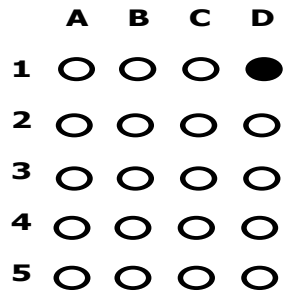
15th International Mathematics and Science Olympiad (IMSO)

Science Theory Test 1

Zhejiang Province, China
28 September- 4 October 2018

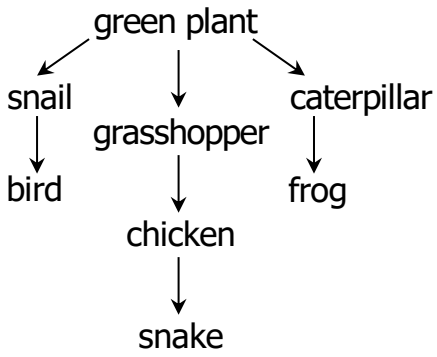
Instructions:

1. Do not turn over this page until you are told to do so.
2. Write your code number on the Answer Sheet.
3. Answer all the questions. A correct answer for each question will be awarded 1 point.
4. Shade the oval fully (●) for the alphabet (A, B, C, D) that best represents your answer for each on the Answer Sheet.

Example	**Answer Sheet**
Question Paper 1. Which group of animals below contains only meat-eater? A. Man, fox and cow B. Snail, cow and caterpillar C. Chicken, cat and rabbit D. Python, shark and tiger	

5. There are 30 questions printed on a total of 17 pages, including the cover page.
6. You have 60 minutes to complete this test.

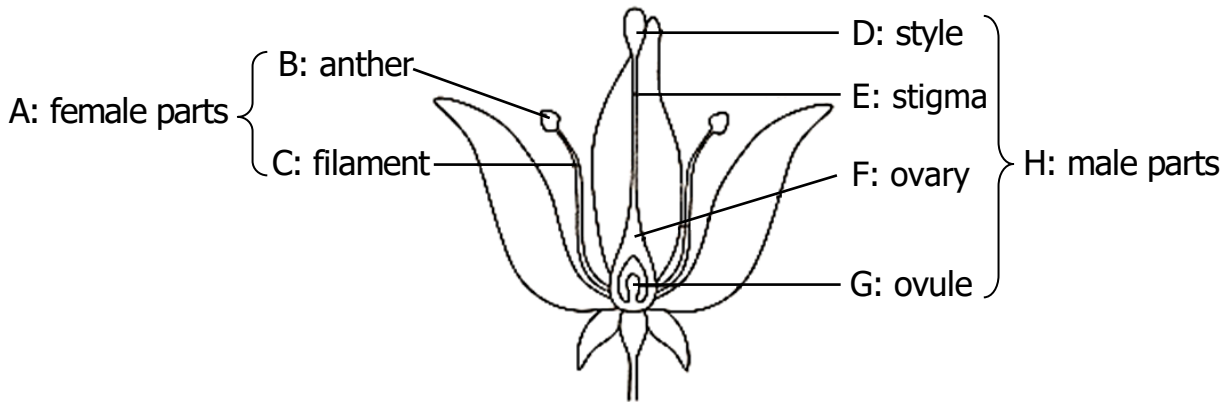
1. A food web is given below:



How many primary consumers and secondary consumers are involved in the food web, respectively?

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

2. Which parts of the flower shown below are wrongly labeled?



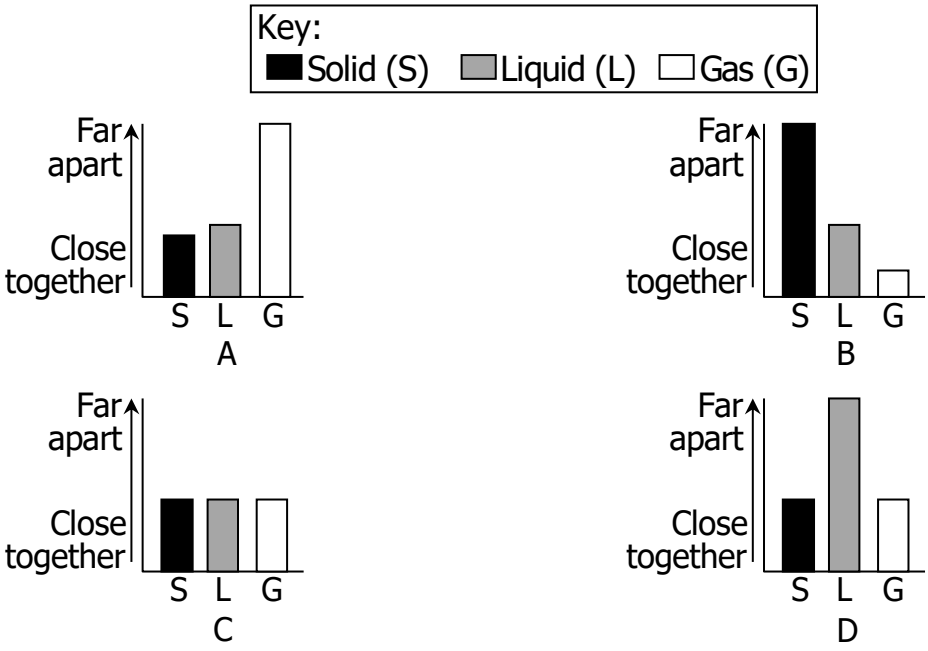
A. A, B, C and H only
B. A, D, E and H only
C. B, C, D and H only
D. D, E, F and G only

3.Which of the following electrical appliances will produce heat when they are turned on?

(1) air-conditioner
(2) electric bulb
(3) fan
(4) refrigerator

A. (1) and (2) only
B. (1) and (3) only
C. (2) and (3) only
D. (1) (2) (3) and (4)

4. Which graph best represents the relative distance between the particles of most substances in their solid, liquid, and gas states?

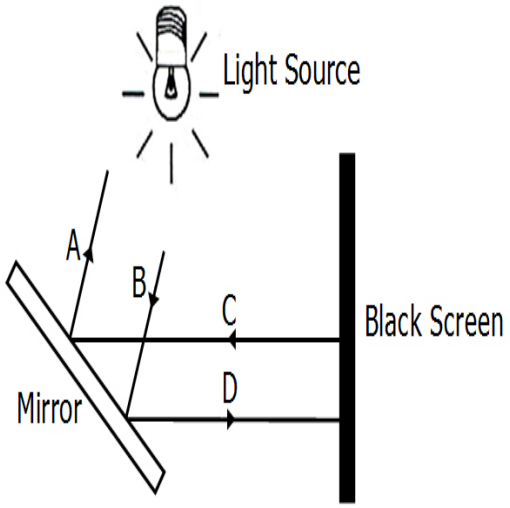


5. Using the table below, if the wind is blowing 30 km/h and the outside temperature is 15°C, what is the wind chill factor in degrees Celsius?

	Temperature (°C)								
Wind speed (km/h)		–15°C	–10°C	–5°C	0°C	5°C	10°C	15°C	20°C
	0	–15	–10	–5	0	5	10	15	20
	5	–18	–13	–7	–2	3	9	14	19
	10	–20	–14	–8	–3	2	8	13	19
	30	–24	–18	–12	–6	1	7	12	18
	50	–29	–21	–14	–7	0	6	12	18
	70	–35	–24	–15	–8	–1	6	12	18
	90	–41	–30	–19	–9	–2	5	12	18

A. 8°C
B. 10°C
C. 12°C
D. 14°C

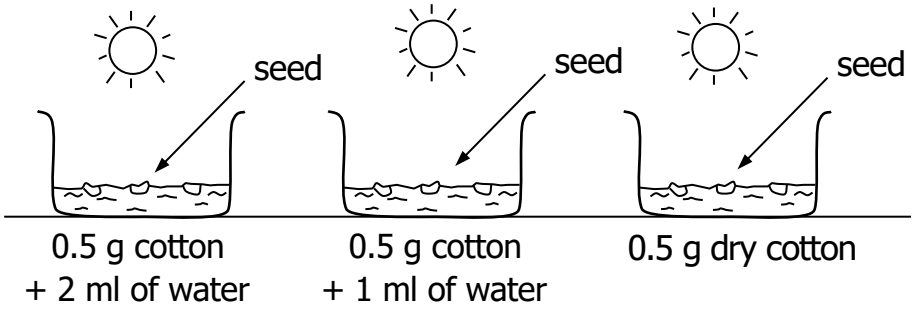
6. Study the set-up shown in the diagram below.



Which pair of arrows shows the correct reflection of light by the mirror?

A. A and C only
B. B and C only
C. A and D only
D. B and D only

7. An experiment as shown below was conducted by a group of students.



Which of the following is NOT a controlled variable?

A. amount of water
B. intensity of sunlight
C. mass of cotton
D. number of seeds

8. The table below shows the color of different colored objects when placed under blue, green and red light.

Original color of object	Color of object when placed under		
	Blue light	Green light	Red light.
blue	blue	black	black
red	black	green	red
yellow	yellow	green	red
white	blue	green	red

How many mistakes are there in the table?

A. 2
B. 3
C. 4
D. 5

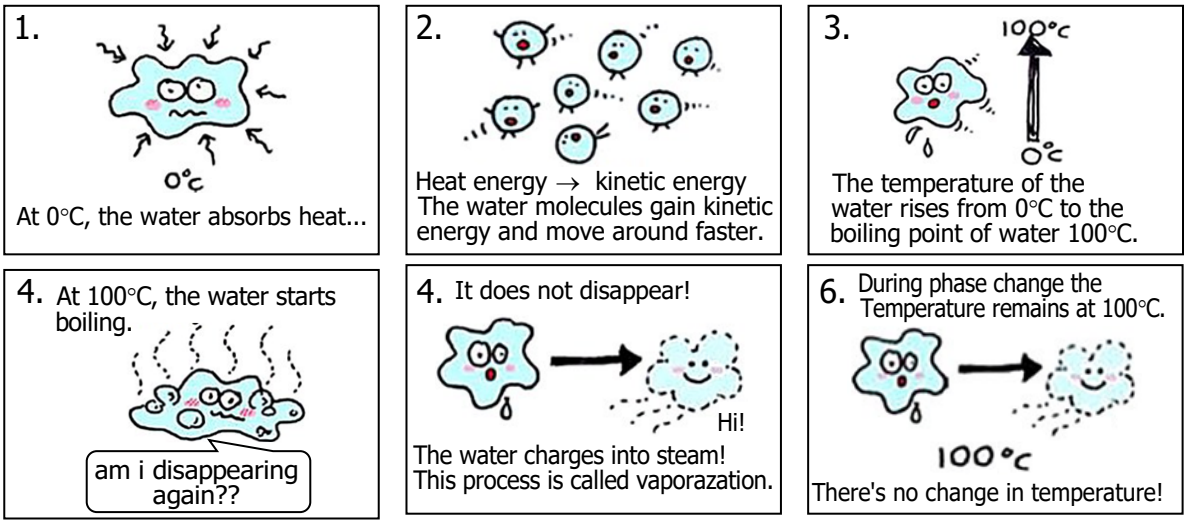
9. Helen wanted to find out how the area of exposed surface affects the rate of evaporation. She got five identical towels and prepared five set-ups as shown in the table below.

Variable	Set-up				
	A	B	C	D	E
Amount of water poured onto the towel	30 ml	20 ml	30 ml	20 ml	30 ml
Number of times towel was folded	2	3	2	2	3
Presence of a fan	Yes	Yes	No	Yes	No
Surrounding temperature	30 °C	30 °C	10 °C	30 °C	30 °C

Which two set-ups should she use to ensure that her experiment was fair?

A. A and D only
B. A and E only
C. B and D only
D. B and E only

10. The comic strip below shows what happens to the water molecules when we continue to heat water.

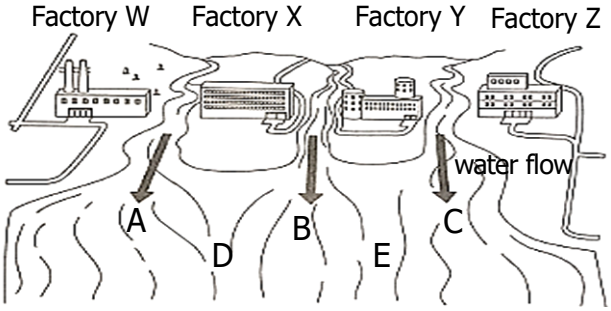


If there is no change in the temperature of water and steam during phase change, what happens to the heat absorbed by the water?

(1) Increase kinetic energy of water molecules
(2) Break the chemical bonds in water molecules
(3) Overcome the attractive forces between the water molecules

A. (2) only
B. (3) only
C. (1) and (2)
D. (1) and (3)

11. Four factories are situated along some small rivers, which merge into one big river. Factories W, X, Y and Z produce chemicals W, X, Y and Z respectively. Henry collects some samples of water and tests them for the chemicals they contain.



	Chemical W	Chemical X	Chemical Y	Chemical Z
Sample P		√	√	
Sample Q	√	√		
Sample R			√	√
Sample S	√	√	√	
Sample T		√	√	√

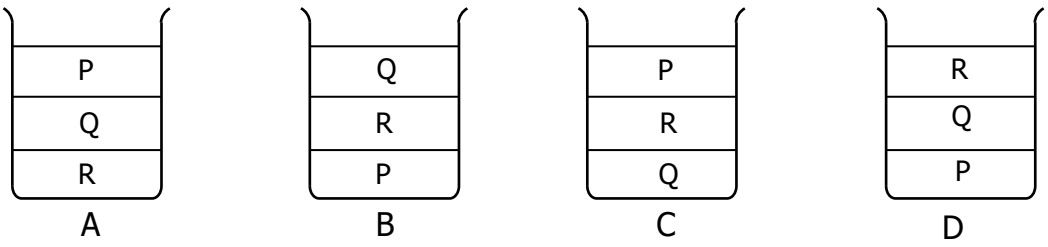
Which one of the following correctly identifies where samples P, Q, R, S and T were collected?

	Sample P was collected at	Sample Q was collected at	Sample R was collected at	Sample S was collected at	Sample T was collected at
A.	A	B	E	D	C
B.	B	A	C	D	E
C.	C	B	A	E	D
D.	D	E	B	C	A

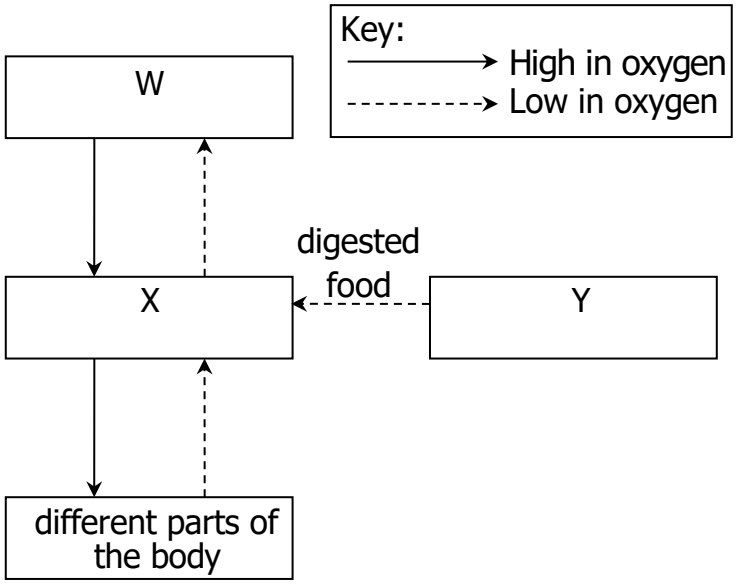
12. The masses and volumes of three immiscible liquids, P, Q and R, are given in the table below.

	P	Q	R
Mass (g)	10.0	5.6	8.0
Volume (cm^3)	12.5	4.0	8.0

Which of the following diagrams shows what you expect to see when they are poured into a container?



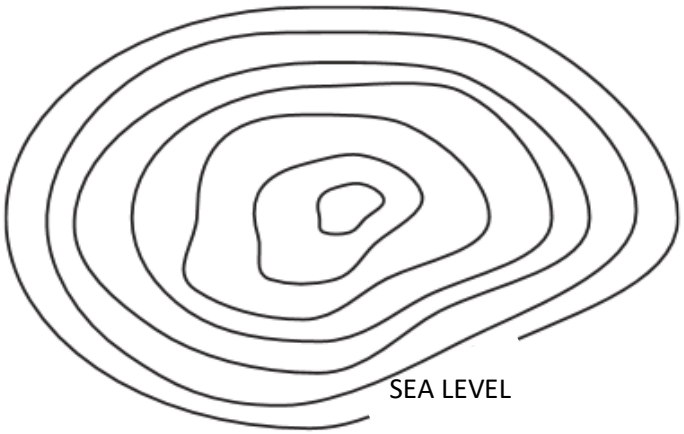
13. The diagram below shows the different systems of the body.



Which one of the following correctly identifies the systems of the body?

	W	X	Y
A.	Circulatory System	Digestive System	Respiratory System
B.	Digestive System	Circulatory System	Respiratory System
C.	Circulatory System	Respiratory System	Digestive System
D.	Respiratory System	Circulatory System	Digestive System

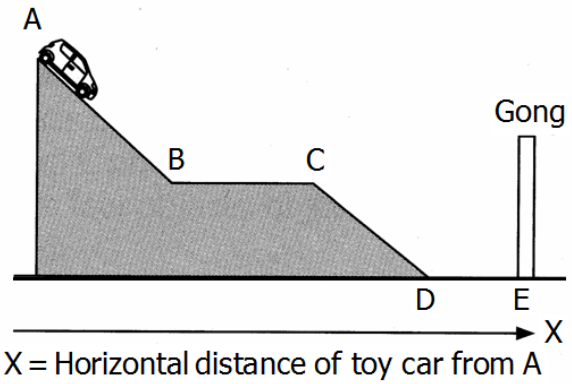
14. Given the topographic map, which of the following height is its highest possible elevation?



Contour Interval - 5 meters

A. 25 meters
B. 34 meters
C. 45 meters
D. 49 meters

15. Patrick released a toy car from the top of a ramp as shown below.

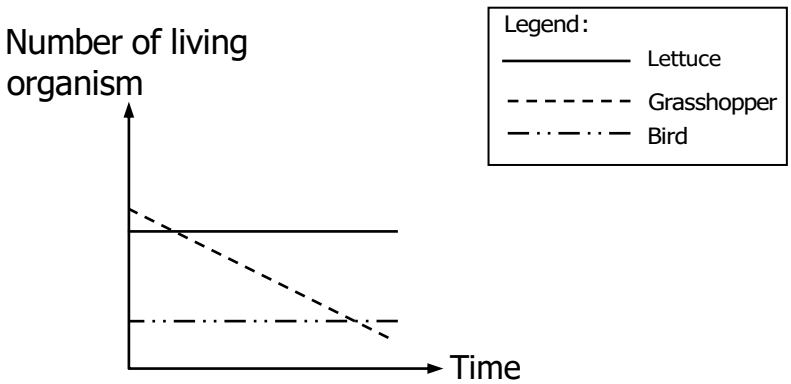


When Patrick released the toy car from A, the toy car travelled down a rough surface and hit the gong with a resounding clash. Which of the following changes would cause the sound from the gong to decrease?

(1) Release the toy car from C instead of A
(2) Use a toy car with a greater mass
(3) Increase the distance from D to E
(4) Use a ramp with a rougher surface

A. (1) (2) and (3) only
B. (1) (2) and (4) only
C. (1) (3) and (4) only
D. (2) (3) and (4) only

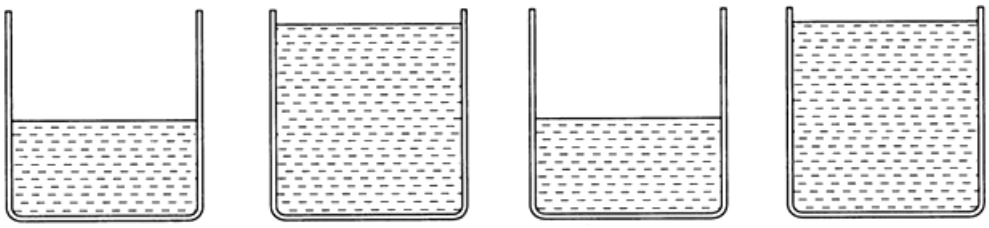
16. The graph below shows the population size of some living organisms in a community after a half day. Assuming that no other living organisms were introduced and none of them have escaped, which of the following statements about them are correct?



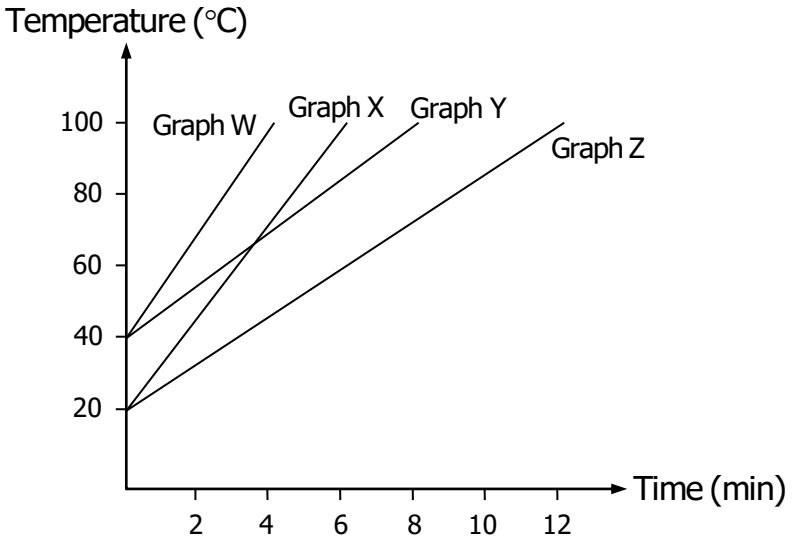
(1) The number of grasshoppers increased with time
(2) The grasshoppers were eaten by the birds
(3) The birds did not eat the lettuce

A. (1) and (2) only
B. (1) and (3) only
C. (2) and (3) only
D. (1) (2) and (3)

17. George poured different amount of water into four identical ceramic containers as shown below. The starting temperature of water in each container was different.



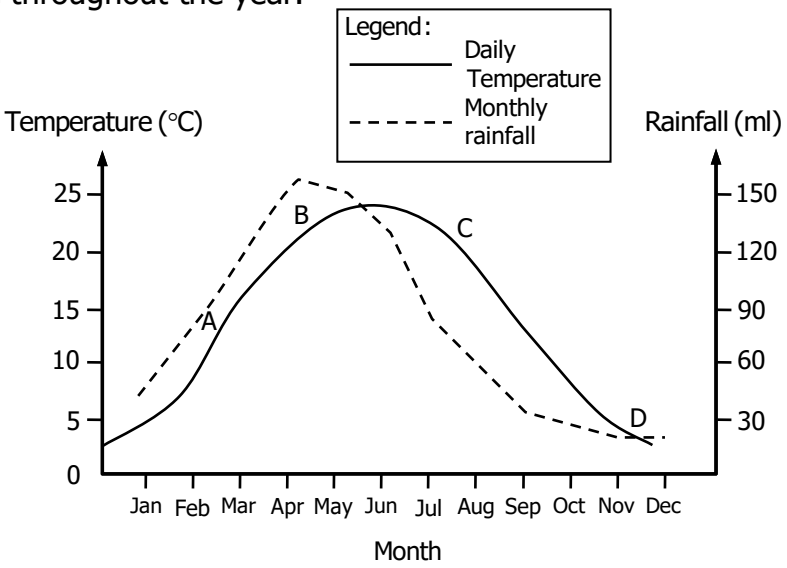
George heated the water in all the containers and recorded the time taken for the water to boil. He then plotted the results on the graph below.



Which of the following correctly identifies the graph of each container?

	Container A	Container B	Container C	Container D
A	Graph W	Graph X	Graph Y	Graph Z
B	Graph Z	Graph W	Graph X	Graph Y
C	Graph X	Graph Y	Graph W	Graph Z
D	Graph W	Graph Z	Graph Y	Graph X

18. The diagram below shows the average temperature and monthly rainfall of a place throughout the year.



Which one of the following correctly describes the weather for period AB?

A. Warm and wet
B. Warm and dry
C. freezing and wet
D. freezing and dry

19. Refer to the two animals below.

Bat:
-Able to fly
-Gives birth to young
-Has fur as outer covering
-Uses echo to navigate in the dark

Housefly:
- Able to fly
- lays eggs
- has a hard outer covering

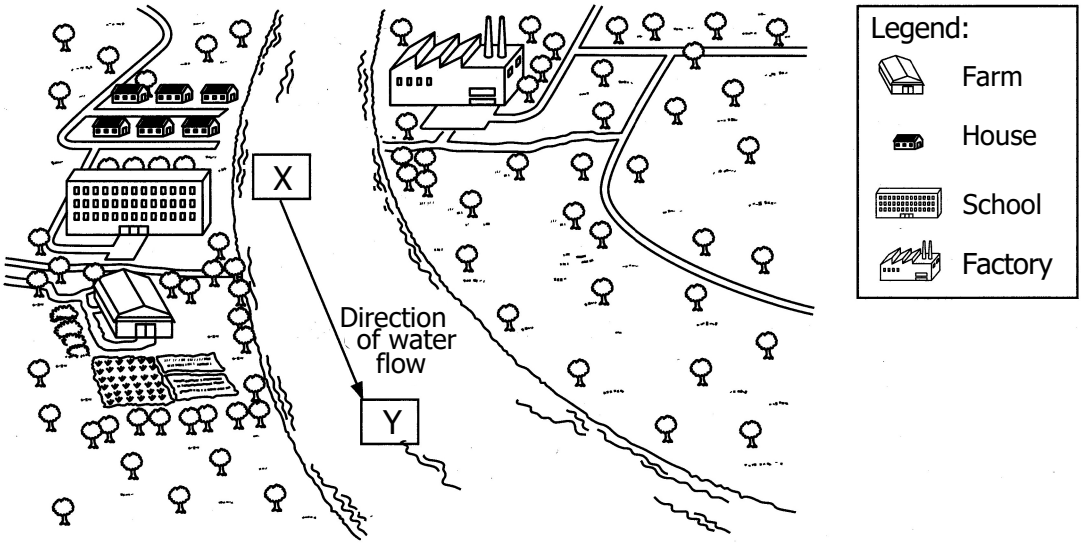
Linda's friends made some comments about the two organisms shown above.

(1) A bat is a mammal that is adopted to fly in the air.
(2) A housefly is an insect that is adopted to fly in the air.
(3) A bat is a bird that is adopted to give birth.
(4) A bat is adopted to fly in the dark.

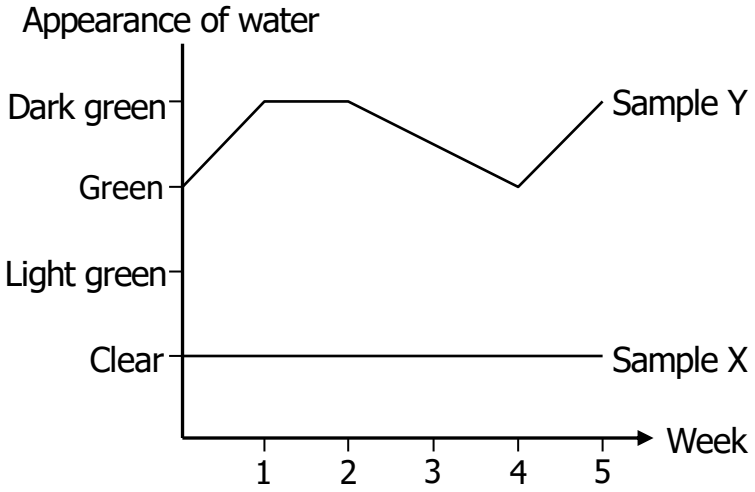
Which of these statements above are true?

A. (1) (2) and (4) only
B. (1) (3) and (4) only
C. (2) (3) and (4) only
D. (1) (2) (3) and (4)

20. Refer to the illustration below.



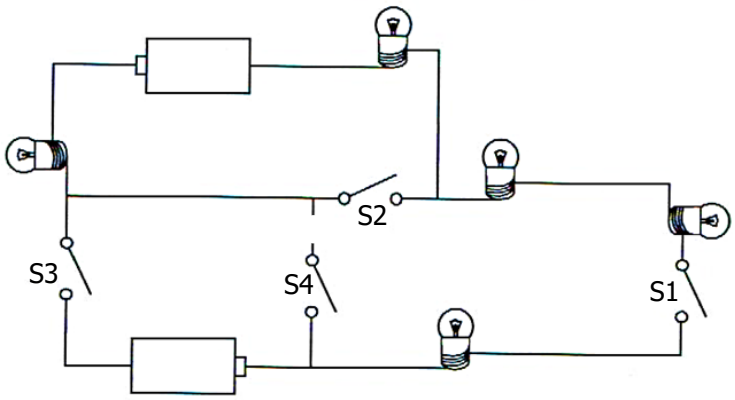
June walked along a slow-flowing river that is shown above. She noticed that the water in certain parts of the river was filled with a green substance. She collected samples of the water at locations X and Y over a period of five weeks and plotted the results on the graph shown below.



What caused the water at Y to turn green?

A. Fertilizer from the farm
B. Green paint discharged by the factory
C. Green detergent discharged from the houses
D. Green paint discharged from the school

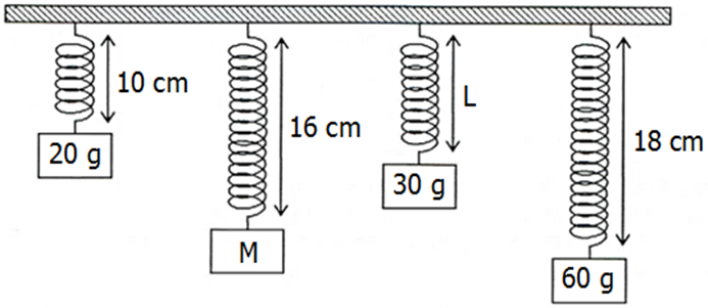
21. The diagram below shows five bulbs connected in a circuit.



Which of the switches, S1, S2, S3 and S4, should be closed for all the bulbs to light up?

A. S1 and S2 only
B. S1 and S3 only
C. S1, S2 and S4 only
D. S2, S3 and S4 only

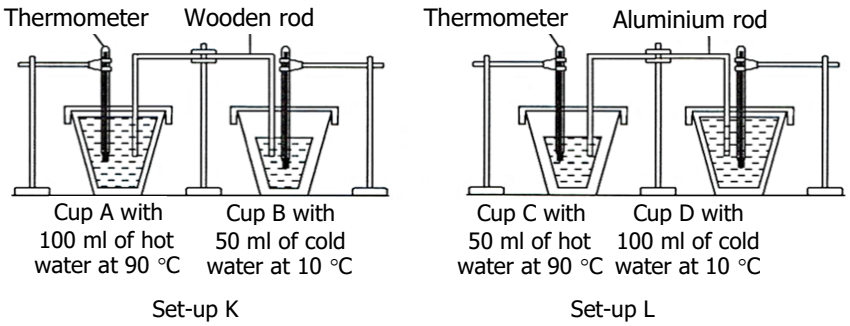
22. The diagram below shows the length of the same spring suspending different loads.



Which one of the following sets of values for M and L is correct?

	M(g)	**L(cm)**
A.	40	12
B.	40	14
C.	50	12
D.	50	14

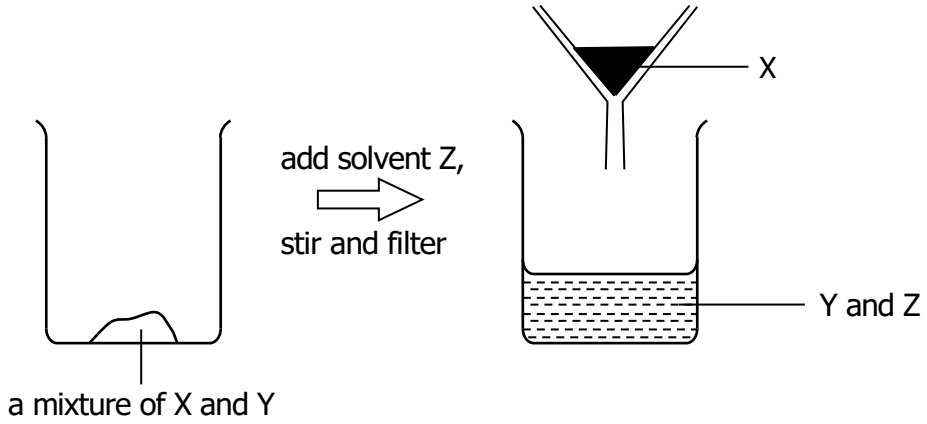
23. Two set-ups, K and L, were prepared for an experiment using four identical Styrofoam cups. The apparatus at the start of the experiment is shown in the diagram below.



The temperature of the water in each of the four cups were recorded ten minutes after the start of the experiment. Arrange the cups according to the temperature of the water in them, from the coolest to the hottest.

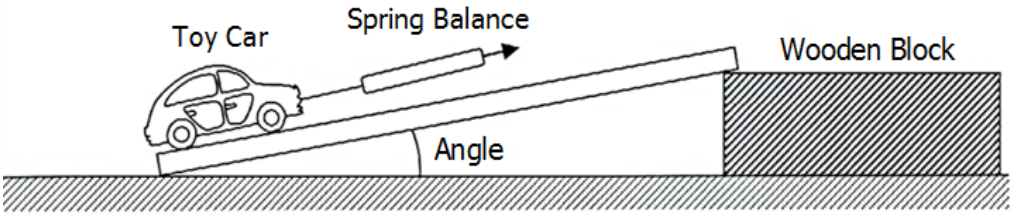
	Coolest ⟶ Hottest
A.	D, B, C, A
B.	A, C, D, B
C.	B, D, C, A
D.	D, C, B, A

24. The diagram below shows how X and Y are separated from their mixture.



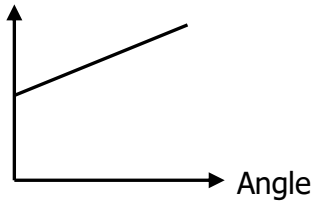
Which of the following statements is correct?
A. Both X and Y are compounds.
B. X is soluble in Z but Y is insoluble in Z.
C. X can be recovered by chromatography.
D. Y can be recovered by evaporating solvent Z.

25. An experiment was conducted to find out how the force applied to pull a toy car up a ramp varied with the angle of the ramp as shown in the diagram below. The angle of the ramp was varied by changing the number of wooden blocks.

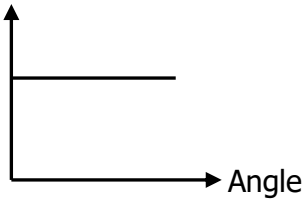


Which of the following graphs show the correct result?

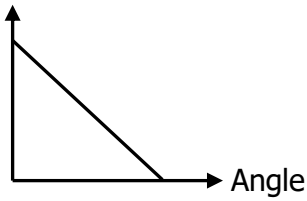
A. Force applied



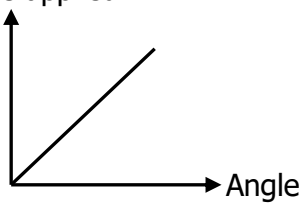
B. Force applied



C. Force applied



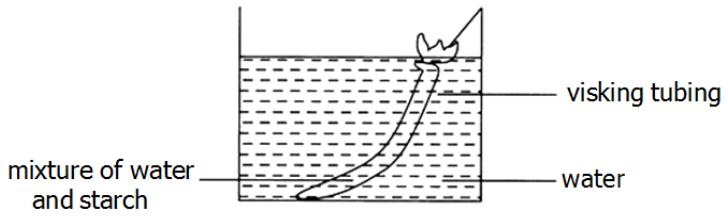
D. Force applied



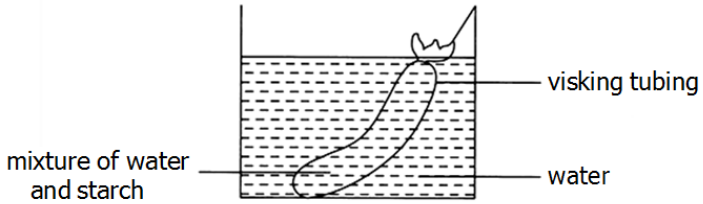
26. Hot water is poured-into a thick glass and a thin glass separately. Which of the following predictions and explanations is correct?

	Prediction	Explanation
A.	Thick glass will break more easily than thin glass	Because the inner wall of thick glass expands faster than the outer wall
B.	Thick glass will break more easily than thin glass	Because the wall of thick glass receives more collisions by the water particles
C.	Thick glass and thin glass are equally breakable	Because both the thick glass and the thin glass are made of glass
D	Thin glass will break more easily than thick glass	Because the thin wall of thin glass cannot take in too much heat

27. Earl filled a visking tubing, which is partially-permeable, with 50% of starch and 50% of water. She was told that the starch molecules were too large to pass through the visking tubing. The tubing was not fully filled at the beginning of the experiment. She then tied a knot at the opening with a cotton thread and attached it to the side of the beaker before immersing it into a beaker of water.



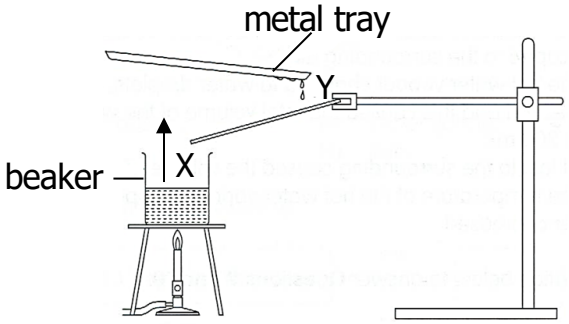
After a day, she observed that the visking tubing was firm and fully filled. She concluded that water entered the visking tubing.



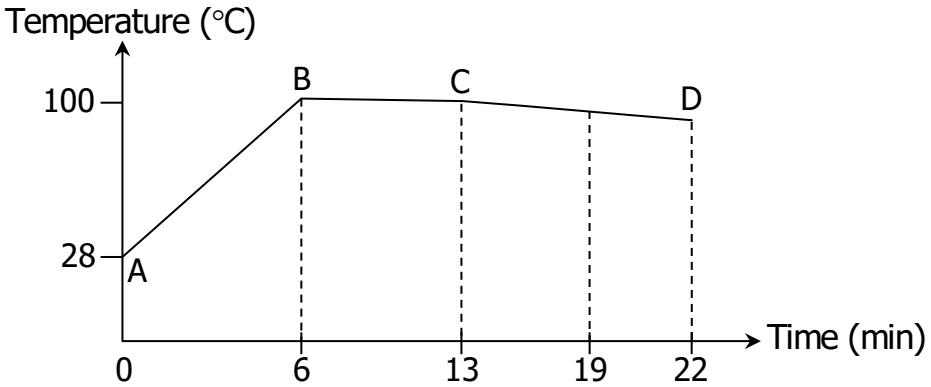
Which one of the following correctly shows the percentage of the starch and water content in the visking tubing after 1 day?

	Percentage of starch in the visking tubing after 1 day	Percentage of water in the visking tubing after 1 day
A.	50 %	50 %
B.	Less than 50 %	More than 50 %
C.	More than 50 %	Less than 50 %
D.	50 %	More than 50 %

28. Simon wanted to show how seawater helps contribute to water vapor in the water cycle. He filled a beaker with 200 ml of seawater at room temperature and heated the seawater to speed up evaporation. He then cooled the hot water vapor and allowed the water droplets formed to flow back into the beaker. He put the set-up in a closed glass tank to represent the water cycle.



The graph below shows the temperature of the water in the beaker.



During which period will most of the water vapor be formed?

A. AB
B. BC
C. CD
D. AC

29. An experiment is carried out: on a soda can containing hot water. The procedures and outcomes are given in the table below. Which of them is correct?

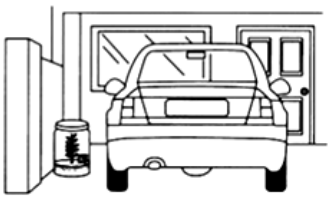
	Procedure	Outcome
A.	Heat the soda can vigorously until the water boils.	The soda can changes the shape.
B.	Cover the mouth of the soda can.	The soda can collapses.
C.	Pour cold water over the closed soda can.	The soda can crushes inwards,
D.	Open the mouth of the soda can.	The soda can crushes outwards.

30. Joe grew four identical plants in four different sealed glass jars. He placed a device in each glass jar to measure the amount of oxygen and carbon dioxide in it. He left the glass jars in four different locations as shown below.

Jar A : Living room

Jar B : Open field

Jar C : Storeroom



Jar D : Car porch

After a day, Joe checked the amount of oxygen and carbon dioxide in each glass jar. He found that jar B has the most oxygen but the least carbon dioxide as compared to the other jars.

Which one of the following correctly explains his findings?

A. The plant in jar B was exposed to the most light, allowing it to photosynthesize. The plant was able to capture light energy to make food using carbon dioxide and water to produce oxygen and sugar.
B. The plant in Jar B was exposed to the least light and was unable to photosynthesize. The plant was unable to capture light energy to make food using oxygen and water to produce carbon dioxide and sugar.
C. The plant in Jar B was exposed to most light, allowing it to photosynthesize. The plant was able to capture light energy to make food using oxygen and water to produce carbon dioxide and sugar.
D. The plant in Jar B was exposed to most light, allowing it to photosynthesize. The plant was able to capture light energy to make food using oxygen, to produce water, carbon dioxide and sugar.

END OF THIS PAPER