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Candidate's Number

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COMMONWEALTH SECONDARY SCHOLARSHIPS

EXAMINATION FOR ONE-YEAR SCHOLARSHIP, 1965

**COMPREHENSION AND INTERPRETATION
(SCIENCES)**

Afternoon Session, Wednesday, 7th October, 1964

Time allowed : 2 hours

TEST BOOKLET. TO BE HANDED IN WITH YOUR ANSWER SHEET.

INSTRUCTIONS TO CANDIDATES.

This is a test of your ability to read and understand material of a scientific nature. It will be possible for you to do well on this test even though you may have studied only a little science in your high school course.

The test consists of 13 units with an average of about 6 questions in each unit. You are strongly advised to observe the following points :

- (1) Work carefully through the questions in the order in which they are given.
- (2) Do not waste too much time on any one question ; if necessary go on to the next question and come back to the difficult ones later.
- (3) If you think you know an answer write it down even if you are not certain that you are correct.
- (4) Make sure that you print each answer in the correct space on the Answer Sheet.

ANSWERING.

In most cases you will be required to select one answer from four or five alternatives and to indicate your answer by printing the appropriate letter (A, B, C, D &c.) on your Answer Sheet.

In other cases you are not required to choose from alternatives, but to work out the answer and write it in the correct space on the Answer Sheet.

If you wish to change an answer, cross it out and print your new answer beside it.

Make any notes or calculations on this Test Booklet. Write only your answers on the Answer Sheet.

NOW look through this examination paper, but do not start writing until the supervisor tells you to do so.

UNIT 1 (Questions 1-5)

The development of blowfly larvae on living sheep is known as blowfly strike, and occurs most commonly on the breech of ewes where the wool is sometimes soiled and kept wet with urine. The adult blowfly lays its eggs in the moist wool and these hatch within 24 hours. During the next three to six days the maggots feed and grow in the wool on the surface of the skin, but they sometimes burrow into the skin and cause severe wounds. The maggots drop off and spend two to four days wandering in the soil. The pupal stage follows and lasts about eight days.

In Merino sheep, the wrinkles in the skin form an ideal breeding place for blowflies, and some scientists have suggested the breeding of sheep without wrinkles around the breech. Others have recommended the Mules operation, which is the surgical removal of the skin wrinkles around the breech. To determine which sheep were most free of blowfly strike an experiment was performed, and the following table sets out the proportion of sheep in each group that developed blowfly strike :

	Wrinkled breech	Plain breech
Treated with Mules operation ..	0.9%(a)	—(b)
Not treated with Mules operation ..	31.1%(c)	8.6%(d)

- To which of the four stages described above in the life history of the blowfly does the maggot belong ?
 - the egg.
 - the larva.
 - the pupa.
 - the adult.
- From the egg stage to the adult blowfly takes approximately
 - 9 days.
 - 12 days.
 - 16 days.
 - 40 days.
- Which sheep were the most free of blowfly strike ?
 - Wrinkled breech, treated with Mules operation.
 - Plain breech, not treated with Mules operation.
 - Wrinkled breech, not treated with Mules operation.
 - Cannot tell from the information in the table.
- What results shown in the table are necessary to support the argument that the Mules operation is successful in reducing the occurrence of blowfly strike ?
 - (a) only.
 - (a) and (c).
 - (c) and (d).
 - (a), (c), and (d).
- What is the best explanation for the dash recorded as result (b) in the table ?
 - No plain-breeched sheep treated with the Mules operation developed blowfly strike.
 - The scientists did not need this information in order to reach their conclusion.
 - The Mules operation cannot be performed on plain-breeched sheep.
 - There was no information available for this group.

UNIT 2 (Questions 6-9)

Substances α , β , γ combine, one at a time, with each of the substances x , y , z to make new substances which are called compounds. Thus α/x is the compound of the substance α with the substance x . Clearly there will be nine such compounds. All of these compounds will dissolve in water except α/z , β/x , γ/y .

Compounds containing α are always white (except α/z which is pink).

Compounds containing β are always pink (except β/x which is green).

Compounds containing γ are always green (except γ/y which is white).

Compounds containing x give off an invisible gas when heated except α/x which is not affected by heat.

Compounds containing y when heated give off a brown gas (except β/y which gives off an invisible gas).

Compounds containing z when heated are not affected (except γ/z which gives off a brown gas).

Use this key to answer the questions below.

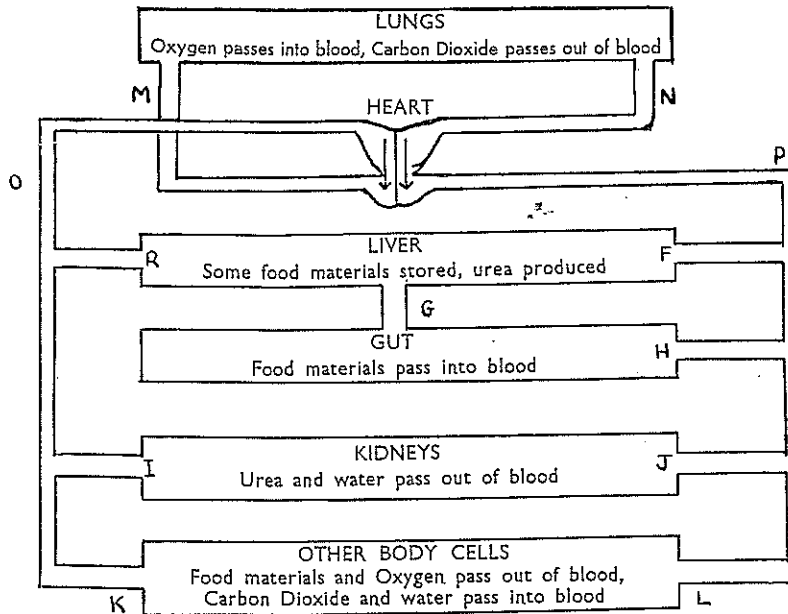
$A \alpha/x$	$D \beta/x$	$J \gamma/x$
$B \alpha/y$	$E \beta/y$	$K \gamma/y$
$C \alpha/z$	$H \beta/z$	$L \gamma/z$

In each of the following questions, use the particulars above to choose the compound with the properties given. Write the letter from the key that corresponds to this compound.

- A pink compound, which will dissolve in water, and which gives an invisible gas when heated.
- A pink compound which will dissolve in water but is not affected by heat.
- A white compound which will not dissolve in water but gives a brown gas when heated.
- A green compound, which will dissolve in water and which gives off an invisible gas when heated.

UNIT 3 (Questions 10-14)

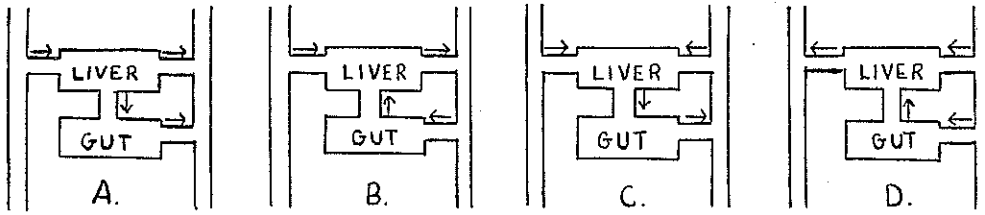
The materials needed by every cell in the body to carry on its life activities are carried to it by the circulation of the blood. An adult human body contains about 12 pints of blood which is pumped around a closed circuit of blood vessels by the heart. The blood is pumped at high pressure from the heart in vessels called arteries, and when these arteries divide into capillaries, which take food materials and oxygen to all body cells, the pressure decreases. The vessels which collect blood from the capillaries and lead into the heart are known as veins. The following is a simplified diagram of the blood circulation. The arrows in the heart show the direction of blood flow.



10. Which of the following is the best answer to the question "Where would you find capillaries?"

- A in the lungs.
- B in the liver.
- C in the gut.
- D in all of the above.

11. In which of the following diagrams do the arrows show the correct direction of blood flow ?



12. The volume of blood travelling each minute through vessel O

- A is less than
 - B is the same as
 - C is greater than
 - D cannot be compared with
- } the volume of blood travelling each minute through vessel P.

13. The highest concentration of food materials is found in the blood vessel marked

- P
- R
- G
- H

14. The lowest concentration of urea is found in the blood vessel marked

- N
- R
- I
- K
- J

UNIT 4 (Questions 15-19)

The work you do in walking on a horizontal surface is mostly work done in lifting your body. (N.B.—Assume that no work is done by you as your body is lowered during each step.) The following procedure can be used to determine approximately how high the body is lifted when each step is taken.

Take a piece of chalk and hold it so that your arm is rigidly by your side and the chalk is touching a blackboard. As you walk along beside the blackboard the chalk makes a rising and falling line. Now find the average vertical distance, d inches, between the bottom of one curve and the top of the next.

To calculate the number of units of work done in lifting your body in each step, convert d inches to feet and multiply this number by your weight in pounds.

15. If you weight W pounds and you lift your body an average of d inches at each step then the number of units of work done in walking 25 steps is approximately given by the expression

- | | |
|-------------------------|-------------------------|
| A $25W$. | D $\frac{12W}{25d}$. |
| B $\frac{25dW}{12}$. | E $25dW$. |
| C $\frac{Wd}{25}$. | |

16. In calculating the approximate amount of work that you do in walking from home to school it is NOT necessary to know

- A your weight.
 B the average distance through which you lift your body at each step.
 C the number of steps you take in walking from home to school.
 D the number of inches in a foot.
 E the distance you walk from home to school.

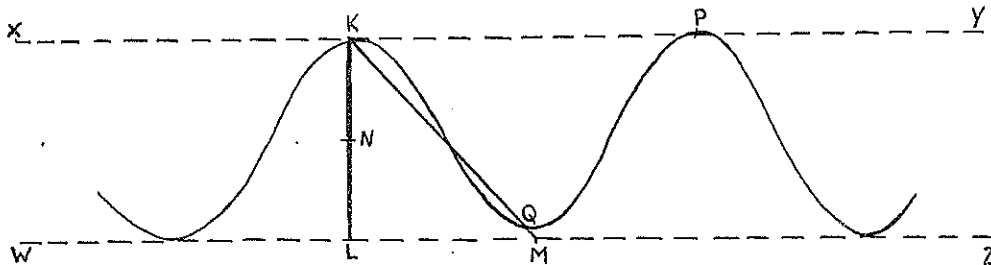
17. The work done by a boy weighing 100 lb. when he steps up on to a platform 15 inches high is approximately

- | | |
|----------------|------------------|
| A 100 units. | D 1,200 units. |
| B 125 units. | E 1,500 units. |
| C 150 units. | |

18. This method of measuring the approximate amount of work done in walking a given distance would not be suitable if you

- A were walking downhill.
 B were walking in a circle.
 C were walking slowly.
 D weighed a great deal.
 E kept stopping to sit down during your journey.

19. The unbroken line in the diagram below represents a section of the curve made by the chalk on the blackboard. The dotted lines XY and WZ are parallel. N is the midpoint of KL .



Which one of the following represents the distance d ?

- A the straight line segment LM .
 B the curve KQ .
 C the straight line segment KN .
 D the straight line segment KL .

UNIT 5 (Questions 20-24)

Various chemical substances (called insecticides) are used on farms and gardens to kill insect pests. Arguments have often raged about their possible bad effects in other directions. Some insecticides are poisonous to fish in amounts which are harmless to humans. A particular example recently occurred in the U.S.A., where an estimated 5 million fish died in the Mississippi River, near its mouth. The Public Health Service blamed the entire loss of fish on an insecticide, called endrin, which is used on cotton and sugar-cane farms in the lower portions of the river near its mouth and which could have been washed or blown into the river. Officers of the service analysed the remains of 50 dead freshwater fish selected at random and found enough endrin in the blood of each one to have killed it. They also analysed the river water where the fish died but found no significant amount of endrin. Agricultural and chemical experts said that endrin was considered to be a notably safe and useful insecticide.

These latter experts said that most of the dead fish were of the kind called menhaden, which are almost inedible and live in salt-water. No menhaden had been analysed, they said, and in any case since they normally live in the sea there was little chance that they could be affected by insecticides.

The Public Health Service officers withdrew the claim that the insecticide had killed the menhaden but still claimed that the remaining 175,000 dead fish, which were freshwater fish, had been killed by the insecticide. For a while they blamed a chemical works which manufactures endrin about 700 miles upstream from the mouth of the river. But the management of this works said that if their endrin got into the river then thousands of dead fish should have been found in the river near their works. The Public Health Officers said that the doomed freshwater fish were probably poisoned in the river around the works and swam to the mouth before they died although other experts said that these fish did not usually migrate and do not live in salt-water.

Some officers put forward the interesting theory that the fish gradually absorb the insecticide over a period of time and that it concentrates in their fat where it could not harm them. During times of food scarcity fish would use this stored fat and so enough endrin would be released in their blood to kill them.

20. Only one of the following statements is scientifically sound. Select it.
- A The death of salt-water fish proves that the freshwater fish were not killed by endrin.
 - B The presence of endrin in the analysed fish proves that no other condition caused their death.
 - C Because only 50 fish were analysed the other fish could not have died from endrin poisoning.
 - D If the endrin slowly accumulates in fish fat this could explain why no fish died near the insecticide factory.
21. Select from the following the one which is the best statement of the point of view that the above passage illustrates.
- A That opinion and analysis go together to establish a theory.
 - B That people should be careful when they use endrin near rivers.
 - C That endrin which kills insect pests also kills fish.
 - D That manufacturers of chemicals should not pipe waste products from their factories into rivers.
 - E That the use of insecticides to control insect pests may have other effects which are harmful.
22. Which of the following lines of observation would be most advisable for the Public Health Service officers to test their "endrin in fat" theory?
- A Analyse the water near the insecticide factory at different times in the year.
 - B Release marked fish in the upper river and trace their movements.
 - C Collect a large number of salt-water fish and inject them with endrin.
 - D Analyse fish at different times in the year for location and content of endrin.
23. From the evidence contained in the above report which of the following conclusions regarding the death of the freshwater fish is most reasonable?
- A Endrin blown and washed from the sugar-cane and cotton farms was responsible for the death of most of the freshwater fish.
 - B Endrin washed into the river from the chemical works was responsible for the death of most of the freshwater fish.
 - C Endrin was responsible for the death of most of the freshwater fish but the information given is not sufficient to decide upon the source of the endrin.
 - D The information given is not sufficient to decide the cause of death of most of the freshwater fish.
24. Which one of the following facts taken from the above report raises the most doubt about the theory that menhaden were killed by endrin?
- A Only 50 dead fish were analysed.
 - B No salt-water fish were analysed.

UNIT 6 (Questions 25-31)

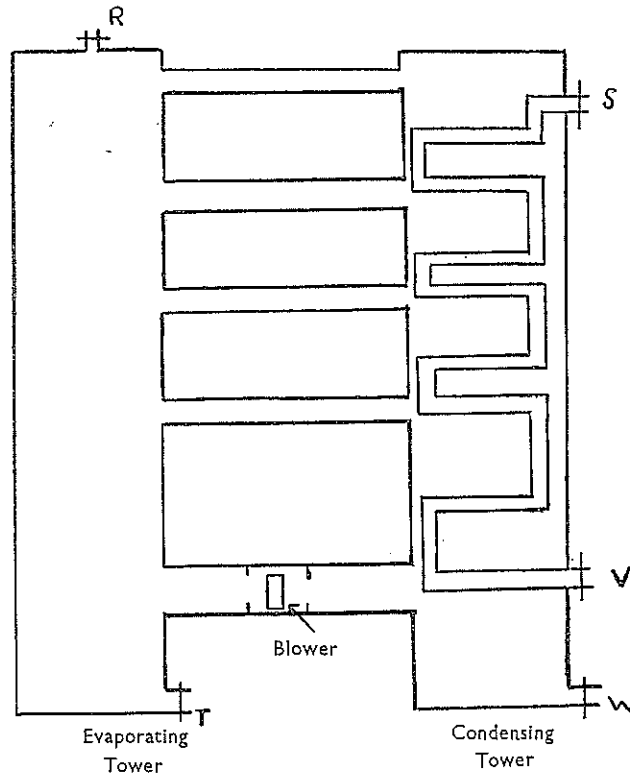
A new system has been developed to produce fresh water from sea water. The system is surprisingly simple in appearance and operation. The major components are two 50-ft. steel towers and a series of solar collectors that resemble large seed beds.

In a sense, the ocean water is put to work to desalt itself. On being pumped into the system, it enters one tower and moves downward through 12,000 feet of finned tubes which are surrounded by hot, moist air. Heated by as much as 80 Fahrenheit degrees while passing through the tubes, it flows on into the series of solar collectors and moves slowly through them, absorbing heat from the sun. The collectors are simply and inexpensively constructed of three layers of plastic film spread between redwood frames that lie on the ground.

The water doesn't evaporate in the solar collectors; it simply becomes heated as it flows between the bottom, black sheet of plastic film and a middle layer of clear film which floats on it. A third film layer, also transparent, is inflated above the second and held there by a small blower—forming a pocket of hot, insulating air.

The sea water, preheated to about 110° F. as it passed through the condenser tubes in the tower, reaches a temperature as high as 160° F. in the solar collectors. It is then pumped directly from the collectors into the top of the second tower. From there the hot water is allowed to dance and splash down through beds of thousands of plastic rings which smash it into countless tiny droplets with maximum evaporation surface.

Rushing up through the tower as the droplets fall is a blast of air from a high-speed blower at the bottom of the tower. As it rises, the air becomes hot and saturated with moisture evaporating from the salt-water droplets. Some of it moves through each of the four cross-ducts into the condensing tower, where the vapour condenses on the cool tubes and runs off as freshwater. Meanwhile the same hot air is pre-heating the sea water inside the tubes as it starts through the system.



Diagrammatic Representation of Tower Section of Apparatus

For each of the following taps in the system write

- A if sea water enters or leaves at this point.
- B if fresh water enters or leaves at this point.
- C if the waste products enter or leave at this point.
- D if insufficient information is given in the above paragraph to decide between A, B, and C.

25. R.

26. T.

27. S.

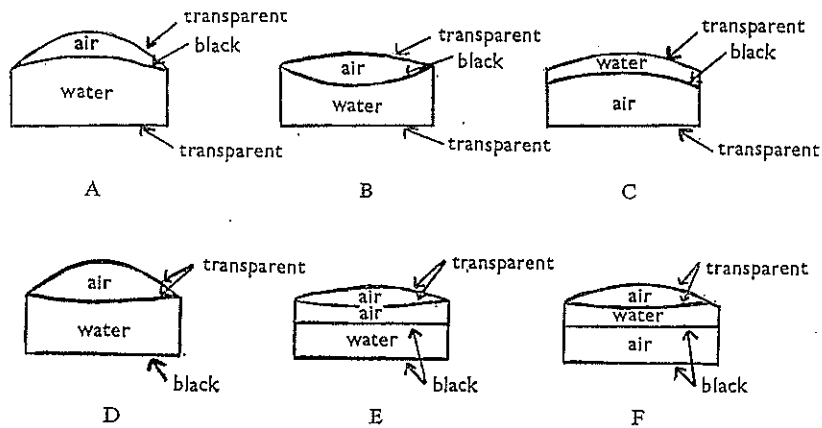
28. W.

29. Below are listed a number of possible reasons for the presence of air in the solar heat collectors. Select the correct alternative or alternatives.

- A To carry water vapour from the solar heat collectors to the towers where it is condensed to form fresh water ;
- B To insulate the heated sea water from the surrounding air so that heat losses are reduced ;
- C To become heated so that it can be blown upwards through the evaporator tower ;
- D To cool the water so that it does not evaporate in the solar heat converters, but only in the evaporating tower ;
- E To cool the plastic layers so that they do not become overheated and melt.

30. Write the letter corresponding to the tap in the diagram at which the water has the highest temperature.

31. Which of the following best represents the cross-sectional diagram of the solar heat collectors ?



UNIT 7 (Questions 32-37)

A few years ago scientists studying the oceans encountered two facts which could not be explained by theories accepted at that time. The first was that breaks in submarine communication cables, caused by earthquakes, were expected to occur more or less simultaneously, but did not. Secondly, research showed that the deep sea bed of the Atlantic Ocean contains deposits of clean sand and recent fossils of shellfish, which live only in shallow water.

The theory of relatively peaceful and graded sedimentation (i.e., the laying down of sediments) in the seas had been accepted for many years. This theory proposed that coarse rock and mineral particles were deposited near land, and that finer particles, which were able to remain suspended for longer periods therefore occurred on the sea floor further away from land. The only substantial movement of sea water was assumed to be near the surface.

Cable breaks were once attributed to landslides caused by earthquakes. These landslides, however, do not travel very far, and only a very complicated landslide pattern could account for the non-simultaneous breaking of cables. Further, landslides would not account for the removal of coastal sand and shells over very large distances to the ocean depths.

To explain the various phenomena, turbidity currents were proposed; (TURBID = muddy). Such currents, consisting of rapidly-moving suspensions of mud in water, and capable of moving sand and gravel, have been experimentally demonstrated, but have not actually been observed in the oceans. Theoretically, they could be responsible for carving out the huge underwater canyons of the Pacific Ocean.

The theory of turbidity currents explains the observed facts. It is opposed by some scientists on the basis of water resistance. A recent theory proposes that the large accumulated sand masses of the continental shelves can progressively and temporarily act like liquids and break the cables by stretching and twisting movements. However, none of the three theories concerning the cause of the cable breaks has been proved or disproved.

32. Which of the following definitions agrees best with the idea of turbidity currents ?
- A A powerful moving current of mud and water.
 - B A powerful movement of water produced by an earthquake.
 - C A powerful current which can move sand.
 - D A powerful current which breaks submarine cables.
33. The significance of the occurrence of shallow water shellfish fossils in deep sea deposits is that
- A some shallow water shellfish migrate to the depths at certain seasons.
 - B some large force is responsible for the considerable movement of shallow water shellfish fossils.
 - C some shallow water shellfish migrate to the depths before death.
 - D some surface currents transport the shellfish away from their natural environment after death.
34. Which of the following conclusions is correct concerning the breaking of the cables ?
- A They were caused by twisting of the cables in a very rapid flow of mud and water.
 - B Submarine landslides are responsible.
 - C They were caused by some movement or movements following an earthquake.
 - D The flow of wet sand acting as a liquid is responsible.
35. Select the reason which you consider most likely to account for accurate knowledge of the times at which the cables were broken.
- A The speed of earthquakes is accurately known.
 - B Some scientists are continually engaged in underwater research.
 - C The breaks occurred near the continental shelves.
 - D Ships continually travel over the cable routes.
 - E The cables were in continual use.
36. Which fact did not fit in with the idea of quiet-graded sedimentation ?
- A The non-simultaneous breaking of submarine cables.
 - B The occurrence of sand on the deep ocean floors.
 - C The laboratory production of turbidity currents.
 - D The formation of canyons beneath the surface of the sea.

37. From the table below, select the correct conclusion concerning the speed at which the cause of the breaking of the cable apparently moved away from the centre of an earthquake.

Distance from centre in miles ..	0	50	150	300	374
Time of cable break	3.31 p.m.	4.31 p.m.	6.35 p.m.	0.33 a.m.	4.53 a.m.

- A* The average speed decreased from about 50 m.p.h. for three hours to about 22 m.p.h. for the next ten hours.
B The average speed was approximately constant.
C The speed dropped very rapidly after 300 miles.
D The average speed decreased to 30 m.p.h. between 150 and 300 miles.
E The varying average speeds cannot be calculated from this data.

UNIT 8 (Questions 38-43)

Two theories are advanced to explain the burning of material in air. Both theories assume that no substance can have negative mass or weight.

Theory X: During combustion, the burning material unites with a certain component of the air. The capacity of air to provide this component is limited.

Theory Y: During combustion a substance escapes from the burning material into the surrounding air. The capacity of air to take up this escaping substance is limited.

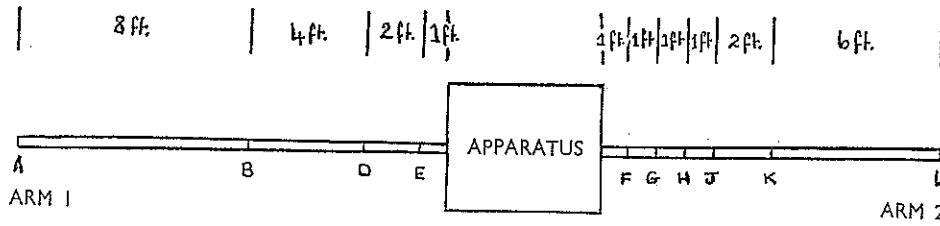
Consider each fact below and decide how this fact, by itself, provides evidence for one theory or the other. Write

- A* if the fact lends more direct support to theory *X* than to theory *Y*.
B if the fact lends more direct support to theory *Y* than to theory *X*.
C if the fact supports the two theories about equally well.
D if the fact could not be used to support either theory.

N.B.—A statement is said to lend greater support to theory *X* than to theory *Y* if it can be more readily (i.e., with fewer or more reasonable additional assumptions) explained by theory *X* or if it contradicts *Y* but not *X*.

38. When a log of wood is burned the weight of ash that remains is much less than the weight of the original piece of wood.
 39. An electric-light filament although completely enclosed in a small space will give off light and heat for long periods of time without any noticeable change.
 40. A lighted candle in an enclosed jar of air stops burning before the candle is used up.
 41. A gust of air will extinguish a glowing match.
 42. A great deal of heat is given off during the combustion of coal.
 43. The solid residue left when a certain metal burns in air has greater weight than the metal used up.

UNIT 9 (Questions 44-48)



A piece of apparatus has two movable arms protruding from it as shown in the diagram. Weights can be hung at different points on these two movable arms, and if appropriate weights and positions are chosen, the arms will balance one another.

A 20-lb. weight is hung from Arm 1 at the point *E*.

The following table (Table 1) lists the weights that must be hung at various points on Arm 2 so that each of these will balance this weight on Arm 1.

TABLE 1.—20-LB. WEIGHT HUNG AT *E*

Point at which weight is applied to Arm 2 ..	<i>F</i>	<i>G</i>	<i>H</i>	<i>K</i>
Weight required	12 lb.	6 lb.	4 lb.	2 lb.

- 44. What weight would have to be hung at the point *J* to balance this 20-lb. weight at *E*?
- 45. What weight would have to be hung at the point *L* to balance this 20-lb. weight at *E*?

The 20-lb. weight was removed from *E*, and an 8-lb. weight was hung on the Arm 2 at the point *H*.

The following table (Table 2) lists the weights that must be hung at various points on Arm 1 so that each of these will balance this weight on Arm 2.

TABLE 2.—8-LB. WEIGHT HUNG AT *H*

Point at which weight is applied to Arm 1 ..	<i>B</i>	<i>D</i>	<i>E</i>
Weight required	10 lb.	20 lb.	40 lb.

- 46. What weight would have to be hung at the point *A* to balance this 8-lb. weight at *H*?

The 8-lb. weight was removed and a 200-lb. weight hung at *E*.

- 47. What weight would have to be hung at the point *H* on the Arm 2 to balance this weight?
- 48. What weight would have to be hung at the point *J* on Arm 2 to balance this weight?

UNIT 10 (Questions 49-55)

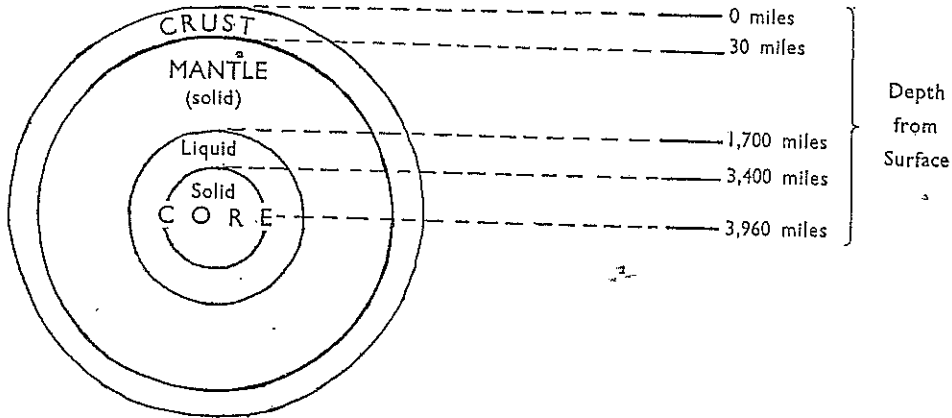
Juices produced in the walls of the alimentary canal contain enzymes which aid the digestion of foods. Two of these digestive juices are saliva, produced in the mouth, and gastric juice, produced in the stomach. The presence of food in the mouth causes a flow of saliva. Such an unconscious and automatic response is called a reflex action, the food being the stimulus which produces the response. There are two kinds of reflex action conditioned and unconditioned. The reflex action just described is said to be unconditioned because it does not depend on previous learning or experience: it is present even in newborn babies. Similarly, the flow of gastric juice as a result of food in the stomach is an unconditioned reflex. However, the presence of food in the stomach is preceded by the presence of food in the mouth; and after a time the flow of gastric juice in the stomach takes place as a result of food in the mouth even before it reaches the stomach. This is an example of a conditioned reflex: the new stimulus of food in the mouth has become associated with the old stimulus of food in the stomach, and now produces the same response in the stomach. This sort of thing may be familiar in your own experience. For example, your mouth waters when you put a piece of food in it (unconditioned reflex), but it may also water if you see or smell the food, or even if you think about eating (conditioned reflex).

49. The word stimulus means
- A a flow of saliva.
 - B that which causes a reflex response.
 - C the presence of food in the mouth.
 - D the smell or sight of food.
50. A newborn baby will not react as a result of conditioned reflexes because
- A its nerve tissue is not fully developed.
 - B it has no previous learning.
 - C it cannot control its reactions.
 - D it is fed whenever it is hungry.
51. The flow of gastric juice in a newborn baby is brought about by
- A the taste of food in the mouth.
 - B a conditioned reflex action.
 - C digestive enzymes in the stomach.
 - D the presence of food in the stomach.
52. A conditioned reflex is
- A the reaction to the sight or smell of food.
 - B the flow of saliva caused by the presence of food in the mouth.
 - C a reflex response where the normal stimulus is replaced by a substitute.
 - D a reflex response to the presence of food in the stomach.
53. A suggestion has been made that many of man's reactions are a series of conditioned reflexes. The paragraph above contains information which
- A proves this suggestion to be false.
 - B proves this suggestion to be true.
 - C indicates that this suggestion is false but does not prove it so.
 - D indicates that this suggestion is true but does not prove it so.
 - E gives no indication one way or the other.
54. A statement is made that if a child is rewarded whenever his behaviour is good he will develop a conditioned reflex to behave well. The paragraph above
- A suggests that the statement is true.
 - B suggests that the statement is false.
 - C gives no indication of whether the statement is true or false.
 - D suggests that the statement is true only for newborn babies.
55. Which of the following persons is most likely to produce a flow of saliva as a result of seeing a bottle of milk?
- A A city dweller.
 - B A native of the arctic.
 - C A newborn baby.
 - D A native of the desert.

UNIT 11 (Questions 56-60)

Earthquakes are the vibrations produced by the cracking apart of rocks which have been bent past their elastic limits. They can be felt by humans only when they are within a few hundred miles of the shock centre or focus, but can be detected by instruments placed almost anywhere on the Earth's surface. Volcanoes and earthquakes generally occur in the same broad areas or belts.

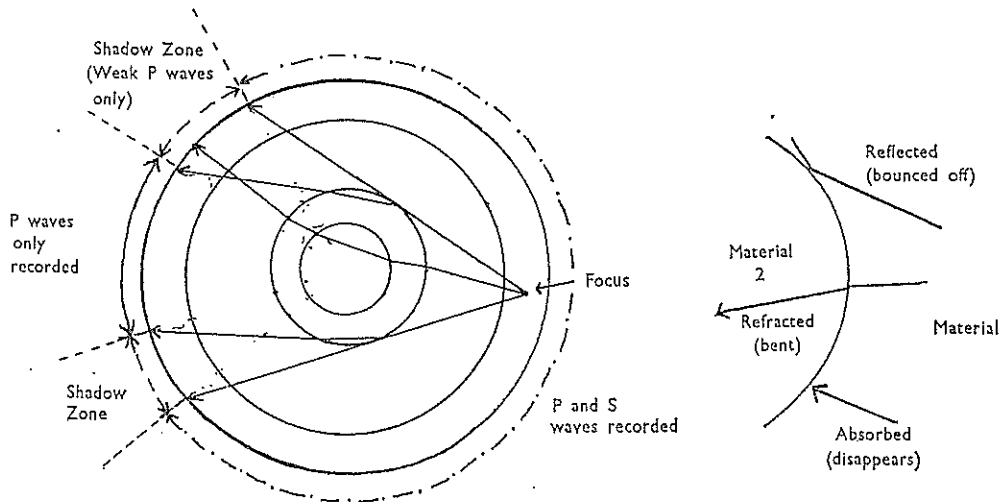
The study of earthquake waves more than any other field of study has contributed to our knowledge of the Earth's interior. The diagram illustrates the structure accepted by many scientists.



Three types of waves, *P*, *S*, and *L*, are produced simultaneously by the cracking apart of rocks in earthquakes. Earthquake damage on the Earth's surface is produced by the *L* waves which travel around the Earth's surface. *P* and *S* waves travel through the Earth and *P* waves travel 50 per cent. faster than *S* waves through solids. Whereas *P* waves can travel through liquids, *S* waves cannot.

All three types of waves travel faster through solids than through liquids, and faster through more dense matter than through less dense matter.

A shadow zone exists on the Earth's surface. This is an area in which no *S* waves and only weak *P* waves are received due to the refraction or bending of *P* waves by the core of the Earth which is more dense than the Mantle. The inner core is considered to be solid because of higher pressure, and because refraction or bending of *P* waves as they pass from a liquid outer core to a solid inner core would account for the arrival of faint *P* waves in the shadow zone.



Despite some knowledge of the cause and effects of earthquakes, we are still unable to predict when earthquakes will occur.

56. Why are earthquakes felt only within a few hundred miles of the focus ?
- A Waves beyond this range do not cause sufficient disturbance.
 - B The shadow zone is then encountered.
 - C *P* and *S* waves travel through the Earth and not around it, other than for a few hundred miles from the focus.
 - D *L* waves cannot be reflected over longer distances.
57. Select the one of the following which would be the best reason for assuming that the mantle is more dense than the crust.
- A The mantle occurs at a greater depth.
 - B The mantle is part of the dense core.
 - C *P* and *S* waves bounce off the boundary between them.
 - D The crust consists of lighter rocks such as granite.
 - E *P* and *S* waves travel faster through the mantle than through the crust.
58. The prediction of when earthquakes will occur is still not possible. Select what you consider is the best reason to explain this.
- A Earthquakes generally occur in zones.
 - B The properties of *P*, *S*, and *L* waves are not well known.
 - C Sufficient research has not yet been performed.
 - D Earthquake waves move through the Earth at different speeds.
59. The reason why the outer part of the Earth's core is thought to be liquid is because
- A *S* waves cannot pass through it.
 - B *P* waves can pass through it.
 - C Both *P* and *S* waves can pass through it.
 - D Neither *P* nor *S* waves can pass through it.
60. The depth of the crust of the Earth varies. Select the method which you would use to determine the depth in different areas.
- A Measure the varying times taken for *P* and *S* waves to reach the other side of the Earth after earthquakes in different areas.
 - B Measure the various times taken for waves from man-made explosions to reach the other side of the Earth.
 - C Measure the times taken for the waves from man-made explosions to rebound from the outer surface of the mantle.
 - D Measure the times taken for *L* waves to travel through different areas of the crust.

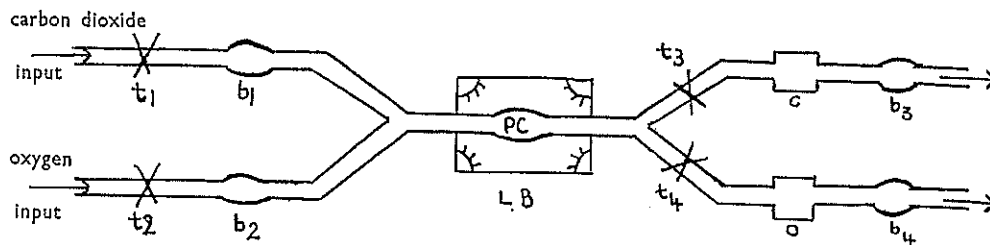
UNIT 12 (Questions 61-68)

Living organisms depend upon air for their supply of certain essential gases.

In green plants, oxygen is used in the process of respiration and carbon dioxide is released. Green plants also manufacture food substances by the process of photosynthesis in which carbon dioxide is used and oxygen is released.

Using the apparatus illustrated the following results were obtained from the first experimental try-out :

Input in bubbles per minute		Units of light intensity inside PC	Output in bubbles per minute	
Carbon dioxide	Oxygen		Carbon dioxide	Oxygen
0	1	0	1	0
0	1	5	0	1
0	5	0	1	4
0	5	5	0	5
5	5	0	6	4
5	5	5	3	7
10	5	0	11	4
10	5	5	8	7



b = bubbler

c = carbon dioxide remover

o = oxygen remover

t = tap control

LB = box containing plants and light

PC = plant container

N.B.—When a mixture of gases passes into an oxygen remover any oxygen gas in the mixture is absorbed while the other gases in the mixture pass through unaffected.

61. To obtain the results shown, essential equipment not shown in the apparatus diagram would be

A a thermometer.

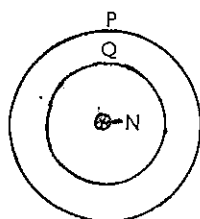
B suitable candles.

C a magnifier.

D a timing device.

62. The inner container in the light box would need to be made of
- A metal, to withstand the gas pressure.
 - B glass, to enable the experimenter to see into it.
 - C a transparent material, to enable light to penetrate it.
 - D the same material as the input and output pipes.
63. With no plants in the plant container, taps t_1 and t_4 opened and taps t_2 and t_3 closed then which one of the following statements is correct?
- A Oxygen will pass through both b_1 and b_4 .
 - B Carbon dioxide will pass through both b_1 and b_4 .
 - C Oxygen will pass through b_1 but no gas will pass through b_4 .
 - D Carbon dioxide will pass through b_1 but no gas will pass through b_4 .
64. With plants in the plant container, which taps would need to be opened to obtain a bubble count for oxygen input and carbon dioxide output?
- A t_2 and t_4 .
 - B t_2 and t_3 .
 - C t_1 and t_4 .
 - D t_1 and t_3 .
65. In order to obtain the results shown, then at some stage during each recording it is necessary that
- A tap t_3 is opened while tap t_4 is closed and vice versa.
 - B tap t_1 is opened while tap t_4 is closed and vice versa.
 - C tap t_1 is opened while tap t_3 is closed and vice versa.
 - D tap t_2 is opened while tap t_4 is closed and vice versa.
66. Which one of the following could not be used in an explanation of the results obtained?
- A Photosynthesis only occurs when light is present.
 - B Respiration will not occur when light is present.
 - C The rate of photosynthesis increases and the rate of respiration decreases when the light intensity changes from zero to 5 units.
 - D Both the rate of photosynthesis and the rate of respiration remain constant when the light intensity changes from zero to 5 units.
67. If it is assumed that the rate of respiration is constant and producing one bubble of carbon dioxide per minute find, from the table of results, the maximum number of bubbles of carbon dioxide converted to oxygen by photosynthesis each minute.
68. If it is assumed that there is no respiration when light is present what is the maximum number of bubbles of carbon dioxide converted to oxygen by photosynthesis each minute.

UNIT 13 (Questions 69-77)



Messages from intelligent beings in outer space reveal that they have discovered a new series of chemical elements.

The atoms of each of these elements have a nucleus N containing three kinds of particles, K , L , and M . Outside the nucleus are two rings P and Q in which particles of the fourth kind J may revolve about the nucleus.

The particles have the following properties :

Particle	Mass of Particle	Electric Charge on Particle
K	1 unit	1 positive unit
L	1 unit	1 negative unit
M	2 units	uncharged
J	negligible	1 positive unit

Electric charge is such that 1 positive unit of charge when added to 1 negative unit of charge gives a neutral or uncharged system which has neither positive nor negative charge.

The following are properties of these new elements :

- The atoms are uncharged.
 - M particles in the nucleus always occur in pairs.
 - The number of M particles in the nucleus cannot be less than the total number of K and L particles added together.
 - Each atom has half as many J particles as L particles.
 - The P ring contains either one or two more J particles than the Q ring.
69. The element alium has ' a ' K particles, ' b ' L particles, ' x ' M particles, ' y ' J particles in the P ring and ' z ' J particles in the Q ring. What is the mass of an atom of alium ?

Questions 70-77

Complete the table on the Answer Sheet, giving the number of particles of each kind for the elements bilium and colium containing 4 and 6 L particles respectively and having the least possible number of M particles in accord with the properties listed above.