slower* the speed of the water. *Conversely*, the *narrower* the valley, the *faster* the speed of water.

Therefore, the speed of the water depends on the width of valley. i.e. the speed of the water is *inversely proportional* to the width of the valley.

**Note:** the opposite of *inversely proportional* is *directly proportional*.

Look at this example



number of tributaries - great / small - amount of water - great / small

*Number of tributaries* – great /small

*amount of water* – great /small

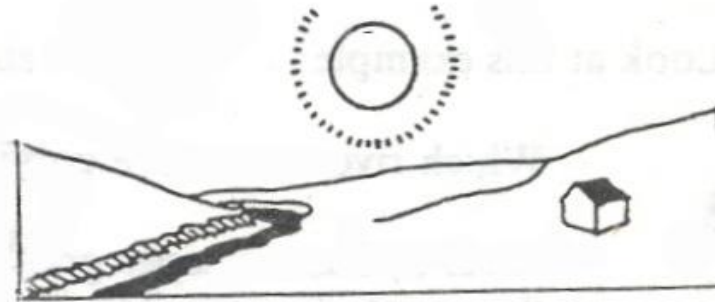
*The greater* the number of tributaries, *the greater* the amount of water. *Conversely*, the smaller the number of tributaries, the smaller amount of water.

Therefore, the amount of water depends on the number of tributaries. i.e. the amount of the water is *directly proportional* to the number of the tributaries.

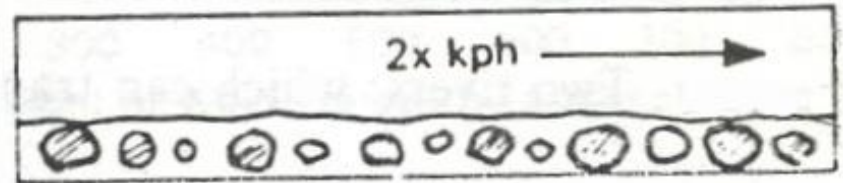
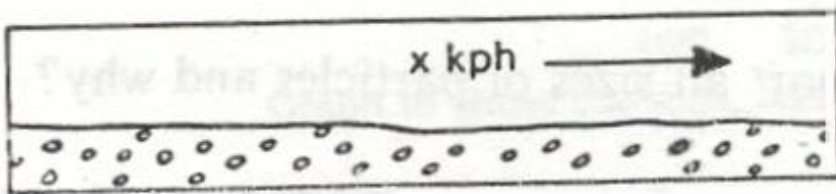
Now look at these diagrams and write similar sentences:



gradient - steep / gentle - stream - fast / slow

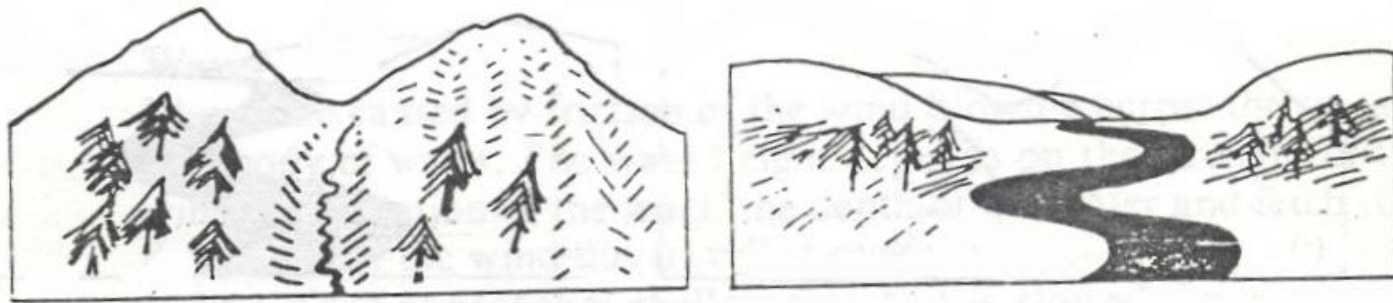


rate of evaporation - high / low - level of water - low / high



speed of river - fast / slow - size of particle which can be transported - large / small

Now look at these diagrams and write similar sentences:

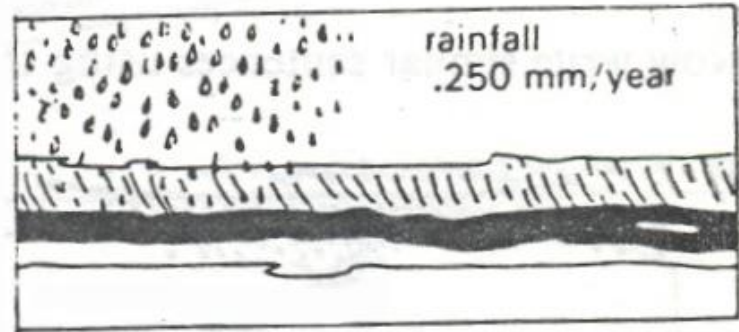
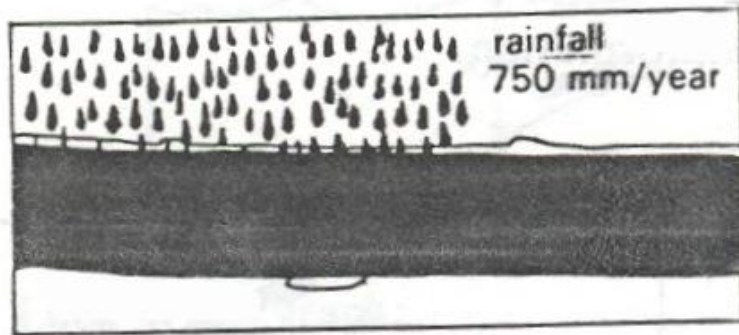


gradient - steep / gentle - stream - fast / slow

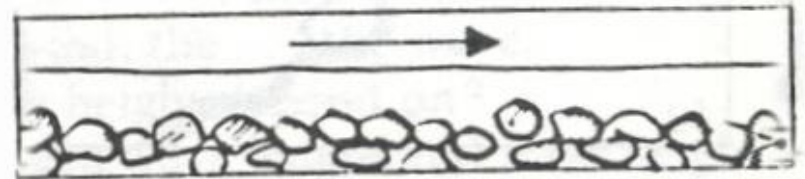
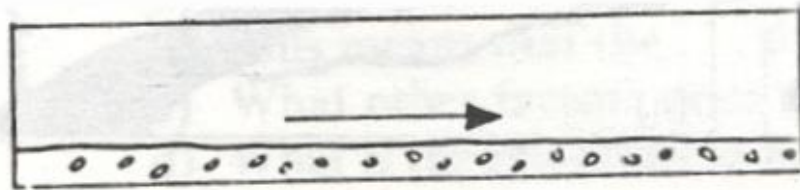
*The steeper the gradient, the faster the stream.*

*Conversely, the gentler the gradient, the slower the stream.*

Therefore, the stream depends on the gradient. i.e.  
*stream is directly proportional to the gradient.*

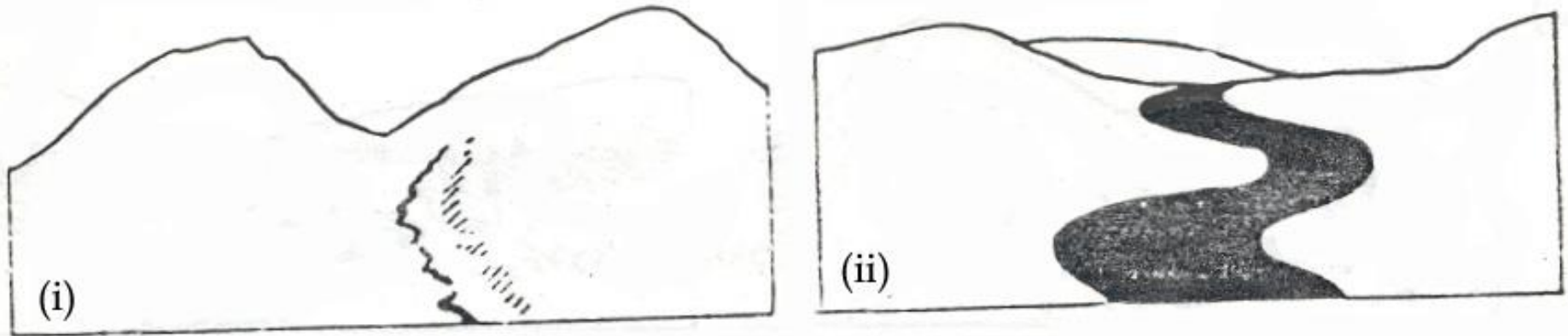


rainfall - high / low - amount of water - great / small



amount of water in a river - great / small - weight of debris which can be transported - large / small

Look at this example:

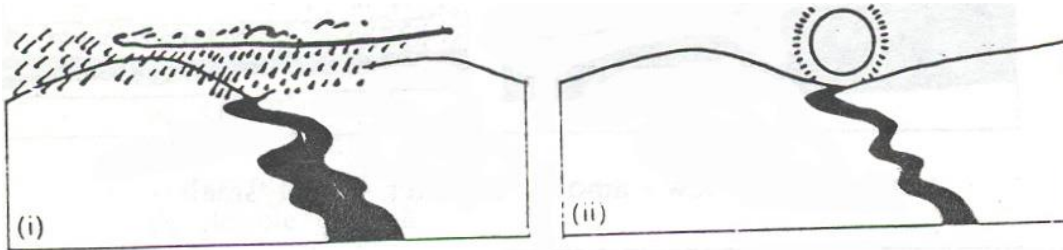


Two rivers: one river transports cobble  
one river transports granule

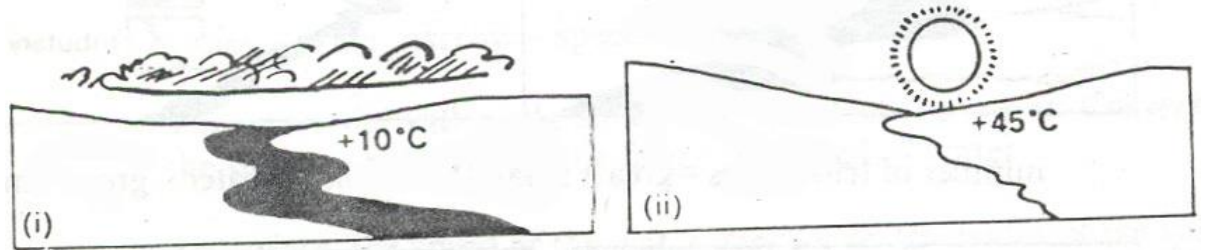
Which river can move cobble and which can move granule?

River (i) has a steeper gradient. The steeper the gradient, the faster the speed of water. The speed *in turn determines* the size of particle which can be transported. Consequently, river (i) can transport cobble.

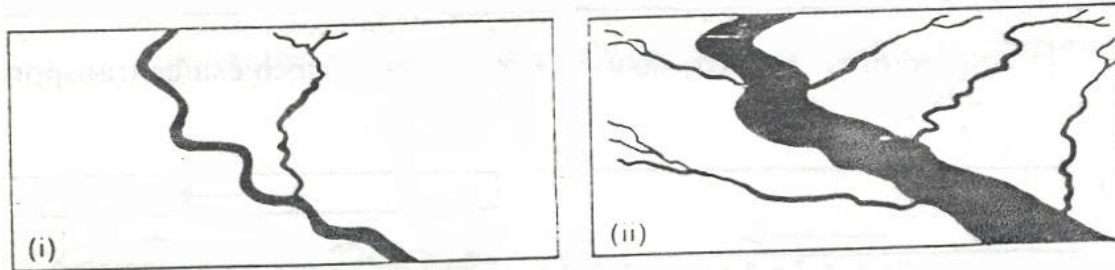
Now write similar sentences using this information:



Two rivers: which can transport boulder and why?



Two rivers: which can transport all sizes of particles and why?



Two rivers: which can transport all sizes of particles and why?

Look at this example and make similar sentences from the table below:

*Example:*

Syenite (has/contains) a small amount of potassium oxide.

Oxide	Gabbro	Diorite	Syenite	Granite
Silicon oxide ( $\text{SiO}_2$ )	48.36%	51.86%	59.41%	72.08%
Aluminium oxide ( $\text{Al}_2\text{O}_3$ )	16.84%	16.40%	17.12%	13.86%
Iron oxides	10.47%	9.70%	5.02%	2.53%
Magnesium oxide ( $\text{MgO}$ )	8.06%	6.12%	2.02%	0.52%
Calcium oxide ( $\text{CaO}$ )	11.07%	8.40%	4.06%	1.33%
Sodium oxide ( $\text{Na}_2\text{O}$ )	2.26%	3.36%	3.92%	3.08%
Potassium oxide ( $\text{K}_2\text{O}$ )	0.56%	1.33%	6.53%	5.46%
Others	2.38%	2.83%	1.92%	1.14%



Look at this example and make similar sentences from the table below:

granite-sodium oxide

gabbro-potassium oxide

syenite-silicon oxide

diorite-iron oxides

granite-silicon oxide

Oxide	Gabbro	Diorite	Syenite	Granite
Silicon oxide ( $\text{SiO}_2$ )	48.36%	51.86%	59.41%	72.08%
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**Look at these analyses of some rocks. Name the rock in each case.**

*Example:*

Rock A contains approximately 60% silicon oxide, approximately 3.5 % sodium oxide and 5% iron oxides.

Is this rock diorite?

No, because the percentage of silicon oxide is too high and there is an insufficient amount of iron oxides.

Oxide	Gabbro	Diorite	Syenite	Granite
Silicon oxide (SiO <sub>2</sub> )	48.36%	51.86%	59.41%	72.08%
Aluminium oxide (Al <sub>2</sub> O <sub>3</sub> )	16.84%	16.40%	17.12%	13.86%
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