Programmed instruction: an experiment with a programmed text: self-pacing versus group pacing

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RAINFALL IN BRITAIN

	1. Can you answer this RIDDLE? WHAT IS EVERYWHERE BUT CANNOT BE SEEN.
1. AIR	2. AIR is made up of different gases which cannot be seen. We say that these gases are i_____.
2. Invisible	3. One of these invisible gases that make up the air is a gas which comes from water and is called _____ vapour.
3. water	4. When water changes into a gas which mixes with the air we call this gas _____ _____.
4. water vapour	5. Can you see water vapour in the air?
5. No	6. The invisible water vapour gas is formed from water which is not itself a gas but a l_____ which can be seen.

6. Liquid	7. When water is a LIQUID it can be seen, it is _____, but when water is a GAS it cannot be seen it is _____.
7. Visible Invisible	8. Water is VISIBLE when it is a _____ but is INVISIBLE when it is a _____.
8. LIQUID GAS	9. There is a great deal of water vapour gas in the air. Where do you think all this water vapour comes from?
9. Water wherever it may be.	10. Streams, rivers, puddles, ponds, lakes, reservoirs seas all contain water and are all possible sources of _____ _____
10. Water vapour	11. When water changes to water vapour we say that it EVAPORATES. Rivers, lakes, seas provide a constant supply of water vapour as the water in them E_____ and mixes with the air.
11. EVAPORATES	12. Wet roads and pavements dry because the water on them _____ and changes to water vapour.

12. EVAPORATES	13. Fill a glass or jar with water. Mark the level of the water and leave it for a few days. When you look again at the water you will find that the water level is (higher/lower)
13. LOWER	14. Why has the level fallen?
14. Because the water evaporates	15. The water level falls because the water in the glass evaporates and mixes with the air as water vapour. You cannot see the water vapour evaporating because it is _____
15. Invisible	16. When water evaporates it changes to very tiny particles (called molecules) of water called Water Vapour that _____ with the air.
16. mix[redacted]	17. When water changes to water vapour we say that it _____
17. Evaporates	18. One way to make water evaporate quickly is to heat it. Notice how quickly the wet clothes dry on a w_____ sunny washing day.

18. warm	19. As you boil a kettle of water the heat produces a great deal of water vapour. Look carefully at a kettle when it is boiling. Where does the steam start, right next to the spout or a little distance away?
19. A little distance away.	20. The gap between the steam and the spout is filled with the tiny particles of water vapour that pour out of the kettle but which are _____. 
20. Invisible	21. When the water is boiling you cannot see the tiny particles of water vapour that are coming out of the spout but you can see a cloud of _____.
21. Steam	If you hold a cold mirror in the jet of steam coming out of the kettle. 22. The cold surface of the mirror will soon be covered with drops of _____.
22. water.	23. When the water in the kettle is boiled it is changed to water vapour which rushes out of the kettle, but once away from the source of heat the tiny particles slow down and c___l down.
23. cool	24. As the particles slow down and cool they join other particles of water vapour in the air and form droplets of water which are visible as _____.

24. steam

25. The invisible particles of water that come from a boiling kettle are called _____ but the visible droplets of water are called.

25. water vapour steam

26. When the kettle is boiling is there any steam to be seen 3 or 4 feet away from the spout.

26. No.

27.

The water droplets at the edge of the cloud of steam become invisible as they are soaked up or a _____ by the air.

27. absorbed

28. Just as a sponge absorbs water so the air is like a huge sponge that can absorb _____ _____.

28. water vapour

29. Water vapour is evaporating all the time from rivers, lakes, seas etc. As more and more water evaporates the water vapour formed rises and is _____ by the air.

29. absorbed.

30. We said that air is like a sponge because it can hold a lot of water vapour. But, a sponge can only hold a certain amount of water. If you dip a sponge into a bowl of water and then lift it out some water _____ out of the sponge.

30. drips falls etc.

31. A sponge can hold a lot of water but when there is too much for it to hold what happens to the water it cannot hold?

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31. It falls out (or similar)

32. The sponge loses water when there is too much for it to hold.
Like a sponge air can hold a lot of water vapour.
But like a sponge air reaches a point when there is _____ _____ water vapour for it to hold.

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32. too much

33. Which of these statements is correct?
(1) Air can hold all the water vapour formed by evaporation.
(2) Air reaches a point at which it cannot hold any more water vapour.

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33. (2)

34. Air reaches a point at which it cannot hold any more water vapour. When something is very wet we say it is soaked or saturated. When the air cannot hold any more water vapour it is very wet and we say it has reached s_____ation point.

---

34. Saturation

35. When air cannot hold any more water vapour it has reached s_____ point.

---

35. Saturation

36.
As the water vapour pours out of a boiling kettle at first it is absorbed by the air nearby.
But so much water vapour is coming out of the kettle that air near to the spout soon reaches _____ point.

36. Saturation	37. The tiny particles of water vapour cannot be absorbed by the saturated air near the spout so as these tiny particles cool they join with other particles to form droplets of water called _____.
37. Steam	38. Droplets of water called steam are formed near the kettle spout because here the air has reached _____ _____.
38. Saturation point	39. A few feet away from the kettle spout the air has not received as much water vapour from the kettle. Will this air a few feet away have reached Saturation Point?
39. No	40. A few feet from the kettle the air has not reached saturation point and is able to _____ the droplets of water that form steam.
40. Absorb.	41. If the kettle boils for only a minute or so the cloud of steam does not grow much bigger as the air a few feet away from the kettle is able to absorb the _____ of _____
41. droplets of water	42. What happens to the cloud of steam if you let the kettle boil for a few minutes or more?

42. It grows larger.

43. The cloud of steam becomes so large that it fills the whole room.
So much water vapour is pouring out of the boiling kettle that all the air in the room reaches _____ _____ and is unable to absorb the droplets of water.

---

43. Saturation point

44. The air in the kitchen becomes saturated with invisible water vapour from the kettle and [illegible]ore water vapour keeps pouring out it changes into _____ droplets of water.

---

44. Visible

45. How can you tell when the air in the kitchen has reached Saturation Point.

---

45. Because you can see the steam (or similar)

46. You can see the droplets of water either floating about as steam or running down the walls, windows and fittings.
When water changes to water vapour we say it EVAPORATES but when water vapour changes to water we say it CONDENSES
Water droplets can be seen when the air reaches Saturation Point because the water vapour c_____ _____.

---

46. Condenses

47. When invisible water vapour changes to visible water droplets we say that it _____

---

47. Condenses

48. Fill a bath with hot water and you can tell when the air in the bathroom has reached saturation point and the water vapour has condensed by the amount of _____ to be seen.

48. steam	49. In a cool bathroom the cool moist air has a low temperature and it also has a low _____ _____
49. Saturation Point.	50. If the cool moist air has a low Saturation Point it will be unable to absorb much water vapour, which will soon _____ to form steam.
50. condense	51. In a heated bathroom the higher temperature of the warm moist air makes the Saturation point higher and the air is able to _____ a lot more water vapour.
51. absorb	52. Where will you find most steam? In a cool bathroom or In a warm bathroom.
52. In a cool bathroom	53. In a cool bathroom where the cool moist air has a lower Saturation Point and the water vapour quickly condenses to droplets of water. In a warm bathroom there is very little steam to be seen as the air can absorb a great deal of water vapour because it has a _____ Saturation Point.
53. High (er)	54. Cool moist air and warm moist air have different _____ _____.

54. Saturation Points.	55. The cool moist air and the warm moist air have different Saturation Points and they are also at different t_____s.
55. temperatures	56. The Saturation Point of warm moist air is higher than the Saturation Point of cool moist air and it also has a higher _____.
56. temperature	57. If warm moist air is cooled will the Saturation Point remain the same?
57. No	58. If the temperature of warm moist air is lowered the Saturation Point is also lowered. When you change the temperature of the air you also change its _____ _____
58. Saturation Point	59. The Saturation Point of air depends upon its _____
59. temperature	60. _____ air absorbs more water vapour than _____ air.

60. warm
cold

61. What do you see when warm air is cooled to Saturation Point?

61. droplets of water

62. When warm air is cooled to Saturation Point the invisible water vapour condenses to visible droplets of water such as can be seen in clouds of _____.

62. steam.

63. A cloud of steam and a cloud in the sky are very similar as they are both made up of tiny _____ of _____.

63. drops
water

64. Clouds are formed when air reaches Saturation Point. When air is cooled, the Saturation Point is lowered [redacted] the air cannot hold as much water vapour so the "spare" water vapour _____ to droplets of water.

64. condenses

65. The droplets of water settle on particles of dust that float in the air and we see _____ in the sky.

65. clouds

66. When you see clouds in the sky or steam in a room it is a sigh that the air has reached _____ _____.

66. Saturation Point.

THIS IS THE END OF THIS SECTION.

NOW GO ON TO THE NEXT SHEET.

CLOUDS AND RAIN

	1. You know that rain comes from _____ in the sky.
1. clouds	2. Sometimes we get a day of steady continuous rain but on other days we get short heavy sh_____ of rain.
2. showers	3. Sometimes we get continuous or st_____ rain.
3. steady	4. Steady rain with small, light drops is called DRIZZLE. Steady rain can be drizzle, or it can have _____ raindrops.
4. heavy	5. Raindrops can be heavy or light. Light rain with small, light drops is called _____.
5. drizzle.	6. We do not get heavy showers of rain and continuous rain from the same cloud. We get different kinds of rain from _____ clouds.

6. different

7. Look at Panel 1 and find the CUMULUS cloud.
Does this cloud stretch across the sky like a sheet,
or is it piled up in a heap?

---

7. It is piled up in a heap.

8. The Latin word for heap is CUMULUS (Say it as Cue - mew - lus)
How many heaped-up clouds can
you find on panel 1 ? Write down their names.

---

8. Two
Cumulus
Cumulo
Nimbus

9. CUMULUS is the Latin word for a pile or a _____.

---

9. heap

10. NIMBUS is the Latin name for RAIN.
So the proper name for a heaped-up rain cloud from which
rain falls is C_____ N_____.

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10. Cumulo
Nimbus

11. Clouds have Latin names ending in US like CUMULUS.
When the two names are joined together, the end of the first
word changes to O as it does in CUMULO-NIMBUS.

What is the Latin word for rain?

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11. NIMBUS

12. We usually get short, heavy showers from heaped up Cumulo-Nimbus
clouds.
When Cumulo-Nimbus get very big we sometimes get Thunderstorms
from them.
When there is a thunderstorm what sort of rain do we get heavy or light.

12. heavy.	13. We get very heavy rain from thunderstorms. From ordinary heaped-up cumulo-nimbus clouds we get short, heavy _____ of rain.
13. Showers.	14. We do not get drizzle (light rain) from Cumulo-Nimbus clouds. The rain we get from heaped-up CUMULO-NIMBUS clouds is always _____.
14. heavy	15. Draw a copy of Panel 2. Then on your copy, write in the box of Cumulo Nimbus cloud the kind of rain it gives (two words)
15. show me your drawing	16. You know that Cumulo-Nimbus clouds give heavy showery rain. Like NIMBUS the Latin name NIMBO also means _____.
16. rain	17. There is another kind of cloud that gives rain as well as Cumulo-Nimbus. Look at Panel 1 and find the name of this other rain cloud.
17. Nimbo-Stratus	18. Look at the shape of the Nimbo-Stratus cloud on Panel 1. Is it piled up like the cumulus cloud or is it stretched across the sky like a sheet?

18. Stretched across the sky like a sheet.	19. The Latin name for a sheet is STRATUS. So a nimbo-stratus cloud is a _____ of cloud from which steady _____ falls.
19. sheet rain	20. Nimbo-stratus clouds give us days of steady, heavy rain or steady light rain called _____.
20. drizzle.	21. Steady continuous rain or drizzle comes from n_____ - s_____ cloud.
21. nimbo stratus	22. On your copy of Panel 2 put the words STEADY RAIN OR DRIZZLE in the box in the cloud that gives this kind of rain.
22. Show me your drawing	23. The sheet of cloud that gives steady, continuous rain, or steady drizzle is called _____-_____ cloud.
23. nimbo stratus	24. Short heavy showers come from heaped up c_____ - n_____ clouds.

cumulo 24 nimbus	25 So far we ~~have~~ looked ~~mostly at~~ Cumulo-nimbus and nimbo-stratus clouds. Write down the parts of their names that tell you they are rain-clouds.
nimbo 25 nimbus	26 NIMBO and NIMBUS both mean rain. The other parts of the names tell you which family nimbo-stratus and cumulo-nimbus couds belong to. Cumulo- nimbus clouds belong to cumulo& nimbus belongs to the CUMULUS family. Nimbo-stratus belongs to the _____ family.
. stratus 26	27 The two families of clouds are stratus and _____.
. Cumulus 27	28. LOOK AT PANEL 1. Which clouds are called by their family name only; the high, low or middle clouds.
low 28	29 LOOK AT PANEL 1 AGAIN. What is the name of the highest wispy "mares-tail" clouds.
~~low~~ 29 CIRRUS	30 CIRRUS clouds are very high up where the temperature is very low. So instead of being made of tiny droplets of water Cirrus clouds are made of tiny crystals of _____.

30. ice	31 Just as clouds that give rain are called NIMBUS (or NIMBO) the clouds that are so high up they are made completely of ice crystals are called C_____ clouds.
31 CIRRUS	32 Stratus clouds that give rain are called nimbo-stratus. Stratus clouds that are very high up and made of ice crystals are called _____RO-STRATUS.
32 CIRRO	33 Cumulus clouds made of tiny ice crystals are called _____ CUMULUS.
33 CIRRO	34 CIRRO-CUMULUS and CIRRO-STRATUS clouds are made completely of tiny _____ of _____.
34 Crystals ice	35 CIRRO-CUMULUS and CIRRO-STRATUS are not shown on Panel 1 as they are not so often seen as the mares-tail wispy _____ clouds.
35. CIRRUS	36 Unlike the other clouds only the cirrus clouds are made completely of _____ of _____

36. crystals
ice

37. When there are clouds in the sky we do not always get _____ falling from them.

37. rain

38. The only clouds which do not give rain are the clouds made of crystals of ice.
So we do not get rain from _____ clouds.

38. CIRRUS

39. ~~The only clouds which do not give rain are the clouds.~~
Cirrus clouds, which are made only of tiny crystals of ice, do not give _____.

39 Rain

40 Look at your copy of Panel 2. Only the box for Cirrus is blank.
The other boxes show what kind of rain falls from these clouds.
Does rain come from Cirrus clouds?

40 No

41. On your copy of Panel 2 write NO RAIN or NONE in the box for the Cirrus cloud.

41.

42. Your copy of Panel 2 is now complete and should look like the one below.

Write down the name of the cloud on Panel 2.

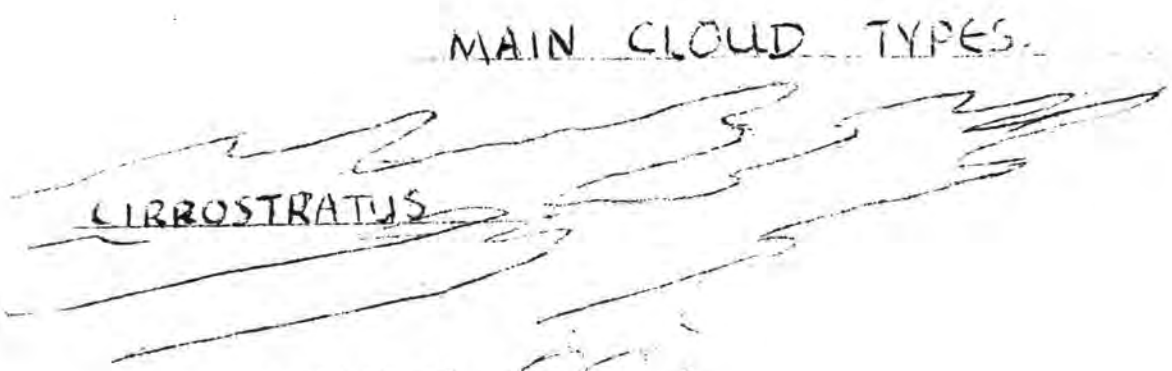
42 . CIRRUS

CUMULO-NIMBUS

NIMBO-STRATUS

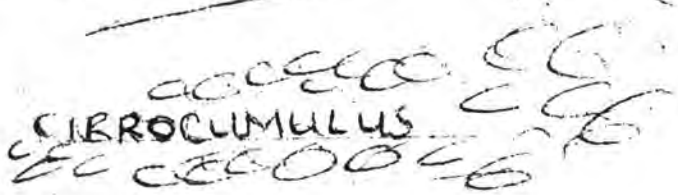
GO ON TO THE NEXT SHEET.

MAIN CLOUD TYPES



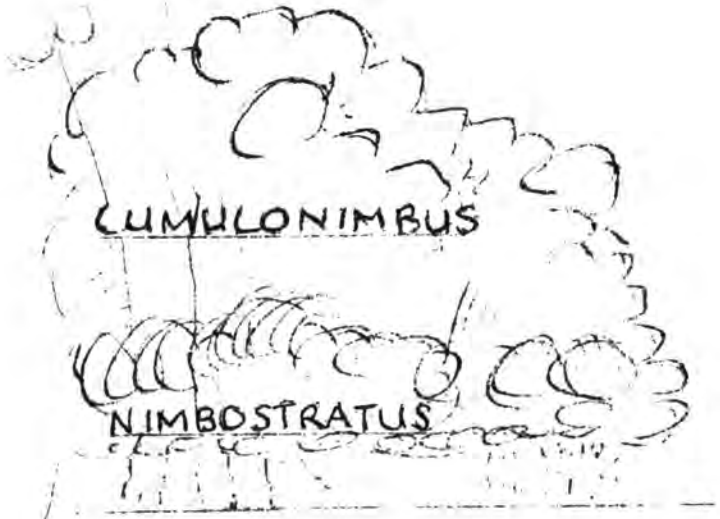
6m

5m



4ms
20 000 FT

ALTOSTRATUS 3m



2m

1mile

PANEL CNE

HOW CLOUDS FORM

	1. Clouds only form when air reaches saturation point and water vapour (condenses/evaporates)
1. Condenses	2. In spite of their different shapes all clouds are formed the same way, by air expanding and cooling so that water vapour condenses. The opposite of expansion is compression. When you pump up a bicycle tyre you force or com_____ a great deal of air into a small space.
2. Compress	3. As you pump up the tyre, the connection between the pump and the tyre, and the bottom of the pump both get hot because the air is being c_____ed.
3. compressed	4. When air is compressed it becomes warm and its temperature (falls/rises)
4. rises	5. What happens to the temperature of air as it is compressed?
5. it rises	6. When you pump up a tyre, you use the pump to compress air. When the tyre is puctured or when you undo the valve, the compressed air escapes and e_____.

6. expands.

7. When the compressed air in the tyre escapes the air expands. When air is compressed its temperature rises but when air expands its temperature _____.

7. falls

8. The temperature of air falls when the air _____.

8. expands

9. When compressed air escapes from a bicycle tyre the air expands and its temperature _____.

9. falls.

10. Air is not always compressed before it expands. Sometimes air is forced to rise over hills.

When compressed air escapes it expands. When air rises it also _____.

10. expands

11. Air expands when it is forced to _____ over hills.

11. rise

12. If air is forced to rise it expands.

When air rises it expands and its temperature _____

12. falls

13. When air rises its temperature falls because as it rises it _____.

13. expands

14. When air rises, it expands and cools.
When the air temperature is lower, the saturation point of the air is also _____

14. lower

15. So when the air rises, expands and cools its saturation point is lower.
When the saturation point of the air is lower, the water vapour in the air (evaporates/condenses) onto particles of dust in the air.

15. condenses

16. When air rises the water vapour condenses into tiny droplets of _____ or crystals of _____ which settle on particles of dust in the air.

16. droplets of water.
crystals of ice

17. As the air rises high above the earth the water vapour in the air condenses.
A mass of droplets of water or crystals of ice forms high above the earth. When this happens we see it as a _____ in the sky.

17. cloud.

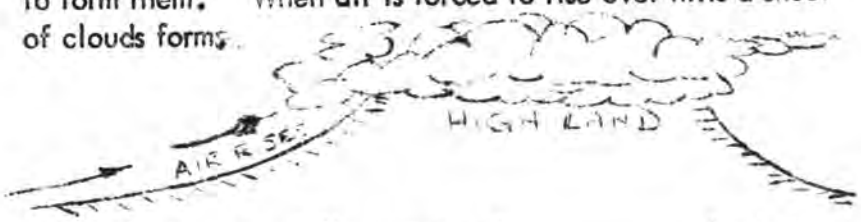
18. Clouds form when the air expands and the temperature falls, and water vapour in the air _____

18. condenses

19. The temperature falls and clouds form when air rises and _____

19. expands

20. Cumulus and Stratus clouds are different shapes because of the different shapes because of the different ways in which air rises to form them. When air is forced to rise over hills a sheet of clouds forms.



When air rises over hills or mountains _____ clouds form.

20. Stratus

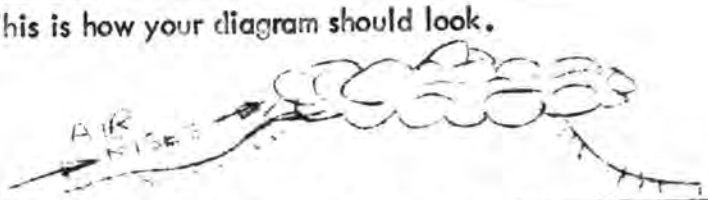
21. Stratus clouds form when air is forced to _____ over high ground.

21. rise

22. When air is made to rise over hills or mountains clouds form. Copy this diagram and put in a cloud.

22.

23. This is how your diagram should look.



In the box is the title of the diagram

Diagram showing how _____ clouds form.

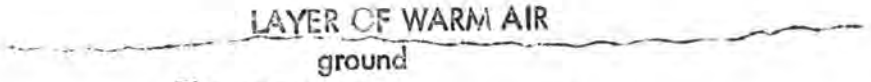
Write this title underneath your drawing and fill in the missing word.

23. Stratus.

24. Air rises in a very different way to form cumulus clouds. Sparks flying from the top of a bonfire and floating upwards and steam rising are two examples of the rule that warm air _____.

24. rises

25. On a warm sunny day the sun heats the ground which in turn warms the layer of air above it.



The warm air _____.

25. rises

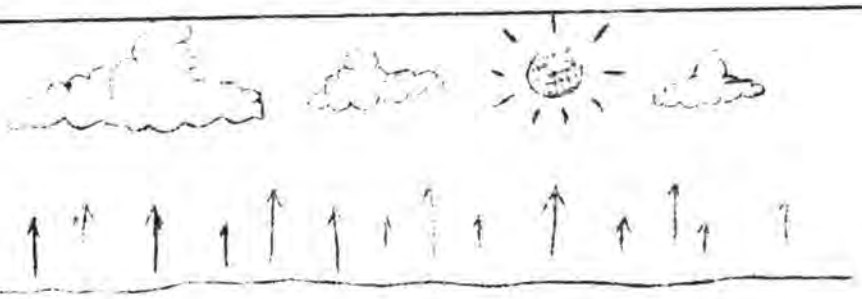
26. On sunny days the hot ground warms up the layer of air above it. "Bubbles" of warm air form and rise, often at speeds of one or two yards per second.
Although the air is warm to begin with as it rises it expands and its temperature _____

26. falls

27. When the temperature of the expanding air fall the saturation point is lower and water vapour _____ onto dust particles.

27. condenses

28.



When the water vapour in the expanded air condenses we see heaped up _____ clouds.

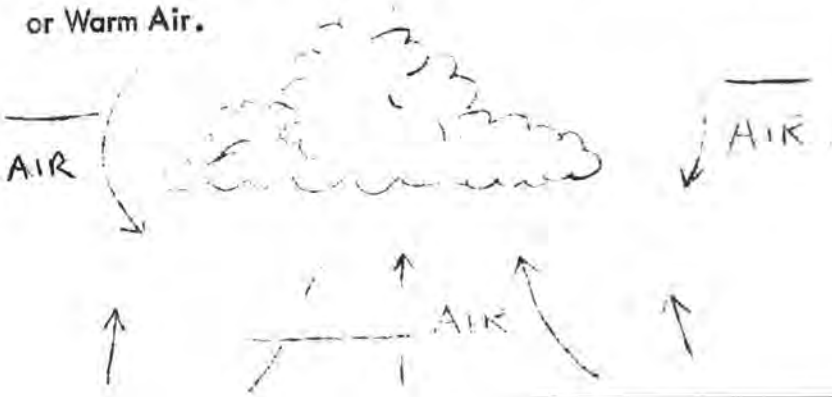
28. Cumulus

29. When warm air rises and cools and water vapour condenses CUMULUS and CUMULO-NIMBUS clouds are formed.

The warm air rises and cool air _____ to take its place.

29. falls

30. Copy this diagram on your copy, label the arrows Cool Air or Warm Air.



30. Show me your diagram	31. DIAGRAM SHOWING HOW _____ AND _____ _____ CLOUDS FORM. Write this title underneath your diagram and fill in the missing words.
31. CUMULUS CUMULO-NIMBUS	32. On a dull day when no sun appears the sky is covered with a sheet of _____ cloud.
32. stratus	33. On fine days the sun warms the ground and fluffy piled up _____ clouds may form.
33. Cumulus	34. Go on to the next sheet.

SECTION FOUR.

HOW RAINDROPS FORM

1. Clouds are made of very small light droplets of _____ and tiny crystals of _____

1. water
ice

2. The only clouds which have just crystals of ice and no droplets of water are _____ clouds.

2. CIRRUS

3. The other clouds can have both droplets of water and crystals of ice depending on the height and temperature of the cloud.
The water droplets and ice crystals do not fall to the ground because they are very _____.

3. small
light etc.

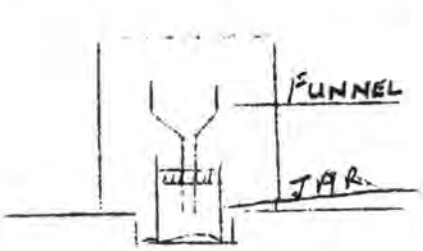
4. Raindrops fall to the ground so they must be (lighter/heavier) than the cloud water droplets.

4. heavier

5. You have probably noticed that Cumulus clouds gradually change shape; you can watch this happening if you have time.
Clouds change shape because the air and water droplets inside them are moving all the time. When cloud water droplets collide they join and make a (bigger/smaller) droplet.

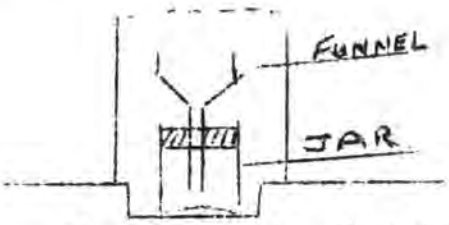
5. bigger

6. As these bigger droplets float about they bump into and join with other cloud water droplets.
When these bigger droplets are too heavy to float they will _____ to the ground.

6. fall	7. When the bigger droplets are too heavy to float they fall to the ground as _____.
7. rain	8. Here is another way in which raindrops can be formed; the top of a cloud may be very high and very cold. Instead of water droplets the top of the cloud will be made up of _____ _____.
8. ice crystals	9. The ice crystals may get too big to float or they may be blown towards the bottom of the cloud. When they reach a part of the cloud where the temperature is above freezing point the ice crystals will m_____.
9. melt	10. When the ice crystals melt they may bump into and join the cloud water droplets until they are too _____ to float.
10. heavy	11. When the ice crystals which have melted make drops that are too heavy to float the drops fall to the ground as _____.
11. rain	12. Some of the rain that falls is collected in a RAIN GAUGE (GAUGE rhymes with RAGE)  A rain gauge is used to _____ rain.

12. collect
measure
etc.

13. Every day the rain water collected in the jar is measured.



The rain water is collected in a R_____ G_____

13. rain
gauge

14. The rain gauge might be placed so that it is sheltered by buildings or dripped on by trees. Will it still measure the amound of rain fall properly.

14. No

15. It would collect too little or too much rain.
To work properly a _____ _____ must be not bw be dripped on or sheltered.

15. rain
gauge

16. If you have two containers outside, they will both collect rain (An empty tin, an old saucepan or two glass jars will do, any two containers with straight lines.
You can measure the depth of water with a ruler or with two sticks. If you measure the wetted part of the sticks with a ruler you can find the depth of rain water. _____

You will find that even if the containers are different sizes they will both collect the _____ depth of rain water.

16. same

17. The two containers collect the same depth (but not the same total amount) of water, because rain falls at the same rate into both containers. It may take a month for an inch of Rain to fall so we measure the depth of rain that falls each day in hundredths of an _____.

17. inch

18. Every day the rain in the jar of the rain gauge is poured into a glass measuring cylinder like the one in the diagram.

The cylinder is marked in 1/100ths of an inch. If the cylinder is filled to the second mark it holds _____ of an inch of rain.

18. 2/100ths

19. The person who measures the depth of rain fall writes down the figure each day. The rain is collected for measuring in a _____ _____.

19. rain gauge

20. The person who has been writing down the rainfall figure for each day adds up these figures at the end of each month. The total of all the daily figures gives the amound of rain which has fallen during the _____

20. month

21. Let us suppose that last year ANYTOWN had 5" of rain in July, 3" of rain in August and $3\frac{1}{2}$" in September. In which of these three months would you choose to go to Anytown on your Summer Holidays this year?

21. August the driest month

22. Would you expect Anytown to get the same amount of rain in July, August and September this year as fell last year?

22, No.

23 As you would expect there is a different amount of rain in the same months in different year. Lets work out the average rainfall for July August and September for Anytown using the rainfall figures for the last 3 years.

	July	August	September.
Last year.	5"	3"	$3\frac{1}{2}$"
Year before last	$2\frac{1}{2}$"	4"	$3\frac{1}{2}$"
Year before that	$1\frac{1}{2}$"	3"	3"
		10"	
Average		3	$3\frac{1}{2}$"

23. Cont. Work out the average rainfall for July and September.

23. July 3"

September $3\frac{1}{3}$"

24. Now you know the average figure, which of these months would you choose to go to Anytown for a holiday?

24. July

25. All sorts of people use the published rainfall figures?
Holiday makers use them to choose when and where to go, and farmers use them to decide what crops to grow and when to plant them and harvest them.
If we add up the twelve monthly rainfall totals we get the amount of rainfall in the y_____.

25. year

26. If we add up the annual rainfall for a number of years and find the average we would have the average _____ rainfall.

26. annual

27. The average annual rainfall for the British Isles is 26.08 inches.
A figure like 26.08" is used for comparing the average rainfall of the British Isles with the rainfall of other countries.
Farmers and others who use the rainfall figures find it more useful to know the average rainfall for each of the twelve _____s instead of the average total for the year.

27. months

28. On frame 23 you worked out the average rainfall for 3 months over the last 3 years. If you worked out the average for each month over a number of years you would get a set of twelve figures like these figures for PLYMOUTH.

JAN	FEB	MAR	APR	MAY	JUNE	JULY	AUG	SEPT	OCT	NOV	DEC
4.3	3.1	2.7	2.1	2.4	2.0	2.6	2.9	2.9	3.8	4.5	4.5

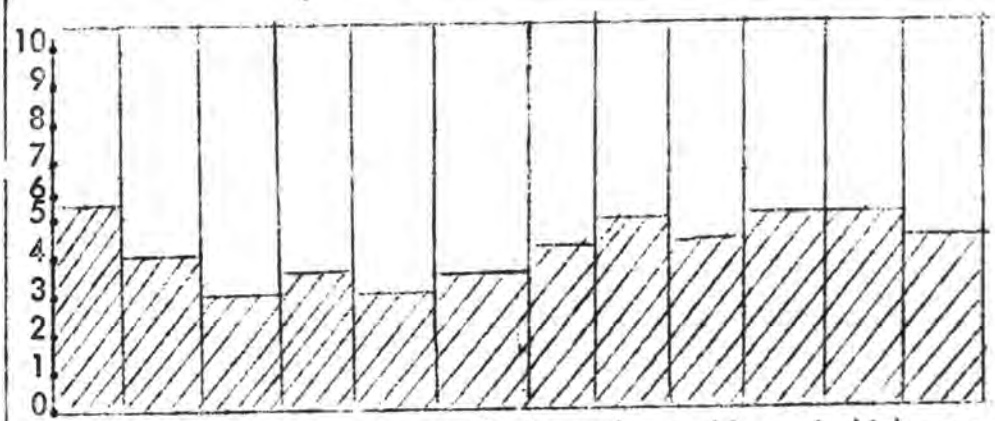
These figures give the a_____m_____ rainfall for PLYMOUTH.

28. average
monthly

29. Another way to show the average monthly rainfall is to make a graph like this.

BUSTON.

Jan. Feb. Mar. Apr. May. June. July. Aug. Sept. Oct. Nov. Dec.



This makes it easy to see which months are drier and which are wetter.

Which are the months with the lowest average rainfall?

29.
March
May

30. Average rainfall can be shown as a set of 12 figures or as a graph.

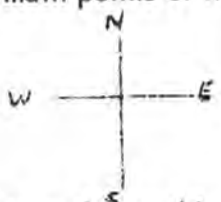
Both methods give the _____ monthly rainfall.

30. average.

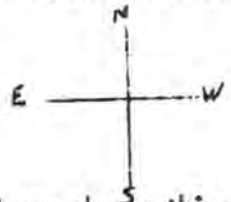
GO TO THE NEXT SHEET.

OROGRAPHIC RAIN

1. Before you can answer the next few questions you must know the 4 main points of the compass. Which of these diagrams is correct?



If you choose this diagram go to Frame 5

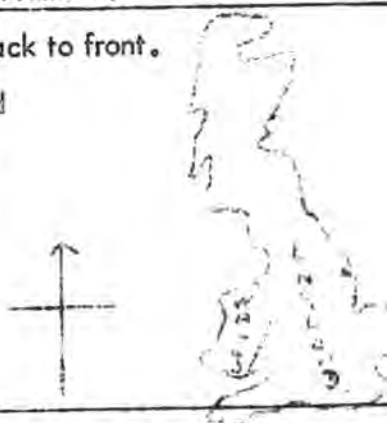


If you choose this diagram go to Frame 2.

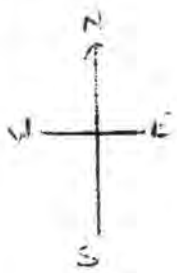
1.

2. Sorry, but you have got East and West back to front.

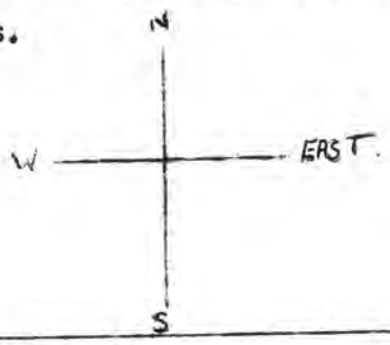
My way of remembering which way round they go is to say that Wales is to West
Now make a copy of this diagram and fill in the letters for the points of the compass.



2.



3. Another way is to spell WEST and put the arrow for North inside the word like this.



3.

4. Look at Map 1 on the Panel.
At the side of the map are the average rainfall graphs for the towns marked.
Which coast of Britain has most rain East or West?
Go to Frame 6

4.

5. Look at the map 1 on the panel.
At the side of the map are the average rainfall graphs for the towns marked.
Which coast of Britain has more rainfall East or West?

---

5. West.

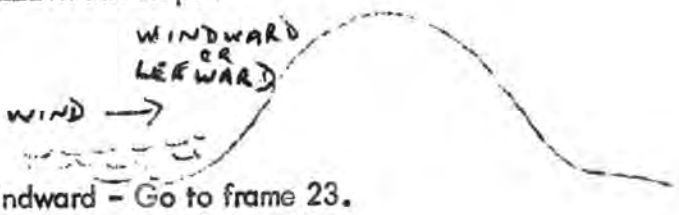
6. Now look at Map 2 which shows the areas of high and low land.
On which coast is the highest land East or West?

6. West	7. Map 3 shows that the areas with the most rain are in the (East/West).
7. West	8. Both the heaviest rainfall and the highest land are in the _____
8. West.	9. You will remember that one way in which rain is produced is when air _____ over hills and mountains.
9. rises	10. The wind often blows from the West. When the wind comes from the west it is moist because it has blown over the _____
10. Sea (Atlantic)	11. When the moist westerly wind blows over the mountains and high ground on the west of Britain the air rises, expands and its temperature _____.
11. falls	12. When the air temperature falls the water vapour in the moist air condenses into particles of dust in the air and a sheet of cloud forms.  What is the name for a sheet of clouds?

12. Stratus	13. As the air continues to rise more condensation takes place, raindrops form and rain falls over the hills and m_____
13. mountains	14. Rain falls over mountains because air is blown over them and forced to rise. The Greek word for mountains is OROS. Rain caused by moist air rising over mountains is called OROGRAPHIC rain. Which three letters in OROGRAPHIC mean mountains?
14. ORO	15. Orographic rain comes from clouds formed when air rises over mountains. Stratus cloud forms in this way so most orographic rain comes from _____-_____ clouds.
15. nimbo stratus	16. The west coast of Britain has the highest rainfall. Much of this rain is caused by air rising over the mountains and is called o_____g___phic rain.
16. orographic	17. The west coast of Britain has the highest land and has a lot of _____ rain.
17. orographic	18. RAIN SHADOW. When the wind blows from the sea onto the west coast of Britain is it dry or moist?

18.

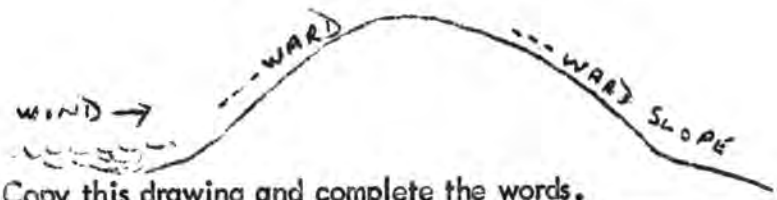
19. Is the mountain slope facing the wind called the WINDWARD or the LEEWARD slope?



A - Windward - Go to frame 23.
B - Leeward - Go to frame 20.

19.

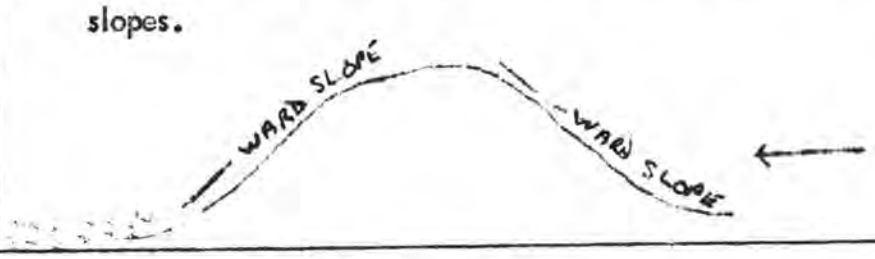
20. You say the slope facing the wind is called the Leeward slope, but LEE means shelter so the leeward slope is the sheltered slope. The leeward slope is opposite the windward slope.



Copy this drawing and complete the words.

20.

21 Copy the diagram below.
The wind has changed direction so be careful when you label the slopes.



21.

22 Which side of the mountain would be sheltered from the wind?

22. leeward

23. Which side does the wind blow onto windward or leeward?

23. windward

24. The moist westerly wind often blows onto the west coast of Britain.

Orographic rain falls over the mountains and high lands. When the wind reaches the low-land on the leeward side is it moister or dryer?

24. dryer

25.

The town likely to have most rain is Town ____

25. A

26. Places on the drier, leeward side of mountains are said to be in the RAIN SHADOW of the mountains.

Which town is in the Rain Shadow?

26. B.

27.

Town B is in the R_____ S_____ of the mountains.

27. B
Rain Shadow

28. Look at the graphs on Map 1.
If you travel from Fort William through BUXTON and BIRMINGHAM to YARMOUTH each town is further east than the one before. The graphs show that the more easterly the town the _____ rain falls.

28. less

29. Look at the rainfall graphs on Map 1 and the areas of high land on Map 2.
The wind often comes from the west, so which two of the towns on the map are on the windward side of high land?

29. Fort William
Buxton.

30. Which 2 towns have the lower rainfall?

30. Birmingham
Yarmouth.

31. Birmingham and Yarmouth have low rainfall because they are on the leeward side of the high land in the r_____ s_____.

31. Rain
Shadow

32.

Which graph belongs to which town?

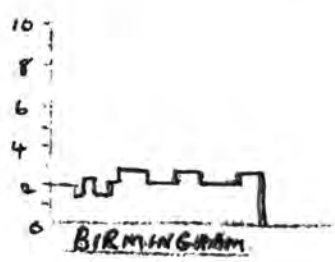
32.
1 to B
2 to A

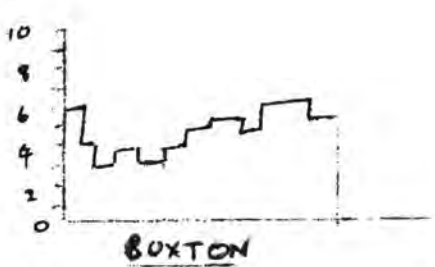
33. Town B is in the _____ _____.

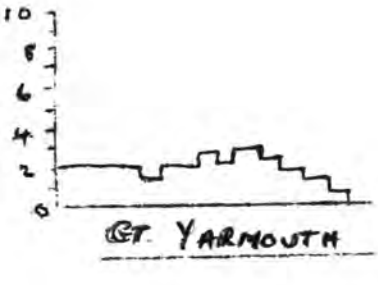
33. Rain
Shadow

34. GO TO THE NEXT SHEET.

PANEL TWO





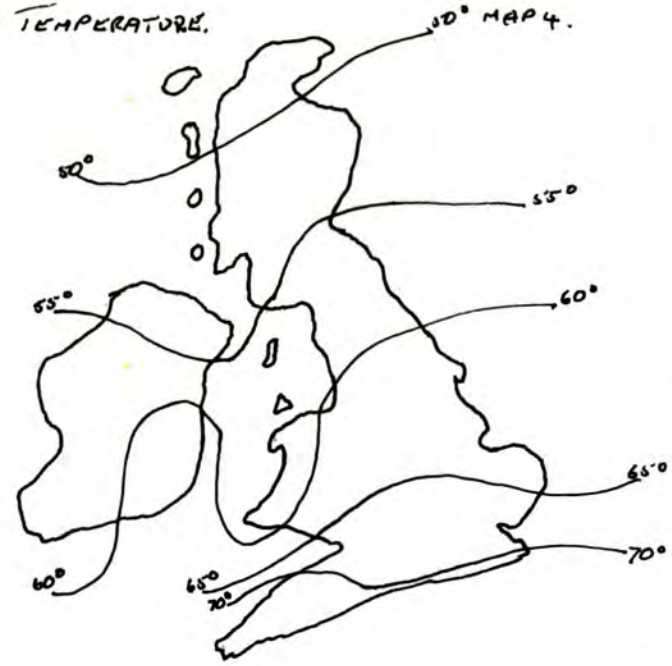


MAP ONE

RELIEF. MAP 2.

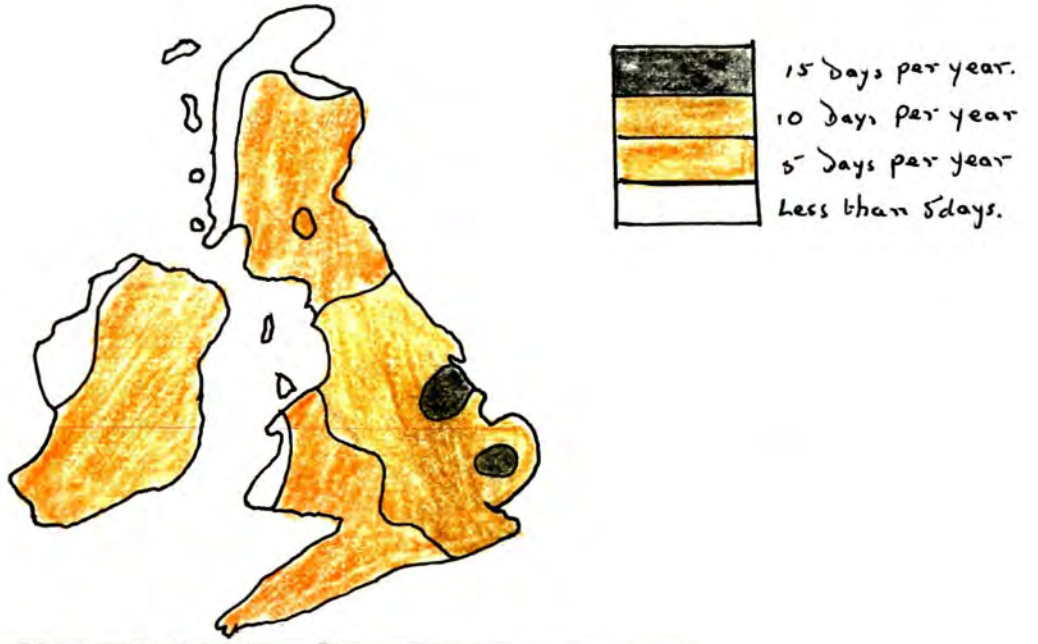
RAINFALL MAP 3.

JULY TEMPERATURE. MAP 4.



SNOW. MAP 5.

FREQUENCY OF THUNDER. MAP 6.



CONVECTIONAL RAIN

1. Cumulo Nimbus

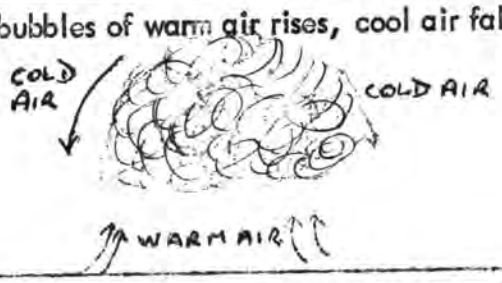
1. OROGRAPHIC rain comes from Nimbo-Stratus clouds so it is usually steady continuous rain or drizzle.
We get sudden heavy showers of rain from _____ _____ clouds.

2. heats warms etc.

2. You know that cumulus clouds form when air is warmed by the ground and rises in "Bubbles". Cumulus clouds only form when the sun _____ the ground.

3. CONVECTION

3. When bubbles of warm air rises, cool air falls to take its place.



These air movements are called CONVECTION CURRENTS.
Both Cumulus and Cumulo-Nimbus set up c_____n Currents

4. CONVECTION

4. Only when the sun heats the ground are Cumulus and Cumulo-Nimbus clouds formed and c_____ currents set up.

5. hottest

5. Cumulus and Cumulo-Nimbus clouds are most likely to form in the (hottest/coldest) part of the country.

6. Look at Map 4., which shows the average temperatures in July.
Which part of the country is the hottest?

6. South or (South East)	7. Very large towering Cumulo-Nimbus clouds are called thunder clouds. Which part of the country is likely to get most thunder clouds the north or the south?
7. South.	8. Cumulus and Cumulo-Nimbus clouds set up convection currents. Rain that falls from Cumulo-Nimbus clouds is called c_____tional rain.
8. Convectional	9. Thunder clouds are very large cumulo-nimbus clouds. When there is a thunder storm the very heavy rain is c_____l rain.
9. Convectional	10. Where is most of the convectional rain likely to fall?
10. In the South	11. The south has more thunderstorms and _____ rain than the rest of the country.
11. Convectional	12. The south has more thunderstorms and convectional rain because in summer its temperature is_____ than that of the rest of the country.

12. Higher hotter etc	13. Since thunderclouds are very big cumulo-nimbus clouds we get downpours of heavy rain from them. What is the name for rain from cumulo-nimbus clouds?
13. Convectional Rain.	14. We get heavy rain from thunderclouds and we may get ice in the form of h_____ stones too.
14. hail	15. The top of a thundercloud can be as much as 5 miles high and is very cold. The top of the cloud is very cold and is not made of tiny droplets of water, but tiny crystals of _____.
15. ice	16. You know that clouds change shape because air is moving inside them. In thunder clouds the rising air is called an up draught. The up draught of air is strong enough to carry large cloud water droplets up to the _____ of the cloud.
16. top.	17. It is so cold at the top of the cloud that the water droplets _____.
17. freeze	18. As these frozen droplets fall back to the warmer parts of the cloud they collect a coating of tiny droplets of _____.

18. water

19. What happens to the frozen drops with their thin coating of water when they meet the strong up draught of air again?

19. They are blown upward

20. At the top of the cloud it is very cold and the coating of water around the frozen drops also _____

20. freezes

21. Every time the frozen drops fall and are carried back up to the top of the cloud they collect a layer of_____

21. ice

22. Each time the frozen drops fall and are carried to the top of the cloud they collect another layer of ice, and each time they collect a layer of ice they get bigger and h_____.

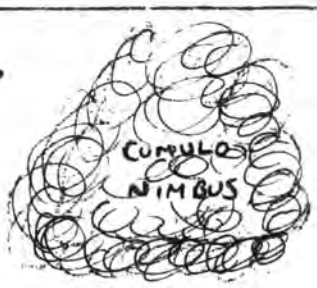
22. heavier

23. A hail stone is made up of layers of ice.
If you were able to cut one in half it would look like this.

It resembles an onion cut in half but the layers are too small to be clearly seen.

23.

24. The bigger hailstones that has fallen in Britain weighted 5 oz. In America hailstones the size of a tennis ball and occasionally the size of a grapefruit have been reported. One 6th July 1928 large hail stones fell in Nebruska (U.S.A.) one of these was seventeen inches in circumference and weighed 1½ lbs.
What are hailstones made of?

24. layers of ice	25. When hailstones are too heavy to be blown upwards by the updraught they start to _____ downwards.
25. fall drop	26. When hailstones fall to the ground we say there is a _____ storm.
26. hail storm	27. Thunderclouds give r_____ as well as hailstone.
27. rain	28.   Both these clouds give rain. Which cloud gives hail as well as rain?
28. Cumulo Nimbus	29. Which area of England is more likely to have sudden downpours of rain or hail North or South?
29. South.	[redacted]

NAME FORM GROUP

PRE - TEST.
POST - TEST.

RAINFALL IN BRITAIN

NOTE: In some questions only one word is needed for the answer, but other questions need a few words to the answer.

1. The gas formed from water is called .....

2. When water changes to a gas we say it .....

3. When air has absorbed all the moisture it can hold we say it has reached .....

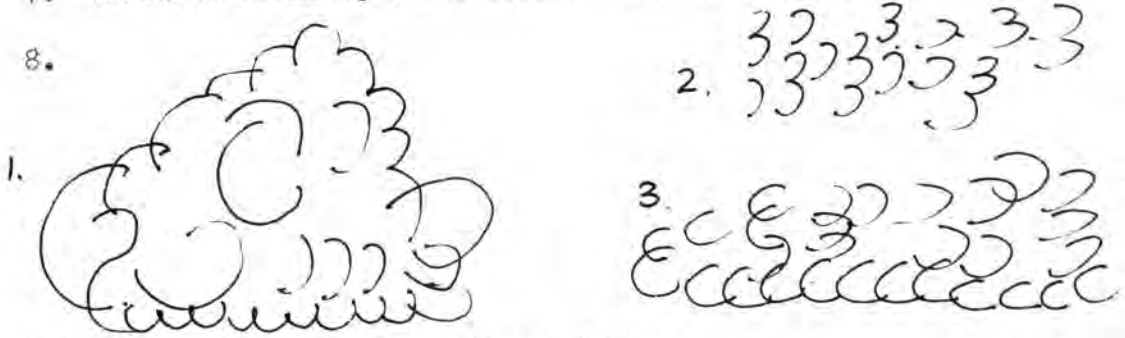
4. When warm moist air is cooled it's ..... is lowered and some of the water vapour in the air .....

5. When the gas formed from water changes back to water we say it .....

6. Clouds are formed when warm moist air .....

7. Clouds are made up of ..... or .....

8.



(a) Name these three clouds shown above.

(b) The cloud in diagram ..... gives heavy showers of rain.

(c) The cloud in diagram ..... gives steady rain or drizzle.

(d) The cloud in diagram ..... gives no rain at all because it is .....

(e) The cloud in diagram ..... gives both rain and hail.

(f) In the spaces below draw a diagram to show how the clouds in Diagram 1 and Diagram 2 are formed.

DIAGRAM 1. DIAGRAM 2.