7-27-1966

Comprehension and interpretation (sciences) 1966

ACER

COMMONWEALTH SECONDARY SCHOLARSHIPS

EXAMINATION FOR TWO-YEAR SCHOLARSHIP 1967-68

COMPREHENSION AND INTERPRETATION (SCIENCE)

Afternoon Session
Wednesday, 27th July.

Candidate's Number

In this section your answers should all be indicated by NUMBERS.

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In this section your answers should all be indicated by LETTERS

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Candidate's Number

COMMONWEALTH SECONDARY SCHOLARSHIPS

EXAMINATION FOR TWO-YEAR SCHOLARSHIP 1967–68

COMPREHENSION AND INTERPRETATION

(SCIENCE)

Afternoon Session, Wednesday, 27th July, 1966

Time allowed : Two 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 12 units with an average of 5 to 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 time ; if, after making a genuine effort, you still find the question too difficult, go on to the next question and come back to the difficult ones later.

(3) If you think you know an answer, give it 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 questions *1* to *58* you will be required to select one answer from a number of alternatives and to indicate your answer by printing the appropriate number **(1, 2, 3, etc.)** on your Answer Sheet.

In questions *59* to *70* you will be required to indicate your answer by printing the appropriate letters (A, B, C, etc.) on your 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.

Prepared by the Australian Council for Educational Research

UNIT I

Questions 1–3.

Scientists make observations and then try to explain the cause of them.

Here is one such observation :

Illness is often accompanied by a high body temperature.

Instructions.—From the ten statements below choose the *three* statements you would investigate as being the most likely to explain the *cause* of this observed fact.

Write the number corresponding to your selections beside Questions *1* to *3* on the answer sheet. (The order does not matter).

Statements :

1 In all animals, many illnesses are characterized by high body temperatures.

2 It is obvious that if you have an illness you must have a high temperature.

3 The high temperature is nature's way of combating the illness.

4 Just as a car engine becomes overhot when it is overworked, so the human body does the same.

5 In some illnesses less blood flows in the surface of the body, so there is less heat loss.

6 This is very similar to the process of becoming hot with violent exercise.

7 Certain products of injured cells are carried to the brain, where they disturb the function of the heat-control processes.

8 The high body temperature makes the blood run faster and produces the fever.

9 The body contains a regulating device that increases the blood flow in the body under certain conditions of body malfunction, and this increases body temperature.

0 Many organisms causing illness flourish if temperatures are higher than normal body temperature.

UNIT II

In the oceans of the world we find a group of organisms called the coelenterates which have delicate bodies consisting largely of water. Some can swim, others drift in the ocean currents, while many live attached to a rock or a limy skeleton which forms coral reefs.

All the coelenterates are predators (feed on other animals) and their success as a world wide group of animals seems to be explained by their inbuilt mechanisms of defence and food capture, combined with effective means of distribution of the young by ocean currents and/or free-swimming adult stages.

This is a diverse group including corals, anemones, jellyfish, and the Portuguese man-of-war.

Amidst all the diversity of the animals of this group, however, there is one distinctive feature which is possessed only by members of this group. Somewhere on all of these animals are minute structures called stinging capsules.

Some of these inject a poison while some others produce a significant reaction from the presence of the injected thread. A few of these poisons can cause the death of a man in a very short time but others are not so powerful.

In certain parts of Australia many cases of stingings are reported each year. The victim has red, swollen, painful areas and sometimes sores. Only some of the stingings are actually caused by members of the coelenterate group. In January, 1960, a batch of stingings occurred in which the damaged region had long narrow swellings with a pink area around each. Although the victims were in pain and greatly alarmed, these spectacular swellings only lasted two hours. A number of stinging capsules were recovered from the skin of two patients.

4. One would expect to find coelenterates living only in water because

1 they have no legs to help them move on land.

2 they would dry up if exposed to the air for too long.

3 their stinging capsules only function in water.

4 they are often dispersed by ocean currents.

5. According to the above information a sea anemone

5 feeds on marine animals.

6 will cause man damage if handled.

7 cannot disperse because the adult cannot swim.

8 has no stinging capsules.

6. To establish the fact that a bather had been stung by a coelenterate one would need

1 to look for symptoms including sores and swellings.

2 to check that the bather had been swimming in the ocean.

3 to find stinging capsules on the swollen area.

4 to check that jellyfish had been around the bather.

7. It has been suggested that certain populations of jellyfish with all members having a powerful poisoning mechanism evolved because this type of jellyfish had an advantage over jellyfish with a less powerful poison. This may have been an advantage because

5 life in the ocean is dangerous.

6 stronger animals such as fish may badly damage the jellyfish unless they are killed quickly.

7 it is essential that they have protection against man.

8 aquatic animals are more difficult to kill than terrestrial ones.

8. An effective means of distributing the young is essential for the success of coelenterates as a group of animals. This is because

1 the young have to be distributed in order to catch their food.

2 if the coelenterates do not move they cannot sting their prey.

3 conditions for survival may be unfavourable in some localized regions.

4 the coelenterates are a diverse group of animals.

UNIT III

It is sometimes convenient to use an arrow to represent diagrammatically the velocity of an object. The length of the arrow represents the speed of the object (e.g., an arrow 10 units long could be conveniently chosen to represent a speed of 10 mph); and the direction in which the arrow points indicates the direction in which the object is moving : (e.g., an arrow pointing north represents an object moving north).

Fig. 1 shows how one can represent the motion of an object moving east at 7 mph.

FIG. 1

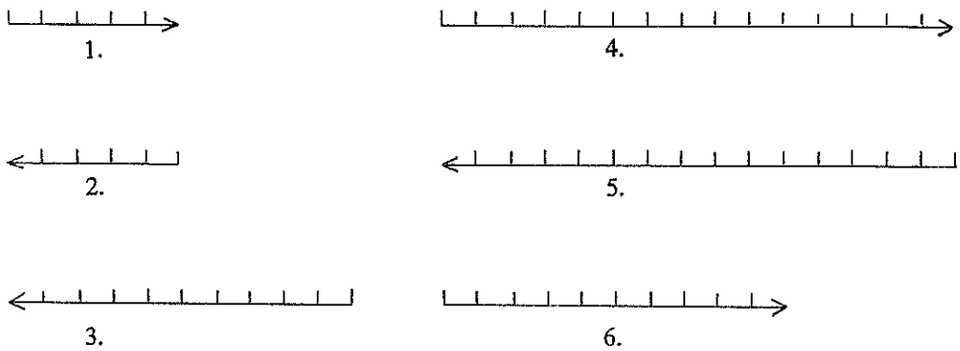
(North is to be taken as up the page throughout.)

9. Which of the following diagrams represents the velocity (speed and direction) of a man walking N.E. at 3 mph ?

— — — — — — —

A boat whose motor is known to propel it at exactly 10 mph in still water is driven due west along a river which is flowing due east at 5 mph.

In each of questions *10–12* you are asked to choose the appropriate diagram **(1, 2, 3, 4, 5, or 6)** which represents the velocity given.



10. The velocity of the boat as seen from the river bank.

11. The velocity of the boat as seen by a person drifting with the water.

12. The velocity of a tree on the bank as seen by a man in the boat.

13. A man on the south side of the river wishes to drive this same boat to a a point on the other bank which is due north of his present position. To do this as quickly as possible he would have to head

7 west of north.

8 east of north.

9 due north.

0 due west.

— — — — — — — —

The following is a quotation from a book written by Albert Einstein :

> " The purpose of mechanics is to describe how bodies change their position in space with time." I should load my conscience with grave sins against the sacred spirit of lucidity were I to formulate the aims of mechanics in this way, without serious reflection and detailed explanations. Let us proceed to disclose these sins.
>
> It is not clear what is to be understood here by " position " and " space ". I stand at the window of a railway carriage which is travelling uniformly, and drop a stone on the embankment, without throwing it. Then, disregarding the influence of the air resistance, I see the stone descend in a straight line. A pedestrian who observes the misdeed from the footpath notices that the stone falls to earth in a parabolic curve. I now ask : Do the " positions " traversed by the stone lie " in reality " on a straight line or on a parabola ?

14. Which of the following is the most satisfactory reply to the question Einstein asks in the last sentence ?

1 A straight path, because a falling stone always travels in a straight line.

2 A curved path, because the person standing on the embankment has the best view of the path taken by the stone.

3 A straight path, because the man in the train has the best view of the path taken by the stone.

4 Each path is an equally good description of the stone's behaviour.

The man in the train now drops a stone (without throwing it) inside the carriage. In questions *15*, *16* you are asked to select from the Key the answer **(5, 6, 7, 8, 9, or 0)** which describes how he sees the stone fall under the circumstances described in each question.

Key :

5 Towards the rear of the train.

6 Towards the front of the train.

7 Vertically downwards.

8 Towards the rear of the train and towards one of the side walls.

9 Towards the front of the train and towards one of the side walls.

0 Towards one of the side walls directly across the train.

15. The train is moving forwards at constant speed in a straight line.

16. The train is travelling forwards in a straight line with increasing speed.

UNIT IV

Hormones are substances formed by particular organs (endocrine glands) and liberated into the general blood circulation which carries them to their sites of action elsewhere in the body. Here they serve to regulate the rates of specific processes.

Because of the regulating nature of their roles, either deficiency or excess in the circulating levels of the hormones may lead to disorders in the normal development and function of the body.

A patient has the following symptoms :

(*a*) He is always thirsty.

(*b*) He produces greater than average quantities of urine.

It is suggested that these symptoms could be caused by

either lack of hormone *X*,

or lack of hormone *Y*,

but not lack of both.

The following information relating to hormones *X* and *Y* is known.

(i) *X* and *Y* are produced by different glands.

(ii) Lack of *X* causes loss of glucose from the body into the urine but lack of *Y* does not.

(iii) In a healthy person glucose is not present in the urine.

In each of questions *17–21* an observation is given.

Key : In each case, state whether the observation

1 suggests the lack of *X* is a cause of the symptoms.

2 suggests lack of *Y* is a cause of the symptoms.

3 supports neither suggestion.

17. Hormone *Y* is injected into the patient and the symptoms disappear.

18. The urine is tested and glucose is found to be present.

19. The patient drinks a lot of water. Symptom (*a*) tends to disappear but (*b*) becomes more acute.

20. The patient is given glucose and the symptoms disappear.

21. A large part of the gland which produces *Y* is removed and the symptoms become more acute.

UNIT V

An investigation is made to determine the way in which the pitch of a musical note is affected by

(*a*) the tension in a wire.

(*b*) the diameter of the wire.

(*c*) the length of the wire.

The diagrams illustrate five experimental results obtained by a student.

Key to diagrams :

Weights .. Each box ☐ represents the same weight. The weights, which stretch the wire, determine the tension in the wire.

Diameters .. The thicker the wire, the thicker is the line used to represent the wire. Three different diameters of wire are used in the experiment.

Lengths .. Lengths are indicated on the diagrams.

Pitch .. The pitch of the note is indicated on the normal musical scale. The higher the pitch of the note, the higher its position on the scale. That is, the note indicated on Figure 2 is higher in pitch than the note indicated in Figure 1.

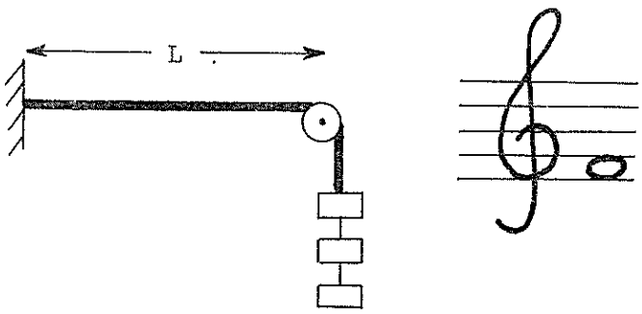


Fig. 1

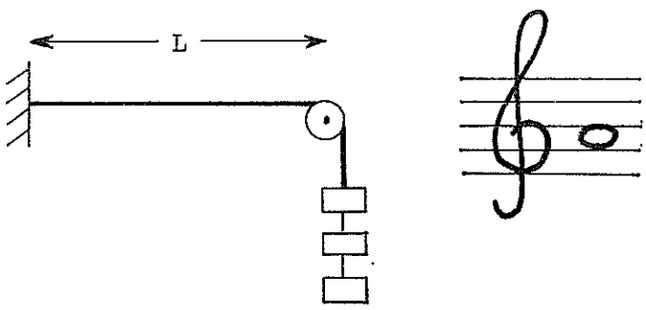


Fig. 2

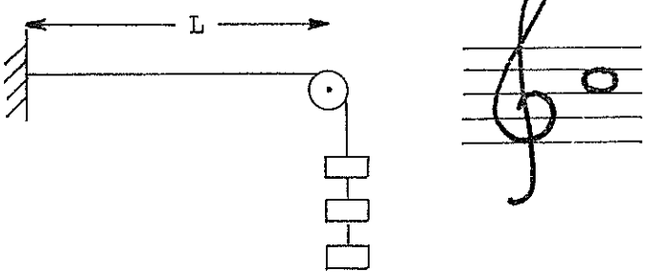


Fig. 3

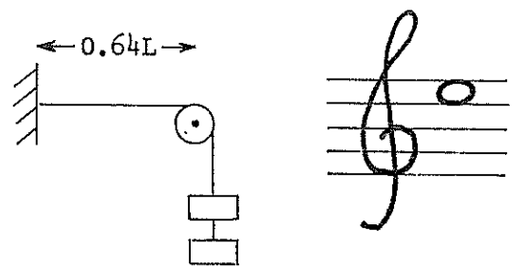


Fig. 4

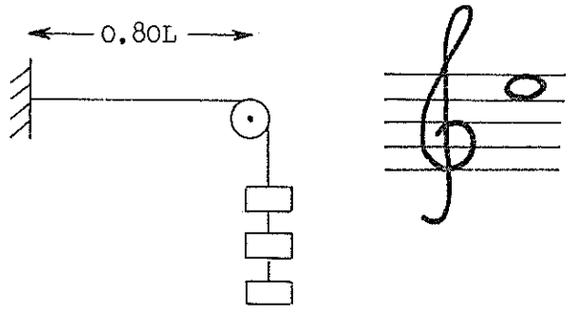


Fig. 5

22. In which Figure **(2, 3, 4, or 5)** is the tension lower than in Figure 1 ?

For each of the following statements (*23* to *26*), indicate whether the results, directly or indirectly

1 support the statement.

2 contradict the statement.

3 neither support nor contradict the statement.

23. For a given tension and length of wire, the greater diameter produces a lower pitch.

24. For a given diameter and tension, increasing the length decreases the pitch.

25. Decreasing the length has the same effect on the pitch as decreasing the diameter.

26. For a given diameter and length, reducing the tension increases the pitch.

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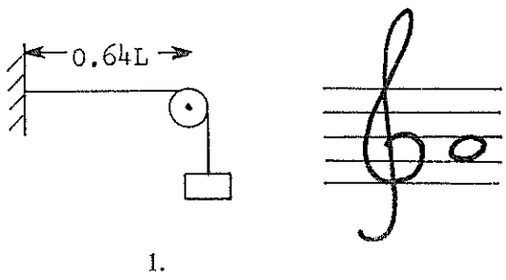
27. Which of the following diagrams is not consistent with the previous results ?



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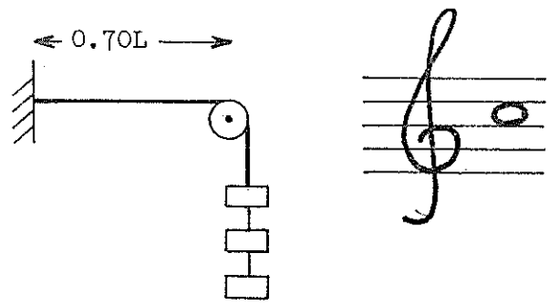

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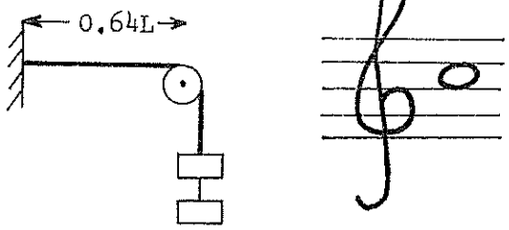

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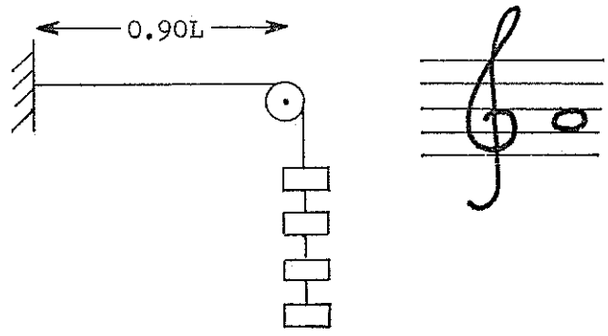


4.

UNIT VI

Blood contains two fractions. The first is the so called "formed elements," principally red blood cells, and the second is plasma, the fluid in which these formed elements are suspended. The red blood cells of an individual may contain a factor *X*, a factor *Y*, both *X* and *Y*, or neither *X* nor *Y*. Similarly the plasma may contain a factor *x*, a factor *y*, both *x* and *y*, or neither *x* nor *y*. All blood contains either *X* or *x*, but not both, and either *Y* or *y* but not both.

When blood containing *X* is mixed with blood containing *x* the red blood cells clump together and prevent the blood from flowing freely. *Y* and *y* react in the same way.

28. If a person's blood contains neither *X* nor *Y*, which of the following must it contain ?

1 *x* but not *y*.

2 *y* but not *x*.

3 Both *x* and *y*.

4 Neither *x* nor *y*.

29. If a person's blood contains *y*, it may also contain

5 *X* and *x*.

6 *Y* but not *X*.

7 *X* but not *Y*.

8 *Y* and *X*.

In cases of shock or severe blood loss a blood transfusion is often given. Usually, only one or two pints of donor blood is added to the blood stream of the patient (recipient), which normally contains over 10 pints of blood. The factors in the plasma of the donor blood are so diluted that they do not cause clumping of the recipient's red blood cells.

30. In blood transfusions, which of the following combinations can lead to the clumping of red blood cells ?

1 The recipient's plasma and the donor's plasma.

2 The recipient's red blood cells and the donor's plasma.

3 The recipient's red blood cells and the donor's red blood cells.

4 The recipient's plasma and the donor's red blood cells.

31. One blood type is known as "universal recipient" because a person having this blood type can receive any blood without the red blood cells clumping.

The plasma of "universal recipient" blood contains

5 *x* but not *y*.

6 *y* but not *x*.

7 both *x* and *y*.

8 neither *x* nor y.

32. If you were in charge of a blood bank in a small country town and could store only one blood type, which blood type would you store ?

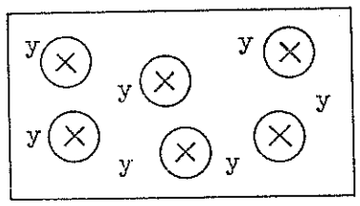
1 Blood containing *X* but not *Y*.

2 Blood containing *Y* but not *X*.

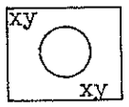
3 Blood containing both *X* and *Y*.

4 Blood containing neither *X* nor *Y*.

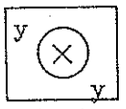
33. The following diagrams represent the recipient's blood and three possible donor bloods.



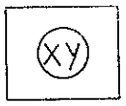
Recipient Blood



(i)



(ii)



(iii)

Donor Blood

Which donor blood can safely be given to the recipient as a transfusion ?

5 (i) only.

6 (i) and (ii).

7 (i) and (iii).

8 (i), (ii), and (iii).

34. Considering the four combinations involving *X* and *Y* for the red blood cells and the four combinations involving factors *x* and *y* in the plasma, how many different " whole blood " types are there ?

1 4.

2 8.

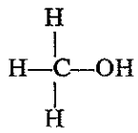
3 12.

4 16.

5 None of these.

UNIT VII

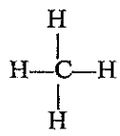
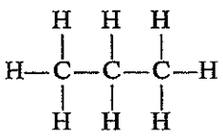
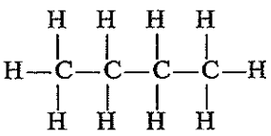
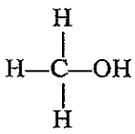
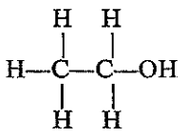
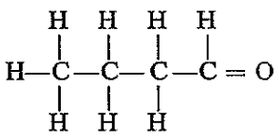
Chemists refer to compounds not only by names, but also by *formula.* A formula consists of a series of letters which represent atoms of the elements making up the compound. For example, the letters C, H, N, and O are used to designate the atoms of the elements carbon, hydrogen, nitrogen, and oxygen respectively. A *molecular formula*, such as CH_4O, indicates the actual number of atoms of each element which makes up each molecule of the compound. A more useful type of formula for the compounds considered here is the *structural formula*, which implies all the previous information together with an indication of which atoms are directly joined to each atom in the molecule. For the molecule called methanol the molecular formula is CH_4O, and the structural formula is



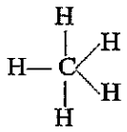
which may also be written CH_3OH.

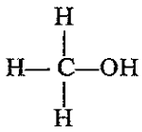
The Table shows some chemical compounds arranged in a systematic fashion.

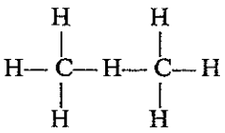
Numbers 35 to 40 have been substituted for some of the names or *structural formulas.*

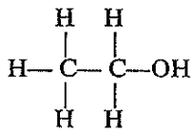
Methane CH_4	*Ethane* 36.	*Propane* $CH_3CH_2CH_3$	*Butane* 37.
	35.		
Methanol CH_3OH	38. CH_3CH_2OH	*Propanol* $CH_3CH_2CH_2OH$	*Butanol* / / / / /
		/ / / / /	39.
/ / / / /	/ / / / /	*Propionaldehyde* 40.	*Butyralaldehyde* / / / / /
/ / / / /	/ / / / /	/ / / / /	

35. In the opposite table No. 35 has been substituted for

1 

2 

3 

4 

5 None of these.

36. No. 36 has been substituted for

1 CH_4CH_2 **2** CH_3CH_3 **3** CH_3CH_2

4 CH_3OH **5** CH_3HCH_3 **6** CH_3CH_2OH

7 None of these.

37. No. 37 has been substituted for

1 $CH_4CH_2CH_4$ **2** C_4H_{10} **3** $CH_3CH_3CH_3CH_3$

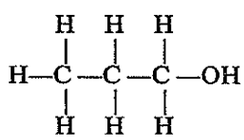
4 $CH_3CH_2CH_2CH_3$ **5** $CH_2CH_3CH_3CH_2$ **6** None of these.

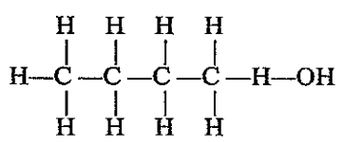
38. No. 38 has been substituted for

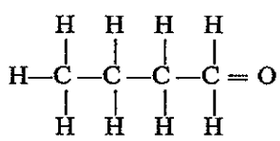
1 Alcohol **2** Propol **3** Octane

4 Tethranol **5** Ethanol **6** None of these.

39. No. 39 has been substituted for

1 

2 

3 

4 None of these.

40. No. 40 has been substituted for

5 CH_3CH_2CHO **6** $CH_3CH_2CH_2O$

7 $CH_3CH_2CH_2OH$ **8** $CH_2CH_2CH_2(OH)_2$

9 $CH_3CH_2CHO_2$ **0** None of these.

Centre Number

UNIT VIII

A human kidney is composed of about a million complete units called kidney tubules (little tubes). By carefully dissecting part of a kidney under a microscope one finds that a kidney tubule looks like Fig. 1. The whole tube is surrounded by a network of capillaries. A certain section (thin slice) cut from *A* will look like Fig. 2.

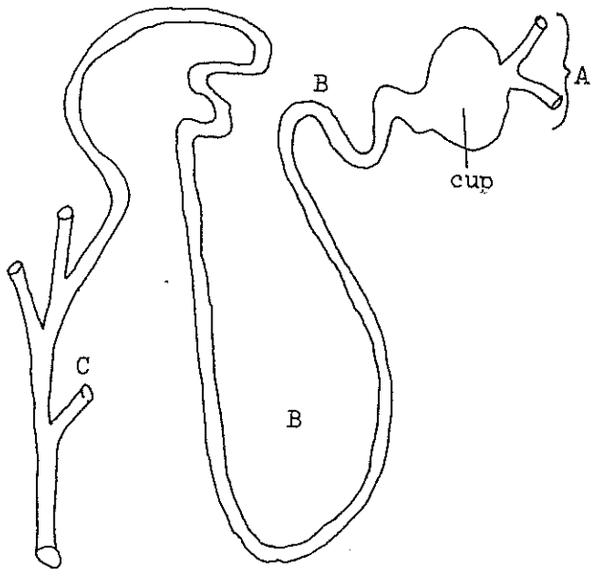


Fig. 1

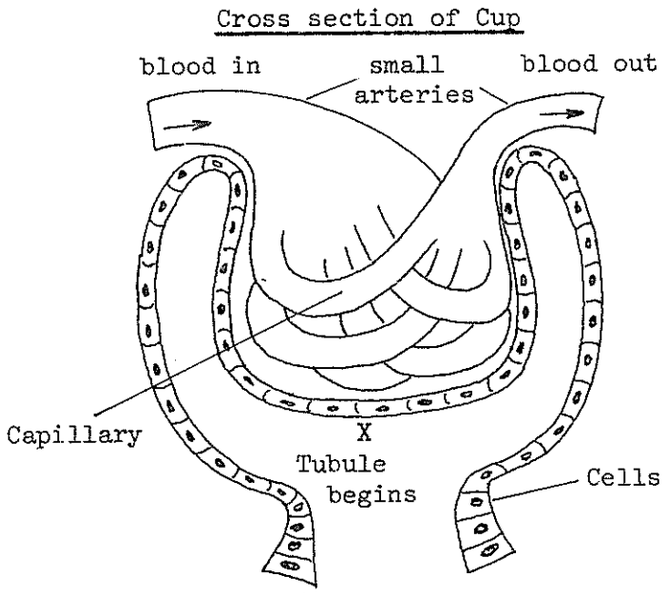


Fig. 2

Each tubule in the kidney functions to keep the composition of the blood constant. Blood flows into the cup by way of a small artery and out again by another. While the blood is in the capillaries in the cup some of the small molecules (e.g., water) from the blood filter into the tube at the base of the cup (area indicated *X* on the diagram). Increasing the blood pressure in the " cup " capillaries increases the number of small molecules filtered out of the blood. By this process of filtration molecules which are needed by the body as well as waste molecules pass out of the blood stream into the kidney tubule.

As this filtrate passes along the coiled tube the molecules required by the body are reabsorbed by the cells which form the tube and are passed *back* into the blood stream. About 98 per cent of the filtered water is reabsorbed. The amount of water and dissolved substances that is reabsorbed depends on how much is needed to keep the blood composition constant.

The molecules which are not reabsorbed pass out of the tubule at *C* as a fluid called urine.

Normal composition of Blood Plasma, of fluid from X, and of Urine (gm/100 ml of fluid)

——	*Blood Plasma*	*Fluid from X*	*Urine*
Urea	0·03	0·03	2·00
Uric acid	0·004	0·004	0·05
Glucose	0·10	0·10	none
Amino acid ..	0·05	0·05	none
Total minerals ..	0·72	0·72	1·50
Proteins and fats ..	8·00	none	none

41. Only substances with small molecules filter into area *X*. Which of the following have large molecules ?

1 Proteins.

2 Amino acids.

3 Glucose.

4 Urea.

5 Uric acid.

42. For substances to filter out of the blood there must be a fairly high blood pressure maintained within the capillaries of the cup. Which of the following structures or arrangement of parts would help to maintain this pressure ?

6 The network of capillaries surrounding the tubule.

7 The " cup " being composed of two layers of cells with a space between them.

8 Many tubules being crowded together to form a kidney.

9 The artery leaving the cups having a diameter smaller than the artery entering.

43. If a patient lost several pints of blood in an accident this would result in

1 less urine being produced.

2 more glucose being reabsorbed from the kidney tubule.

3 more blood passing to the kidneys.

4 less glucose being reabsorbed from the kidney tubule.

44. Excess protein is taken to the liver where it is changed to carbohydrate and urea. If a person has a diet containing very large amounts of protein one would expect the urine to contain

5 less than 2·00 gm of urea/100 ml.

6 more than 2·00 gm of urea/100 ml.

7 2·00 gm of urea/100 ml.

8 no urea.

UNIT IX

A Geiger counter is a device for detecting and counting the number of radioactive particles which strike a sensitive tube. The counter only records a fraction of all the particles which strike the tube, and this fraction varies with the voltage applied to the tube as shown in Fig. 1.

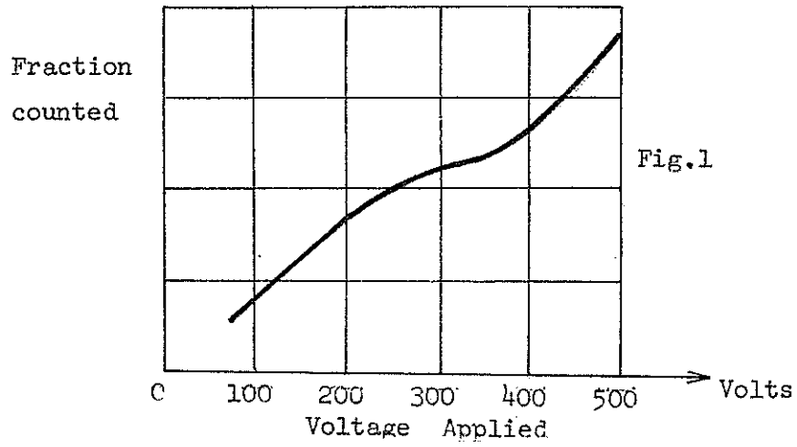


Fig.1

45. Which of the following voltages should be applied to the tube so that a small variation in the applied voltage will give a minimum variation in the fraction counted ?

1 100 volt.
2 200 volt.
3 300 volt.
4 400 volt.
5 500 volt.

A Geiger counter can be used to measure the absorption of radioactive particles by different materials. The material to be tested is placed between the source of the particles and the counter. Graphs such as that in Fig. 2 are obtained. We can express the absorbing properties of an absorber in terms of a " half thickness ". This is the increase in thickness of an absorber which reduces the number of radioactive particles by half.

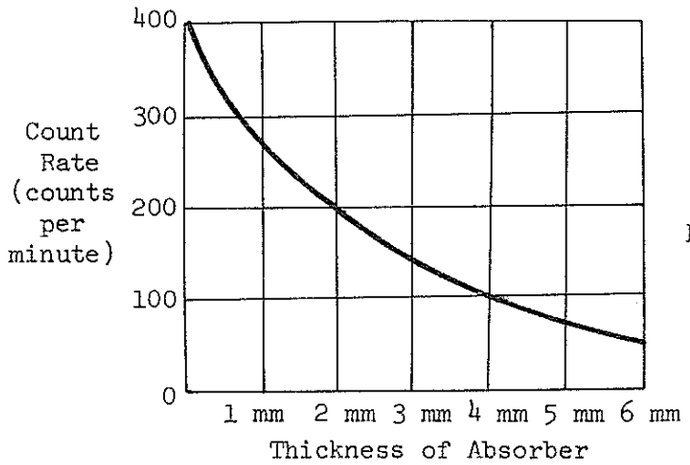


FIG. 2

46. Below is a table containing 4 sets of values for count rates and absorber thickness. (All sets refer to the same absorber material.)

		Count Rate			
		Set 1	Set 2	Set 3	Set 4
Absorber Thickness	0 mm	400	400	400	400
	2 mm	200	300	200	275
	4 mm	50	200	100	150
	6 mm	25	100	50	50

Which of these sets **(1, 2, 3, or 4)** corresponds to Figure 2 ?

47. What is the " half thickness " of the absorber in Figure 2 ?

5 1 mm.
6 2 mm.
7 3 mm.
8 4 mm.
9 5 mm.
0 6 mm.

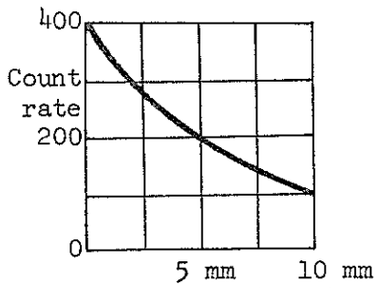
48. Which of the following would be the count rate for an 8 mm thickness of the absorber in Figure 2 ?

1 50 counts per minute.
2 37·5 counts per minute.
3 30 counts per minute.
4 25 counts per minute.
5 12·5 counts per minute.
6 0 counts per minute.

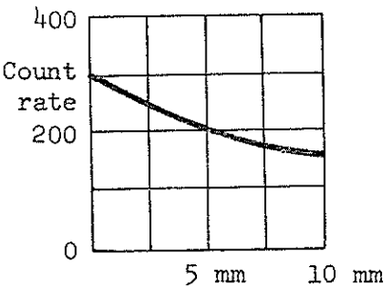
49. At what thickness of the absorber in Figure 2 will the count rate be 12·5 counts per minute ?

1 7 mm.
2 8 mm.
3 9 mm.
4 10 mm.
5 12 mm.
6 24 mm.

Below are graphs of count rate against absorber thickness for five samples 1, 2, 3 ,4, 5. Questions *50* and *51* are based on these graphs.



1.



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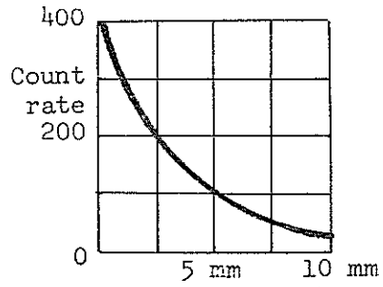

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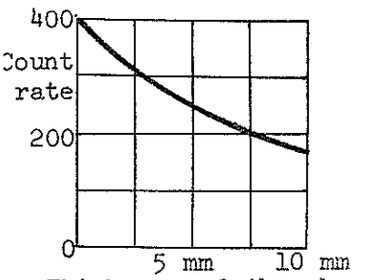
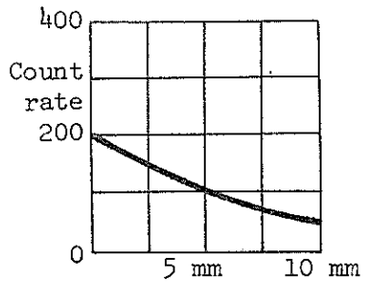


4.



5.

50. Which sample (2, 3, 4, or 5) has the same " half thickness " as sample 1 ?

51. Gold has a " half thickness " of 2·5 mm for the radioactive particles used. Which sample (1, 2, 3, 4, or 5) is gold ?

— — — — — — — —

If we consider the radioactive decay of a substance, i.e., the way the count rate from a sample decreases with time, we define a new constant, the " half lifetime ", which is defined similarly to " half thickness ".

Consider a sample with a " half lifetime " of 2 hours, and which gives a count rate of 100 counts per minute at 12 noon.

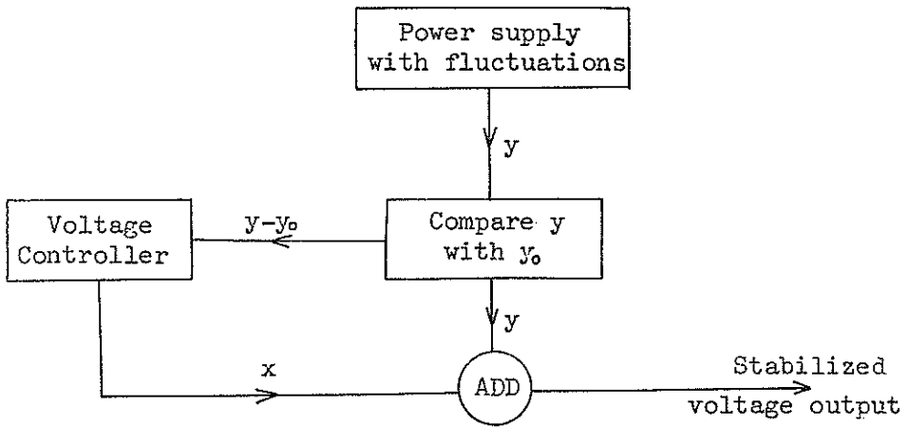
52. What would be the count rate at 2 p.m. ?

1 100 counts per minute.
2 75 counts per minute.
3 50 counts per minute.
4 25 counts per minute.
5 0 counts per minute.

53. What would be the count rate at 4 p.m. ?

6 100 counts per minute.
7 50 counts per minute.
8 25 counts per minute.
9 12·5 counts per minute.
0 0 counts per minute.

UNIT X



Negative feedback control systems are useful devices for stabilizing (or holding constant) the output or goal of mechinical devices and biological systems.

The voltage controller illustrated is an example. We wish the voltage output of the complete system to be constant. However, the main power supply varies up and down from our required stable voltage output, y_0.

To maintain a constant output, a " difference signal " is applied in negative feedback to the controller, which itself produces the voltage x required to stabilize the output of the main system.

54. Negative feedback would *not* refer to a control system which

1 compensates for errors in the main system.

2 produces a positive response to compensate for a negative error in the main system.

3 produces a negative response to compensate for a positive error in the main system.

4 works independently of the main system and so may keep its output constant.

55. The response of the voltage controller is uniquely determined by

5 the required output.

6 the supply voltage.

7 the voltage controller output.

8 the difference between the supply voltage and the required voltage.

56. The response of the voltage controller would be zero when

1 $y = y_0$

2 $y - y_0 = x$

3 $y_0 - y = x$

4 $y + x = y - y_0$

57. If the output is stabilized, we could be sure that

5 $y = y_0$

6 $y - y_0 = x$

7 $y - y_0 = -x$

8 $y + x = y - y_0$

58. Which of the following does *not* incorporate a negative feedback control system ?

1 A rocket guided on to a target.

2 A dog racing after a ball.

3 A man driving a car.

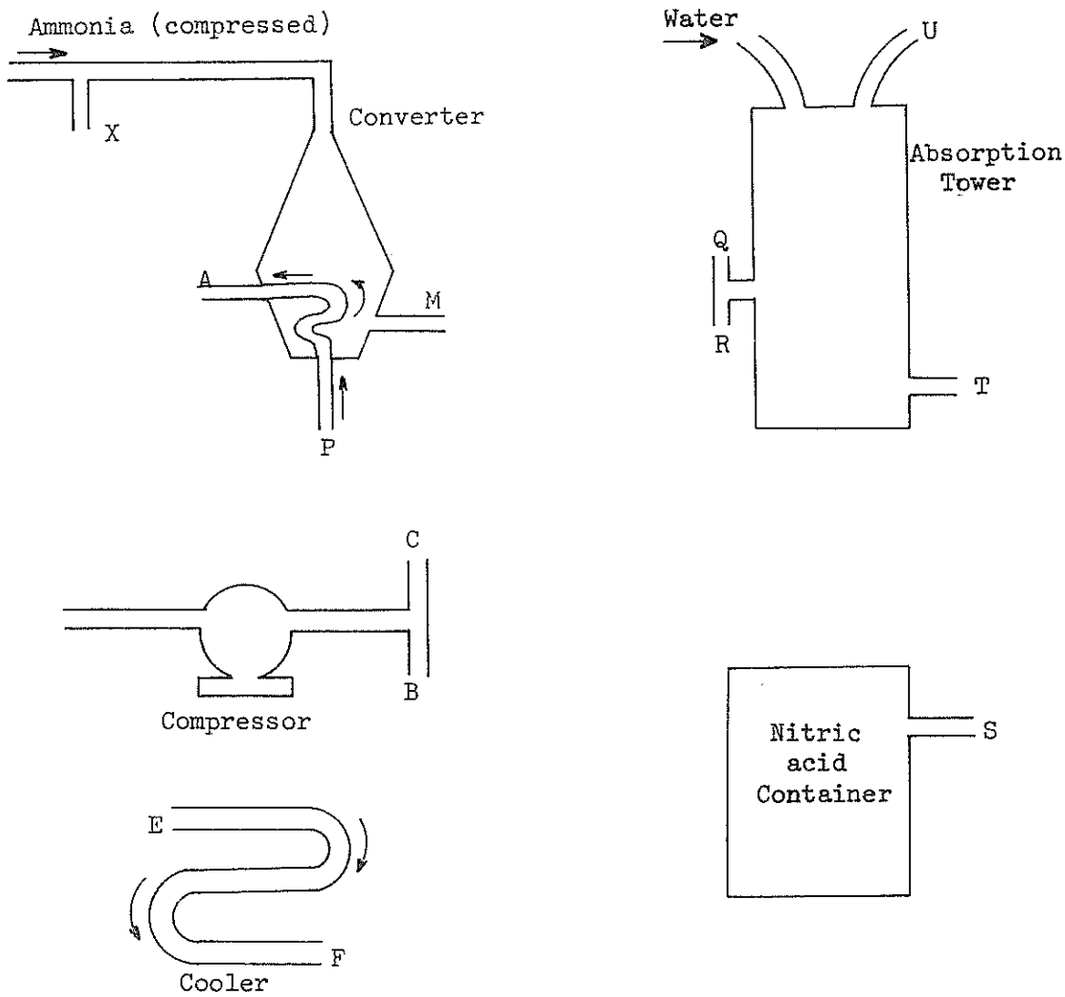
4 A bullet speeding to its target.

UNIT XI

Nitric acid may be manufactured from ammonia, air, and water.

Air and ammonia are compressed and passed into a converter which contains platinum-rhodium gauze pads. The ammonia and oxygen (from the air) react in the converter to form gaseous oxides of nitrogen, and steam. The heat of the reaction is more than sufficient to maintain the required temperature in the converter and some heat is removed by pre-heating the compressed air before it is mixed with the ammonia.

The gases from the converter are cooled, and then mixed with more compressed air as they enter the absorption tower, down which water flows. As the gases rise up the tower oxides of nitrogen are absorbed in the water to form nitric acid.



The components of the apparatus are sketched above. It is your job to decide how the various components should be connected to set up the system.

Actually compressed air flows from *C* to *Q* and enters the absorption tower. The answer to a question " how is *C* connected " would be shown on your answer sheet [*C* | *Q*], the order of the letters indicating the direction of flow of the gases or liquid when the connection is made. The same answer would be required for a question " how is *Q* connected ", because it is connected to *C* and the direction of flow is from *C* to *Q*. Not more than one connection may be made to each point. One connection, *CQ*, may be assumed to have been made.

59. How is *B* connected ?

60. How is *A* connected ?

61. How is *F* connected ?

62. How is *M* connected ?

63. How is *X* connected ?

64. How is *S* connected ?

65. How is *E* connected ?

UNIT XII

The following list describes five groups of plants.

LIST 1

A. Plants with water-conducting tubes, leaves grow from underground stems, water necessary for reproduction, do not produce seeds.

B. Water-living plants, some single-celled, some many-celled, definite nuclei and chloroplasts.

C. Land plants, water-conducting tubes, produce seeds which lie unprotected on scale-like leaves.

D. Single-celled plants, no distinct nuclei or chloroplasts, live in water.

E. Small plants, definite nuclei and chloroplasts, no water conducting tubes, live in moist places.

The following features are characteristic of evolutionary development in plants :

(i) increase in size and complexity.

(ii) development of plant parts with specialized functions.

(iii) improved adaption to dry-land conditions.

(iv) increased efficiency of methods of survival.

Bearing these features in mind, rank the above groups of plants in ascending order of evolutionary development.

That is, next to Q. 66 on the answer sheet, write the letter corresponding to the group that is at the lowest state of evolutionary development ; next to Q. 67 write the letter corresponding to the group that is at the second lowest stage of evolutionary development and so on to Q. 70.

A. C. BROOKS, Government Printer, Melbourne.