7-21-1971

Comprehension and interpretation (science) 1971

ACER

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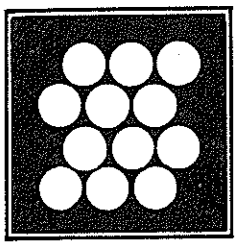
commonwealth
secondary
scholarships
examination

afternoon session:
wednesday
21 july
1971

time allowed:
two hours



comprehension & interpretation (science)

instructions to candidates

This is a test of your ability to read and understand material of a scientific nature. It is possible to do well on this test even if you have studied only a little science at school. The test consists of 10 units (66 questions in all) to be answered in two hours.

You will obtain the best possible score if you observe the following points: (1) Work carefully through the questions in the order in which they are given. (2) Don't 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, mark it—even if you are not certain you are correct. Marks will **not** be deducted for wrong answers. (4) Make sure that you mark the letter you have chosen in the correct line on your answer sheet.

answering

Each question has four alternative answers, represented by the letters A B C D. You must choose one answer from these alternatives. Having done so, make sure you mark your answer correctly.

If you want to change an answer, erase your first mark completely. Try to avoid having to make erasures by not answering hastily. Take care that your pencil mark does **not cross** into another row or column, and that there are no marks or smudges on your answer sheet.

Now look through this booklet, but **don't start writing** until the supervisor tells you to do so.

UNIT 1

Four layers of pliable material form a sheet and are placed in the order shown in figure 1. The layers are of equal thickness and are shaded for identification purposes.

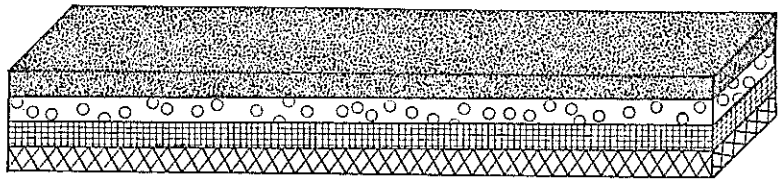


figure 1

The sheet was then folded as shown in figure 2 below.

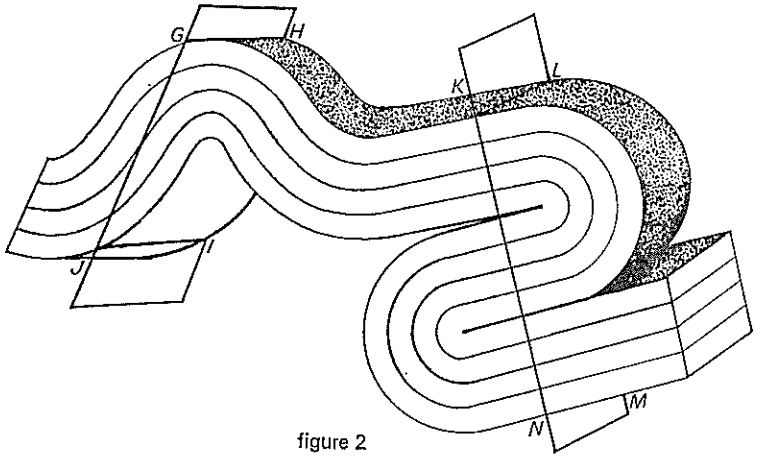
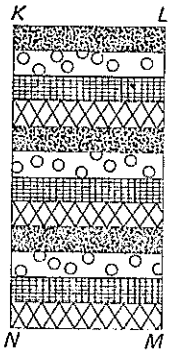


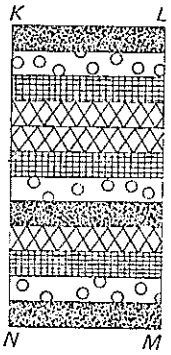
figure 2

1 Which one of the following best represents the appearance of the section *KLMN*?

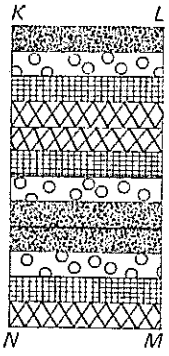
A



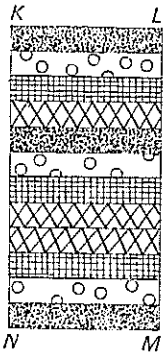
C



B

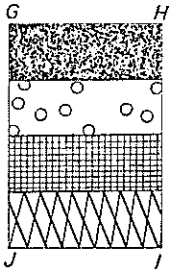


D

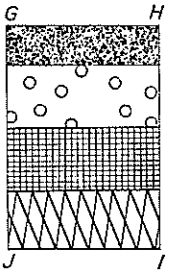


2 Which one of the following best represents the appearance of the section *GHIJ*?

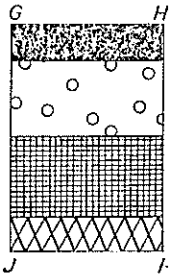
A



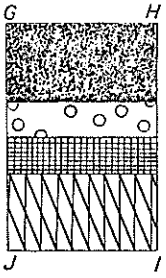
C



B



D



Questions 3 and 4 refer to figure 3:
The sheet was then folded as in figure 3 below.

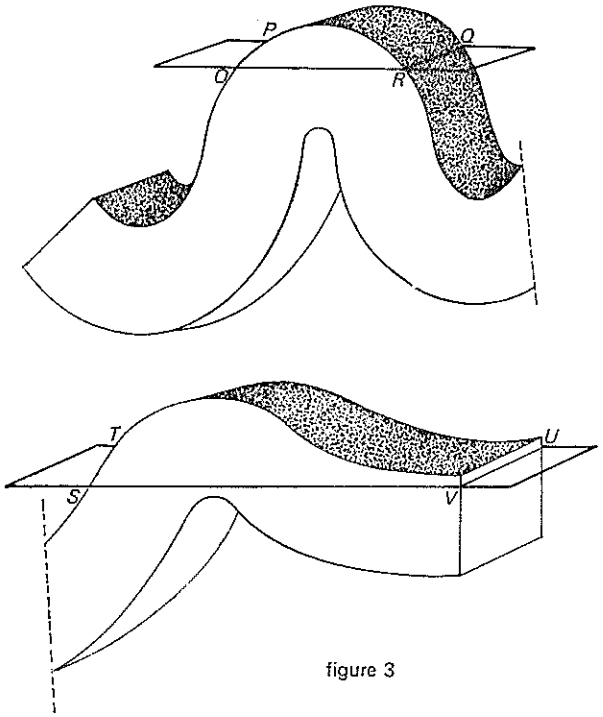
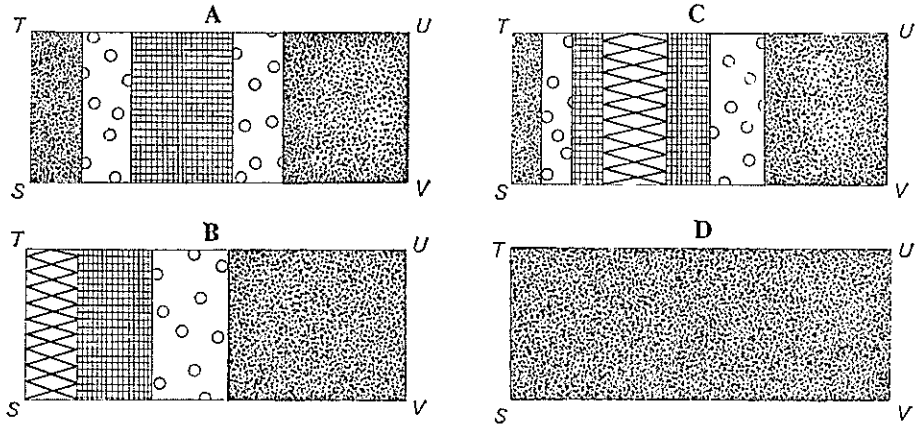
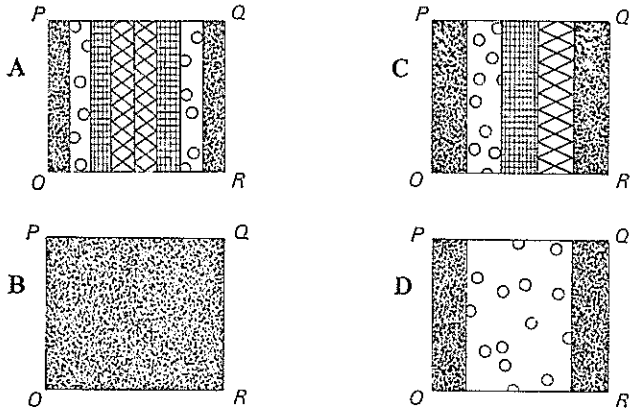


figure 3

3 Which one of the following best represents the appearance of the section *STUV*?



4 Which one of the following best represents the appearance of the section *OPQR*?



Question 5 refers to figure 4:

The sheet was then bent as shown in figure 4 below.

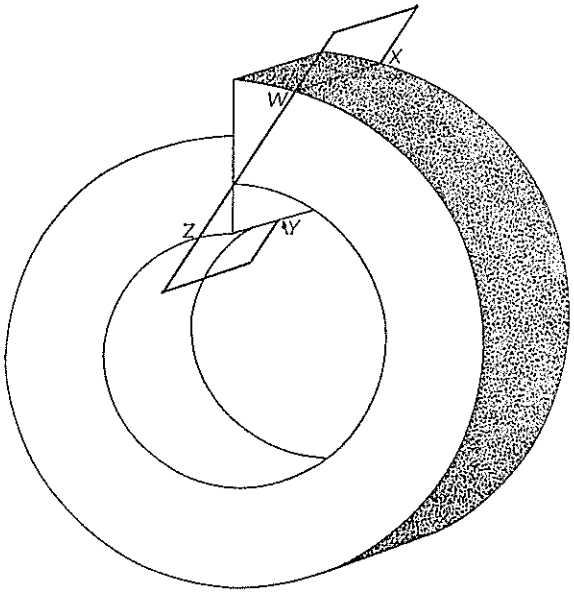
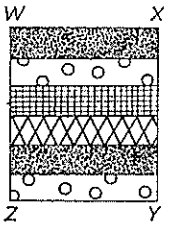


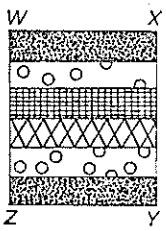
figure 4

5 Which one of the following best represents the appearance of the section *WXYZ*?

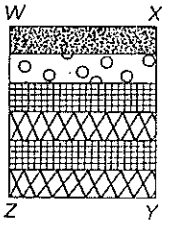
A



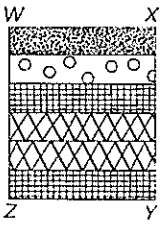
C



B



D



UNIT 2

Solutions of certain substances are called acidic or basic. The extent of their acidity or basicity may be expressed as a number on a scale between 0 and 14.

Acidic solutions have scale values less than 7; basic solutions have scale values greater than 7 (see figure 1). Any solution with a scale value of 7 is called neutral.

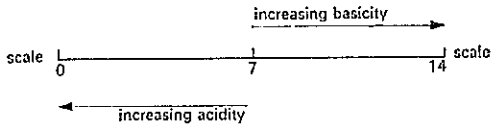


figure 1

Indicators are chemical substances which turn various colours depending on the acidity or basicity of the solutions in which they are placed. If a few drops of an indicator are added to various solutions, the indicator is one colour in solutions with scale values in a certain range and is another colour in solutions with a different range of scale values.

Thus in the table which follows, indicator *S* is blue in solutions with scale values 0 to 3 and red in solutions with scale values 5 to 14. Over the range of scale values 3 to 5, indicator *S* changes from blue to red.

Note that two indicators, *P* and *W*, undergo more than one colour change.

Indicator	*Colour change*	*Scale values over which change occurs*
P	red to yellow	1·0 — 2·6
P	yellow to blue-violet	7·6 — 9·2
Q	colourless to pink	1·4 — 3·2
R	yellow to blue-violet	2·8 — 4·6
S	blue to red	3·0 — 5·0
T	yellow to red-violet	4·8 — 6·4
U	orange to deep red-violet	5·0 — 6·0
V	yellow to purple	5·2 — 6·8
W	red to yellow	0·2 — 1·8
W	yellow to purple	7·2 — 8·8
X	yellow to green-violet	9·0 — 13·0
Y	colourless to blue	9·3 — 10·5
Z	yellow to red	10·5 — 12·0

Two experiments using some of these indicators are described below.

Experiment I
Samples of solution 1 were poured into each of four clean empty containers. One of the indicators *P*, *R*, *T*, and *V* was added to each container and the following colours were obtained.

Solution	*Indicator used and colour obtained*			
	P	*R*	*T*	*V*
1	yellow	yellow	yellow	yellow

6 The acidity, in terms of scale values, of solution 1 is

A between 1·0 and 2·6
B between 2·6 and 2·8
C between 2·8 and 4·8
D between 4·8 and 5·2

7 If indicator *S* were added to a sample of solution 1 in one container and indicator *U* were added to a sample of solution 1 in a second container, the resulting colours would be

A *S* blue, *U* orange.
B *S* red, *U* orange.
C *S* blue, *U* deep red-violet.
D *S* red, *U* deep red-violet.

8 A solution has a scale value of 8·0. Which one of the following indicators would be yellow after being added to this solution?

A indicator *R*
B indicator *T*
C indicator *V*
D indicator *X*

9 Two solutions are known to have scale values of 10·0 and 11·0 respectively. In order to distinguish between them by the use of indicators, one would need to use

A indicator *P*.
B indicator *W*.
C indicator *X*.
D indicator *Z*.

10 Each of the indicators *P* and *W* is found to be yellow when added to samples of a particular solution. Using fresh samples of this solution with each of the indicators *Q*, *X*, *U*, and *R*, which one of the following colours would **not** be observed?

A indicator *Q* pink
B indicator *X* green-violet
C indicator *U* orange
D indicator *R* yellow

Questions 11–13 refer to the following additional information:

Experiment II
Indicators were added to solutions 2, 3, 4, 5, 6, 7, 8, 9, using the procedure outlined in Experiment I. Three indicators were used for each solution and the following results were obtained.

Solution	*Indicator used and colour obtained*							
	P	*R*	*S*	*T*	*U*	*W*	*Y*	*Z*
2	red					red	colourless	
3	blue-violet					purple	colourless	
4	blue-violet						blue	red
5				yellow			colourless	yellow
6		blue-violet	red		orange			
7	yellow	blue-violet			deep red-violet			
8		yellow	blue		orange			
9	yellow			yellow	orange			

11 In one of the following pairs both solutions are basic. Which pair?

A solutions 3 and 4
B solutions 5 and 6
C solutions 3 and 9
D solutions 7 and 8

12 One of the solutions 6, 7, 8, 9 is neutral. Which one?

A solution 6
B solution 7
C solution 8
D solution 9

13 From the information obtained in Experiment II, it is possible to determine the actual scale value of only one solution. This is

A solution 2.
B solution 3.
C solution 6.
D solution 8.

GO ON TO THE NEXT PAGE

UNIT 3

The measurement of population size is an important aspect of modern biological research. It is easier to estimate the number of people living in Melbourne than the number of cod in the River Murray. Over the past 40 years, several methods, four of which are described below, have been developed for estimating non-human populations. To illustrate the first three methods, imagine a large sealed room containing hundreds of flies. You wish to estimate the fly population of the room.

Method 1: tracer technique
Obtain a known number of flies from the room, say 50, mark their backs with coloured paint, and release them again in the room. Then trap a sample on a piece of fly paper. If, for example, 100 are trapped on fly paper and 10 of these have been painted, the original fly population is estimated to be 500.

Method 2: ratio and proportion technique
Place an open cage of known volume (say 1 cubic foot) in the room. Measure the volume of the room (say 100 cubic feet). After some time some of the flies will be inside the cage. Count the number of flies (say 25). Assuming the flies are evenly distributed throughout the room the fly population is estimated to be 2,500.

Method 3: modified tracer technique
Determine the proportion of male to female flies (say 2 to 1) by taking samples with fly paper, then release a known number of flies of one sex into the room (say 100 females). Now trap a sample of the new population on fly paper and compare the new ratio of male to female flies (say 1 to 1). The change in this ratio must have been due to the extra flies (in this example female flies) which were introduced into the room. The original population is estimated to be 300.

The fourth method below was originally developed to measure the number of baby fish in a fish-breeding pond.

Method 4: fish-dipping technique
A small trap is lowered into the pond, and remains in place for a fixed time (say one hour). The trap allows fish to enter but not to leave. Suppose that 250 fish are trapped in this way. The trap is then removed, emptied into another pond, and then immersed in the original pond for a second one-hour sampling. Suppose that this time only 200 fish are trapped. Since the second sampling indicates a drop from the first sampling (here a 20 per cent drop), the population after the first sampling must have decreased in size. This decrease is due to the 250 fish removed by the first sampling. An estimate of the original population (1,250) can be made.

Two separate population size investigations will now be described.

Investigation Number 1
Salmon tend to swim together in large, well defined schools. In order to estimate the population of a migrating school of salmon, a number of fish were caught, marked by putting a small nick in their tail fins with a razor blade, and immediately returned to the population. When the fish arrived at their destination, a net was used to capture a random sample of them. The proportion of marked fish in the sample was then found, and used to estimate the population size.

Let N = the estimated number of fish in the migrating population at the beginning of the migration ;
M = the number of fish originally captured, marked, and returned to the population ;
R = the number of fish caught at random in the net at their destination ; and
S = the number of fish which were marked, released, and recaptured.

14 Which one of the following can be used to calculate N?

A $N = \frac{SM}{R}$

B $N = \frac{R}{SM}$

C $N = \frac{RM}{S}$

D $N = \frac{S}{RM}$

15 Which one of the statements below, if true, would make the reasoning used in Investigation 1 **incorrect**?

A Marking the tail fin of a salmon reduces its ability to swim to its destination.

B A weak, unhealthy fish is just as likely to be caught for marking as a strong, healthy fish.

C Marked salmon remain clearly distinguishable from unmarked salmon at the end of the process of migration.

D The probability of capturing a marked salmon depends on the proportion of marked salmon in the population.

16 Subsequent investigation shows that about 25 per cent of the salmon which begin the migration do not arrive at their destination.
Four students are discussing the effect this loss will have upon the estimate of *N*. Whose argument is the most sound in view of the information given?

A *Michele:* 'As 25 per cent of the population has been lost, the calculated value of *N* underestimates the actual size of the population beginning their migration.'

B *David:* 'The calculated value of *N* gives a good estimate of the size of the population arriving at the destination, but over-estimates by 25 per cent the number beginning their migration.'

C *Mario:* 'Population losses will affect both the marked and the unmarked fish in the same ratio ; the calculated value of *N* therefore gives a good estimate of the number of fish beginning their migration.'

D *Karl:* 'Since population losses only begin to occur after the marked fish have been returned to the population, the calculated value of *N* still gives a good estimate of the number of fish arriving at their destination.'

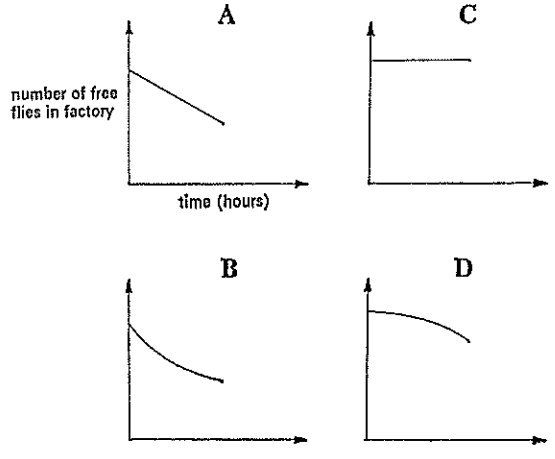
Investigation Number 2

In a food-canning factory it was decided to estimate the fly population in order to establish a baseline for control measures. Every two hours, a fresh fly paper was hung in the centre of the factory. The first fly paper trapped and killed 32 flies ; the second trapped and killed 24. During the investigation, all doors, windows, and other openings were kept tightly sealed.

17 This is an example of population estimation using the

A tracer technique.
B modified tracer technique.
C ratio and proportion technique.
D fish-dipping technique.

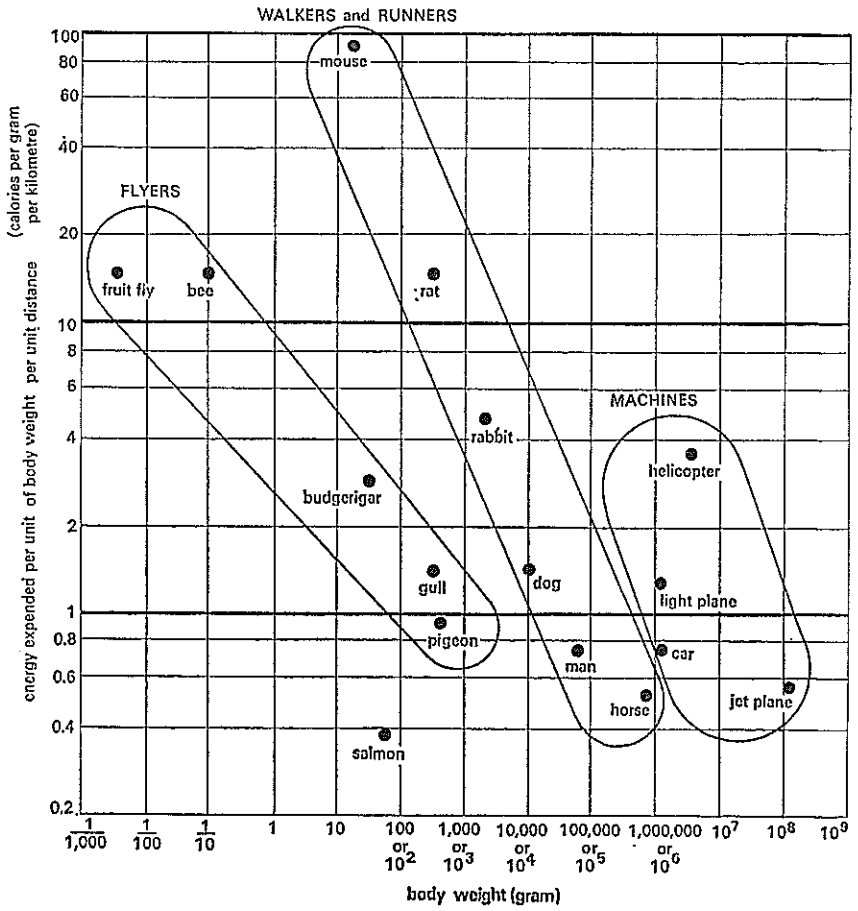
18 Which graph best shows the number of free flies in the factory over a period of several hours?



UNIT 4

For transportation (i.e., self-movement) of an organism or object, energy must be used. The graph below provides information on the energy expended for the transportation of a number of organisms and machines. The vertical axis shows the energy expended per unit of body weight per unit distance travelled. Energy is measured in calories, weight in gram, and distance in kilometres. The horizontal axis shows the weight of the organisms and machines and the weight is measured in gram. Note that on both the horizontal and vertical axes the divisions are not equal but are based on multiples of 10.

One animal is said to have a **more economical** means of transport compared to another if it has a **lower** expenditure of energy per gram of body weight for every kilometre travelled.



19 Which one of the following has the **least** economical means of transport?

A jet plane
B helicopter
C pigeon
D bee

20 Assume a rat and a gull both travel the same distance. The total energy expended by the rat is about

A the same as that for the gull.
B double that for the gull.
C ten times that for the gull.
D twenty times that for the gull.

21 A dog runs 2 kilometres. Which one of the following is the most accurate estimate of the total energy expended in calories?

A 3
B $1{\cdot}5 \times 10^2$
C $1{\cdot}5 \times 10^4$
D $3{\cdot}0 \times 10^4$

22 A jet plane and a car travel the same distance.
Given that

W_c = weight of car (gram)
E_c = energy expended by car per unit weight per unit distance (calories per gram per kilometre)
W_j = weight of jet plane (gram)
E_j = energy expended by jet per unit weight per unit distance (calories per gram per kilometre),

which one of the following gives the method of calculating the ratio

$$\frac{\text{total energy expended by car (calories)}}{\text{total energy expended by jet (calories)}}\ ?$$

A $\dfrac{W_c \times E_c}{W_j \times E_j}$

B $\dfrac{W_c \times E_j}{W_j \times E_c}$

C $\dfrac{W_j \times E_j}{W_c \times E_c}$

D $\dfrac{W_j \times E_c}{W_c \times E_j}$

23 A swarm of 10,000 bees, 1,000,000 fruit flies, and one rat all move the same distance. Which has the greatest total expenditure of energy (in calories)?

A the swarm of bees
B the fruit flies
C the rat
D It is not possible to decide from the information given.

24 One of the following generalizations is consistent with the information given. Which one is it?

A Lighter organisms and machines generally travel more economically than do heavier ones.
B For walkers and runners, as body weight increases, travel becomes more economical.
C A bird expends more energy to cover a given distance than does a walking or running animal of the same size.
D Machines travel more economically than do animals although animals are much lighter.

UNIT 5

A noted psychologist has written the following article:
The study of spontaneous social activity reveals that, in a group, people show noticeable changes in posture, points of view, voice, vocabulary, and other aspects of behaviour from time to time. These behavioural changes are often accompanied by shifts in feelings. Thus, for a given individual, a certain set of behaviours corresponds to one state of mind, while another set corresponds to a different state of mind inconsistent with the first. Each particular set of behaviours and its accompanying feelings is known as an ego-state. To the person in a particular ego-state, it is not a role he is playing but seems a reality. Each grown-up person seems to have three ego-states :

1 Child ego-state: (C)

Each person carries with him some impressions and attitudes from his childhood. It can be said that 'everyone carries himself as a child around inside'. Child ego-states are characterized by submissive, dependent behaviours or by defiant, defensive behaviours.

2 Adult ego-state: (A)

Each person is capable of looking at problems, personal or other, objectively and reasonably. It can be said that 'everyone has an adult inside him'. Adult ego-states are characterized by a problem-solving approach or by a sense of reasonableness.

3 Parent ego-state: (P)

Each person carries with him an ego-state similar to the ego-states of his parents, as he saw them. It can be said that 'everyone carries his parents around inside himself'. Parent ego-states are characterized by authoritarian, dominating, judging, or critical behaviour.

25 The psychologist suggests that, in general, when a person changes from one ego-state to another,
- **A** he pretends to be a parent or a child although he is in fact an adult.
- **B** he pretends to be an adult or a parent although he is in fact a child.
- **C** he is deliberately changing his attitude according to a pre-arranged plan.
- **D** he changes in response to a stimulus outside himself.

26 When the psychologist writes that a person 'carries his parents around inside himself', he means that
- **A** at times everyone reacts to other people the way he once reacted to his parents.
- **B** people sometimes, unconsciously, behave the way their parents behaved in similar situations.
- **C** parents have deliberately trained their children to become parents themselves.
- **D** children inherit the behaviours of their parents.

27 In the passage as a whole, the psychologist is primarily concerned with
- **A** presenting a theory.
- **B** describing his observations.
- **C** stating objective information.
- **D** explaining his function as a psychologist.

Questions 28–35 refer to the following additional information:

When two or more people encounter one another in a group, eventually one person will speak and this may result in another replying. This encounter between the two people is called a **transaction.** From the statements made by the two people during a transaction, it is possible to identify:

- the ego-state of the speaker, and the ego-state the speaker expects of the other person in response to his statement;
- the ego-state of the person replying, and the ego-state he interpreted the first speaker as having.

In this unit the statement of the first speaker is called a **stimulus** (*S*) and the reply by the second person a **response** (*R*).

Examples of how transactions could proceed are given below.

S says: (ADULT-ADULT)	'I think we should meet to discuss arrangements for next week.'
R replies: (ADULT-ADULT)	'I'll look up my diary to find times that suit us both.'

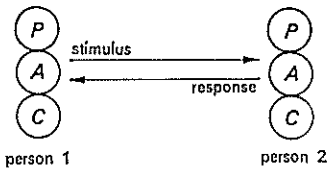


figure 1

S says: (CHILD-PARENT)	'Will you please help me with this task?'
R replies: (PARENT-CHILD)	'Yes, I'll show you how to do it.'

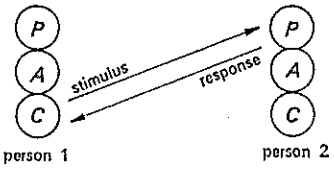


figure 2

The transactions shown in figures 1 and 2 are **complementary**, that is, the response is appropriate and expected, and communication can proceed smoothly. However, when the response does not correspond to the one expected by the person who provided the stimulus, communication is broken and this is called a **crossed transaction.** An example is given below.

S says: (ADULT-ADULT)	'Perhaps we should find out why you're having trouble with maths.'
R replies: (CHILD-PARENT)	'You're always picking on me!'
or:	'I can't help it if I can't do it!'

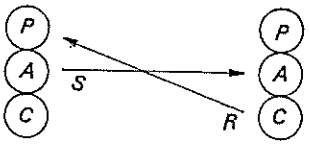


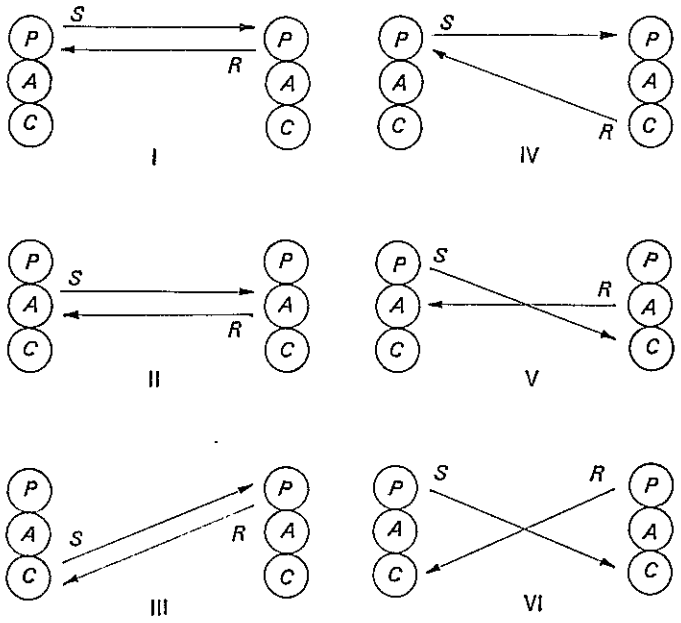
figure 3

For questions 28–35 assume that all transactions are between grown-up persons.

28 Someone says : 'Why didn't you water the garden when I told you to do so?'
Which one of the following is the complementary response to this stimulus?

A 'Perhaps we should share this job.'
B 'Does the garden need watering at this time of year?'
C 'I forgot, I'll do it now.'
D 'Why can't you look after the garden—you never do a thing!'

Questions 29–34 refer to the following diagrams:



29 Where is broken communication shown?

A V only
B VI only
C V and VI only
D IV, V, and VI

For questions 30–34 choose, from the alternatives given, the diagram which best fits the conversation. Assume that in each question the conversation is between grown-up people.

30 *S:* 'Do you know where the newspaper is?'
R: 'Yes, I saw it in the kitchen.'

A I
B II
C III
D IV

31 *S:* 'Just look how badly you've typed these letters!'
R: 'I'll be interested in your detailed comments.'

A II
B IV
C V
D VI

32 *S:* 'Mary certainly looks haggard lately!'
R: 'Yes, her husband expects her to wait on him hand and foot.'

A I
B II
C IV
D VI

33 *S:* 'Will you please fix my tie?'
R: 'Yes, I'll help you.'

A I
B II
C III
D V

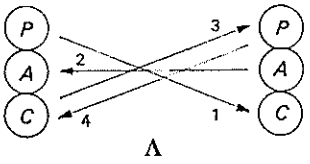
34 *S:* ' I think we should find out why these typed letters have not turned out as well as expected.'
R: ' One reason could be that I have difficulty spelling words correctly.'

A I
B II
C IV
D V

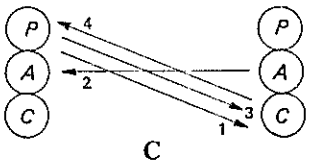
Question 35 refers to the following conversation between two people:

1 ' Make sure you come home straight after work! '
2 ' If I can get away on time, I'll make sure we're not late for dinner.'
3 ' So you say, but you're always letting me down and making things hard for me.'
4 ' Well, make sure you're ready when I get home! '

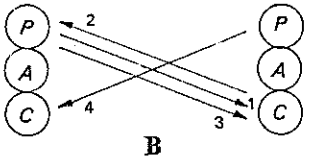
35 From the diagrams below, choose which one best fits the conversation.



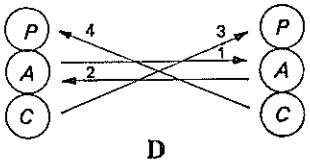
A



C



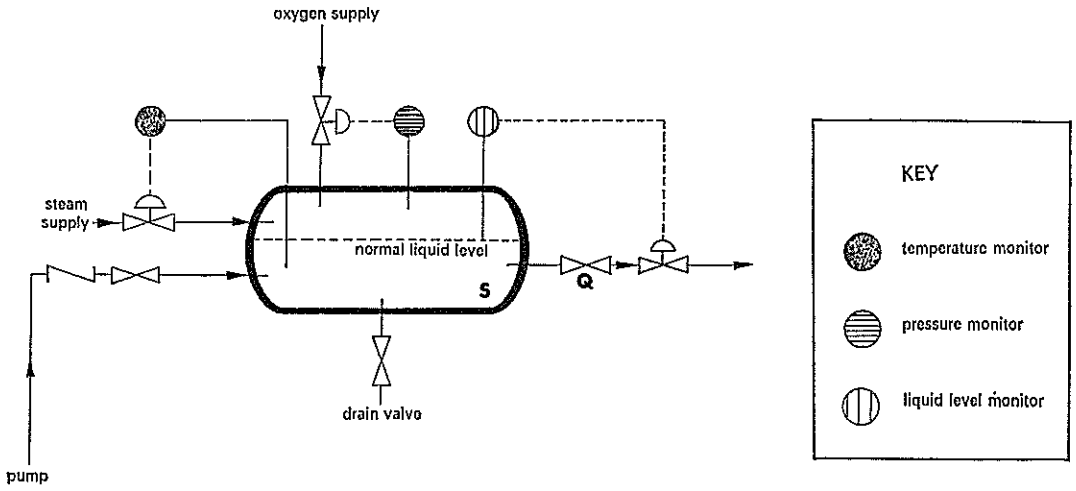
B



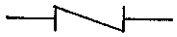
D

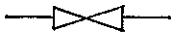
UNIT 6

The diagram below shows a vessel, S, in which a chemical reaction is carried out at high temperature and high pressure.



The three types of valves in the diagram are:


a non-return valve which allows flow in one direction only;


an isolating valve which allows flow in either direction and is normally either fully open or fully closed;


a control valve which is opened and closed automatically by means of signals from a measuring device in the system. The function of a control valve is to control a condition such as temperature or pressure. Alarm systems, with high or low level warning devices, are used to warn personnel when a control valve fails.

Cold liquid containing the reacting substances is pumped into the vessel S through a line which has a non-return valve and an isolating valve which is normally open. The vessel takes half an hour to fill to the level shown.

Steam is injected into the vessel to heat the liquid. A signal from the temperature monitor operates a control valve on the steam line so that, when the required temperature in the vessel is reached, the temperature remains constant.

Oxygen also required in the reaction is pumped into the space above the liquid. The total pressure is the sum of the steam pressure and the oxygen pressure. The oxygen supply is controlled by a pressure monitor so that the total pressure remains constant.

The product of the reaction is extracted through a discharge line containing an isolating valve **Q**, normally open, and a control valve operated by a liquid level monitor.

The drain valve allows the whole vessel to be emptied if necessary.

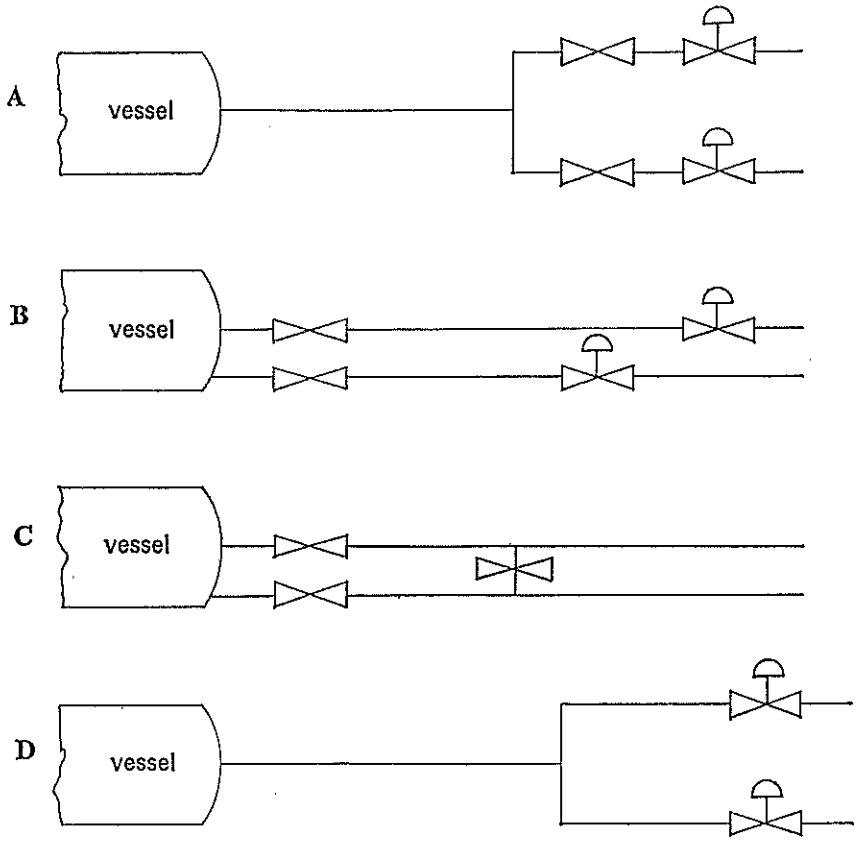
36 If the low temperature and low pressure alarms both ring, which one of the following could account for this?

A The steam supply has suddenly increased.
B The pump has stopped.
C The control valve on the discharge line has become stuck in the open position.
D The steam and oxygen supplies have both been shut off.

37 Assume the control valve on the discharge line has become stuck in the open position, allowing too much liquid to discharge and, as a result, the liquid level monitor alarm has rung. Which one of the following steps should be taken to provide half an hour to repair the control valve ?

A Close valve **Q** only.
B Close valve **Q** and shut off the steam supply.
C Close valve **Q**, stop the pump.
D Lower the pressure and drain the vessel.

38 In order to eliminate delays due to control valve failure, it has been decided to install an additional control valve on a spare line so that one control valve can be repaired while the other is in use. Which one of the following arrangements would provide the cheapest workable system if an isolating valve costs less than another direct outlet from the pressure vessel?



39 If the oxygen supply to the vessel were shut off, which one of the following would happen?

A Steam pressure would increase to keep the pressure constant.
B There would be a gradual fall in pressure, and later the low pressure alarm would ring.
C The liquid level alarm would ring immediately.
D The high temperature alarm would ring immediately.

40 Assume the system is operating properly and the vessel becomes full to the normal liquid level. Suddenly the pump stops, due to a defective bearing. Which one of the following most accurately describes what would happen?

A The temperature monitor would operate to prevent the temperature rising.
B The temperature and pressure monitors would act to shut off steam and oxygen.
C The liquid level monitor would close its control valve.
D All three monitors would operate to shut off steam, oxygen, and the discharge.

UNIT 7

Man may exhibit three emotional responses to a threatening situation: anger, depression, or anxiety (fear). A complex set of reactions prepares the body to meet the threat with 'fight' or 'flight'. These bodily reactions include deeper respiration, increased rate of heart-beat, increased blood pressure, and the release of sugar from the liver. These reactions result from the release into the blood stream of **adrenalin** and **nor-adrenalin.**

Experiments 1 and 2 described in this unit studied the relation between the substances adrenalin and nor-adrenalin and the three emotional responses. The subjects of the experiments were healthy university students.

Experiment 1

Ten students were given a slow, continuous injection of nor-adrenalin over a period of 60 minutes, at a rate known to increase the blood pressure by about 30 per cent. Ten minutes after the start of the injection, each student was injected with a standard dose of the drug **mecholyl** which is known to lower the blood pressure. The effects of mecholyl on the blood pressure were noted

The next day each student was put through the same procedure except that adrenalin (instead of nor-adrenalin) was given to raise the blood pressure. Again the effects of mecholyl on the blood pressure were noted.

The blood pressure change for one student is shown in figures 1 and 2. Other students showed almost identical blood pressure variations. The pattern of blood pressure variation in figure 1 is known as a **Type N** reaction to mecholyl, and that in figure 2 is known as a **Type E** reaction to mecholyl.

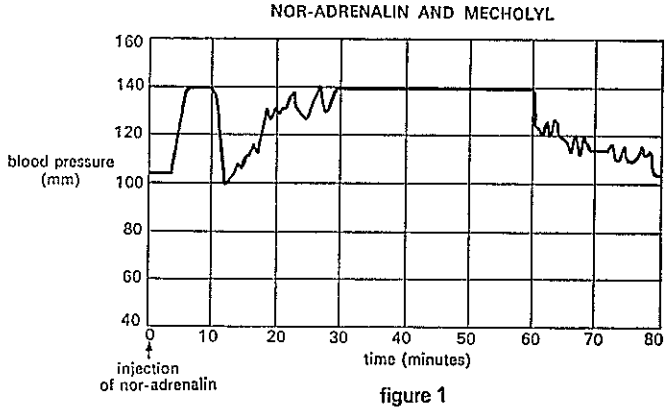


figure 1

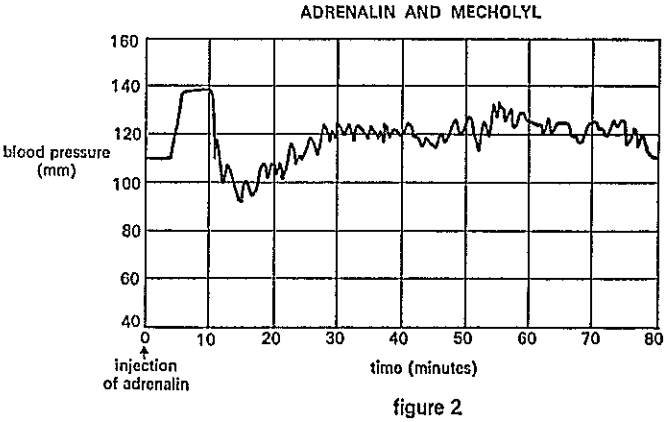


figure 2

41 In figure 1 the decrease in the blood pressure noted after the 60th minute is most probably due to

A an injection of mecholyl.
B an increase in the amount of adrenalin present.
C the effects of mecholyl wearing off.
D the decrease in the amount of nor-adrenalin present.

42 When mecholyl is injected into a person who is receiving a continuous injection of nor-adrenalin, the person's blood pressure

A increases suddenly then decreases suddenly, and then increases to its level just before the injection of mecholyl.
B decreases suddenly, then increases to its level before the injection of mecholyl.
C decreases suddenly, then rises to its level before the injection of nor-adrenalin and stays constant until the nor-adrenalin injection is discontinued.
D decreases suddenly, then increases slowly but never reaches its level just before the injection of mecholyl.

43 Which one of the following is most characteristic of a Type N reaction to mecholyl?

A a sharp 5-minute increase followed by a sharp decrease in blood pressure
B a steady increase in blood pressure until a maximum value of 140 mm is reached
C a temporary decrease in blood pressure, lasting no longer than 20 minutes
D a fluctuating blood pressure increasing to a peak about every 2 minutes

Questions 44-47 refer to the following additional information:

Experiment 2

Blood pressure measurements were made on a class of university students at a time when they were under stress, awaiting the results of an important competitive examination. Some of the students responded to this situation with elevated blood pressure and these students were given the standard dose of mecholyl. Two types of reactions to the mecholyl were noted—the students who were angry at others for the situation in which they found themselves had a Type N reaction; those who felt depressed or anxious had a Type E reaction.

After the results of the examination were announced, and the students' blood pressure had returned to pre-stress levels, the students were again injected with the standard dose of mecholyl. All the students reacted in the same way to this injection.

44 A man becomes angry with the people with whom he works. In his blood you would expect to find an unusually large amount of

A adrenalin.
B nor-adrenalin.
C mecholyl.
D a Type E substance.

45 In Experiment 1 the students were first given adrenalin or nor-adrenalin (both of which raised the blood pressure) and then injected with mecholyl (which lowers the blood pressure). Of the following reasons for adopting this experimental procedure, which one is the most acceptable?

A An increase in blood pressure occurs with certain emotional responses; the scientist wanted to compare the effects of those responses with the effects produced by adrenalin and nor-adrenalin.
B If a standard dose of mecholyl were to be given to a person with normal blood pressure, the blood pressure would drop by 30 per cent to a critical level.
C Adrenalin and nor-adrenalin are normally present in the body; the doses of these substances were to make the experimental situation as natural as possible.
D The scientist found that mecholyl was necessary to bring blood pressure back to normal after he had increased it with adrenalin or nor-adrenalin.

46 In Experiment 2 the experimenter injected the students with mecholyl again **after** the results of the examination were announced. Which one of the following is the most likely reason for doing this?

A He wanted to see what the students' reaction to mecholyl was when their blood pressure was normal.

B He wanted to see if all the students had reacted to the stressful situation with increased blood pressure.

C He wanted to see if the earlier, different reactions to mecholyl were due to the temporary emotional states.

D He wanted to see if the reaction to mecholyl was the same under all conditions whether stressful or not.

47 Which one of the following suggestions needs the results from **both** Experiments 1 and 2 to support it?

A Certain emotional states raise the blood pressure by measurable amounts.

B Nor-adrenalin and adrenalin raise the blood pressure for a certain period of time.

C Mecholyl affects the blood pressure for a certain period of time.

D Blood pressure reactions to adrenalin and nor-adrenalin are related to those produced by certain emotional states.

UNIT 8

A student was shown a red light flash (a **stimulus**) and, shortly afterwards, a blue light flash. The student took 390 milliseconds (msec) to react to the first stimulus, the red flash, but 400 msec to react to the second stimulus, the blue flash. When the student was shown the blue flash by itself, he took only 320 msec to react to it.

This delaying of a response to a second stimulus is called the **psychological refractory period effect**, or PRP effect.

The following symbols will be used in reference to the PRP effect:

First stimulus:	S_1	Second stimulus:	S_2
First response:	R_1	Second response:	R_2
Time taken to respond to S_1:	T_1	Time taken to respond to S_2:	T_2

The time interval between the beginnings of the two stimuli is called the interstimulus interval, ISI. Above a certain value of the ISI, called the critical ISI, the PRP effect does not occur.

One hundred students took part in an experiment designed to investigate the PRP effect. The students were each given a visual stimulus, S_1, followed by an auditory stimulus, S_2. S_1 was a light flash and S_2 a click. The students pressed a small lever in response to each stimulus. The experimenter varied the ISI from 50 to 500 msec.

Figure 1 shows a graph in which the times, T_2, that students took to respond to S_2 are plotted against the different values of the interstimulus intervals.

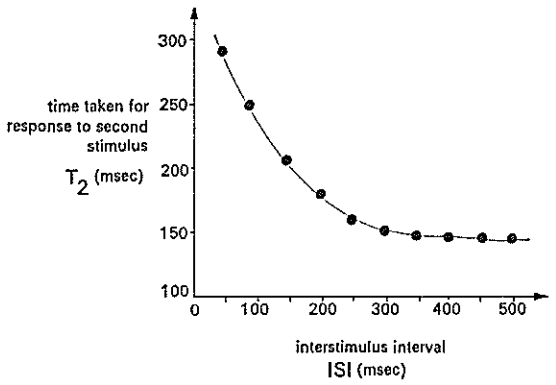


figure 1

48 Which one of the following happens if the PRP effect is observed?
When a person is given two stimuli, S_1 and S_2, in rapid succession

A T_1 is longer than it is when S_1 is given alone.
B T_2 is longer than it is when S_2 is given alone.
C T_2 is shorter than it is when S_2 is given alone.
D T_1 is shorter than it is when S_1 is given alone.

49 From the graph it appears that, of the following, the best estimate of the critical ISI is

A less than 50 msec.
B 150 msec.
C 250 msec.
D 350 msec.

50 Which one of the following is consistent with the results of the experiment?
At interstimulus intervals

A shorter than the critical ISI, T_2 tends to decrease as the ISI increases.
B shorter than the critical ISI, T_2 tends to increase as the ISI increases.
C longer than the critical ISI, T_2 tends to be shorter than T_1.
D longer than the critical ISI, T_2 tends to be longer than T_1.

51 Of the 100 students who were given the two stimuli, a randomly-selected 50 used their left hands for R_1 and their right hands for R_2. The remaining 50 used their right hands for R_1 and their left hands for R_2. Which one of the following gives the most probable reason for dividing the group in this way?

A It is expected that right-handed students will predominate and will respond more quickly with their right hands. If all the students used their right hands for R_1 and their left for R_2, T_1 would be less than predicted and T_2 greater.
B It is expected that, in a randomly-selected group of 50, 25 will be left-handed and 25 right-handed. Thus no advantage will be given for left- or right-handedness.
C It is expected that right-handed students will predominate and will respond more quickly with their right hands. One group of 50 will have a faster response to S_1 than the other group, which will have the faster response to S_2. These 'faster' times give the best estimates of T_1 and T_2.
D Scientific experiments on humans should always divide the group into two on any relevant characteristic. In this case the group was divided into left- and right-handed students.

Questions 52–55 refer to the following additional information:
One proposed explanation of the PRP effect is that when the brain analyses the messages from the stimuli, a so-called 'single channel' occurs and the messages are analysed one at a time. Thus when two messages arrive at the brain almost simultaneously, both are received but the analysis of the second message is delayed until the first has been analysed by the 'single channel'.

Figure 2 below shows a diagram of events when S_1 and S_2 are given at an interstimulus interval shorter than the critical ISI for these stimuli.

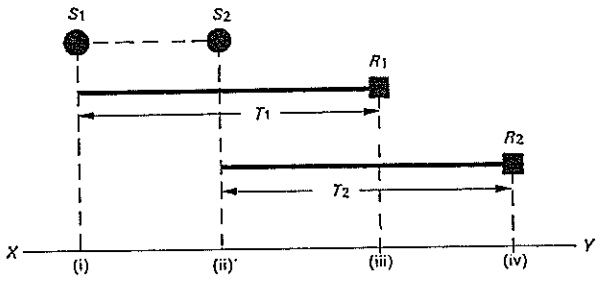


figure 2

52 In figure 2, which point on the line XY most nearly represents the instant at which the 'single channel' begins to analyse the message from S_2?

A (i)
B (ii)
C (iii)
D (iv)

53 If the proposed 'single channel' explanation of the PRP effect is correct, a delay in R_2 is expected to occur only when

A T_2 is longer than T_1.
B T_2 is shorter than T_1.
C T_1 is shorter than the ISI.
D T_1 is longer than the ISI.

54 On the basis of the information given, the 'single channel' idea is best described as

A an observation.
B a hypothesis.
C a conclusion verified by experiment.
D an accurate description of the way in which the brain operates

55 The following comment was made by a person who was criticizing the 'single channel' idea: ' Most people appear to be able to do more than one thing at a time. For example, we are able to read a book, follow a television programme, and know what is happening in the room, seemingly all at the same time.' Which one of the following comments is most likely to be made in a reply which defends the 'single channel' idea?

A ' It is common knowledge that people can do more than one thing at a time.'
B ' A person can concentrate on several things at the same time. In your example one channel will analyse the reading messages, another one the messages from the television, and another one the messages from activity in the room.'
C ' At any one moment the person is engaged in only one activity—watching television or reading or attending to the activity in the room. He quickly alternates the focus of his attention, shifting it from one event to another.'
D ' Evidence for the "single channel" idea has been obtained from experiments investigating simple behaviour patterns. Your example is concerned with the simultaneous execution of a number of complicated behaviour patterns, so it cannot be used as an argument against the "single channel" idea.'

GO ON TO THE NEXT PAGE

UNIT 9

A computer known as the Film Input Digital Automatic Computer, or FIDAC, can be used to rapidly detect and examine the parts of the living cell which control heredity. The information gained is valuable as a number of diseases in humans are known to be linked to chromosome abnormalities.

The diagrams of stages E, F, G, and H show some of the procedures in the FIDAC system. It should be noted that stages E, F, G, and H are not necessarily independent. Stage H occurs within stage G, and both stages G and H may occur within stage F.

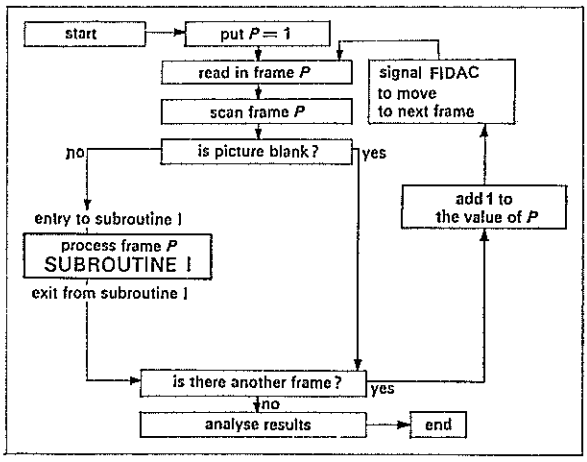
Study the four stages, noting the purpose of each stage.

Measurements are made on chromosomes located by FIDAC, and from this analysis any abnormalities in their shape and size are detected.

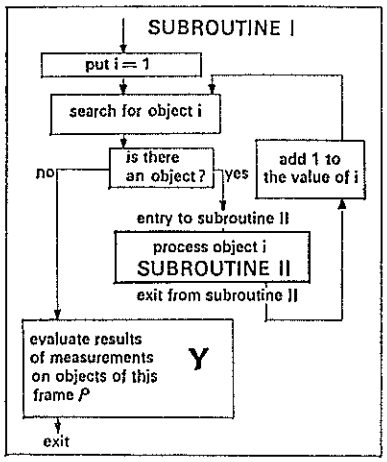
In the following diagrams *P*, i, and *K* represent members of a series of whole numbers:

P identifies individual frames,
i identifies objects, and
K identifies the segments of particular objects.

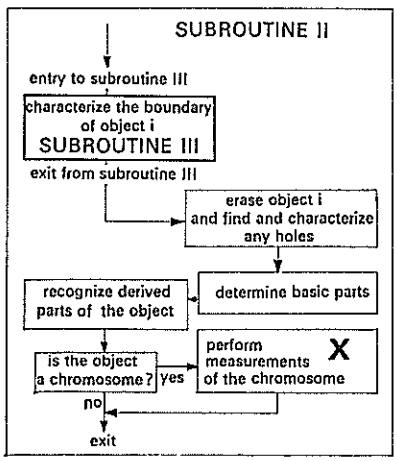
STAGE E



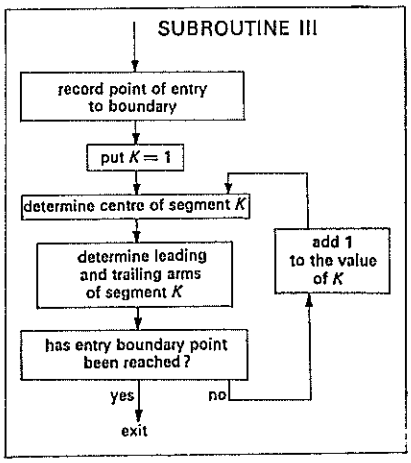
STAGE F



STAGE G



STAGE H



56 In stage **E** the word 'frame' refers to

A one picture.
B part of the computer itself.
C a roll of film.
D a picture of one chromosome.

57 Stage **H** may best be characterized as one which

A notes if there is an object present in the frame.
B distinguishes the details of both the boundary of an object and the segments which comprise it.
C determines whether or not the object is a chromosome.
D searches out and counts all the objects appearing in a frame.

58 If, in stage **F** subroutine I, the answer to the question is 'yes', the computer would always include, in the stages to be followed,

A subroutine II which includes subroutine III.
B subroutine II but not necessarily subroutine III.
C subroutine III but not necessarily subroutine II.
D subroutine III which includes subroutine II.

59 Immediately after the step marked **X** (perform measurements of the chromosome), the computer would go to the step labelled

A 'signal FIDAC to move to next frame'.
B 'analyse results'.
C 'record point of entry to boundary'.
D 'add 1 to the value of i'.

60 Immediately after the step marked **Y**, the computer would go to the step labelled

A 'is there another frame?'.
B 'search for next object i'.
C 'signal FIDAC to move to next frame'.
D 'end'.

61 If the answer to the question in stage **H** were 'yes', we can correctly infer that

A the object was a chromosome.
B the object was not a chromosome.
C the boundary of the object had been characterized.
D there are no more objects in the frame.

GO ON TO THE NEXT PAGE FOR UNIT 10

UNIT 10

The sun is a star—a gaseous energy-producing body. For thousands of millions of years, the sun has been emitting thousands of millions of units of energy each second, some of it in the form of light radiation. The energy is produced mainly in the interior of the sun where the temperature reaches about 9,000,000°C. This energy is derived from the change of one form of matter into another—the element hydrogen into the element helium.

A mass of one gram of hydrogen, when changed completely into helium, produces roughly 200,000 units of energy.

When hydrogen is changed into helium, energy is liberated from the interior of the sun in the form of high-speed particles called positrons and a form of radiation called g-radiation. The change may take place in several ways. One such process is summarized below.

In the following steps, H stands for a hydrogen atom and He for a helium atom. Hydrogen and helium each exist as atoms of different masses, and the numbers 1, 2, 3, 4 show the relative masses of the atoms of hydrogen and helium.

Step I $H^1 + H^1 \longrightarrow H^2 +$ 1 positron + 1 unit g-radiation

Step II $H^2 + H^1 \longrightarrow He^3 +$ 1 unit g-radiation

Step III $He^3 + He^3 \longrightarrow He^4 + H^2$

62 The sun's energy is best described as being produced in the form of

A light radiation emitted from the sun's surface.
B positrons and g-radiation liberated from the interior.
C heat due to the sun's internal temperature of 9,000,000°C.
D the reaction of two He^3 atoms.

63 About $\frac{1}{40{,}000}$ of the energy emitted from the surface of the sun reaches the earth's surface. If the earth receives 200,000 units of energy, the amount of hydrogen in the sun which must be transformed is

A 1 gram.
B 5 gram.
C 40,000 gram.
D 200,000 gram.

64 In the process of changing hydrogen to helium, how many hydrogen atoms (H^1) are involved in the production of one helium atom (He^4)?

A 2
B 3
C 4
D 6

65 One gram of hydrogen atoms H^1 is completely used up to form helium (He^3). Disregarding the relatively insignificant mass of positrons and g-radiation, the mass of helium produced is

A $\frac{1}{3}$ gram.
B $\frac{1}{2}$ gram.
C $\frac{2}{3}$ gram.
D 1 gram.

66 Four people were discussing the likely future of the sun. Only one of their statements below is consistent with the information given. Which one is it?

A *Alan:* 'The sun has been emitting thousands of millions of units of energy per second for thousands of millions of years, so the sun must have lost most of its energy and will cool down soon.'
B *Bob:* 'The energy-liberating reactions in the sun lead to vast amounts of energy being emitted from the sun; therefore the sun will become hotter and brighter indefinitely.'
C *Clive:* 'Eventually, as all the hydrogen is changed to helium, the temperature of the sun will drop, and there will be a reduction in the energy emitted.'
D *Dick:* 'When hydrogen is changed into helium, you start with two hydrogen atoms, and since two hydrogen atoms are left at the end to start the process again, the sun will go on producing energy forever.'

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C. H. Rixon, Government Printer, Melbourne