GAMSAT

Graduate Australian Medical School Admissions Test

Practice Test

Contents

1 Introduction

The *GAMSAT Practice Test* contains materials and questions equivalent to the full annual Graduate Medical School Admissions Test, and will take approximately five and a half hours to complete if worked under test conditions.

Questions contained in the Practice Test are grouped, as in the live test, into three Sections:

Section I	Reasoning in Humanities and Social Sciences
Section II	Written Communication
Section III	Reasoning in Biological and Physical Sciences

As in the live test, the timing of each section is as follows:

Section I	75 questions	100 minutes
Section II	2 questions	60 minutes
Section III	110 questions	170 minutes

You are encouraged, if possible, to devote an entire day to the completion of the *Practice Test*, taking a one hour break before commencing Section III. You are strongly advised not to check your answers against the keys provided for Sections I and III until you have completed all three Sections of the test. In fact, it would probably be beneficial to leave the scoring of your work and analysis of any errors until the following day.

By working through the *Practice Test* you will become familiar with the level of difficulty and the kind of materials found in the live test. You will also accustom yourself to the number of questions it is necessary to complete in the given timeframe. These questions should enable you to gain useful experience in the techniques of answering multiple choice questions.

The writing prompts provided for Section II give you an opportunity to practise writing two finished essays in a limited time. Obviously, no solutions can be given, but notes on the assessment of GAMSAT Written Communication are provided on page 83.

More general advice on how you can prepare for GAMSAT is contained in the *GAMSAT Information Booklet*, available on the website below:

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2 Reasoning in Humanities and Social Scie

Unit 1

Questions 1 – 10

In February 1994 the ***Brisbane Courier Mail*** *reported that Premier Wayne Goss had ordered a draft for a Year 5 social studies book to be rewritten. Mr Goss deemed unacceptable the book's recommendation that teachers refer to the European arrival in Australia as 'invasion' rather than 'settlement'. According to the report, the book had also suggested that teachers not use the words 'explorer', 'pioneer' or 'discoverer' to describe Europeans in Australia.*

The material in this unit has been adapted from comments which appeared in the ***Brisbane Courier Mail*** *in response to the report outlined above.*

COMMENT I

Once upon a time it was perfectly polite to say that Captain Cook 'discovered' Australia. And, of course, if there was no one here, it was all right to use words like 'settlement' to describe the arrival of the British. By any standards, this has to be a one-sided version of events. Criticisms have been made of the curriculum in the past few years not just because it gives a false picture of the way things were, but also because such a biased account can actually be harmful to a significant segment of students. It's pretty tough if you are an Aboriginal or Torres Strait Islander person to have to sit through lessons and learn that your people weren't here and that they don't count.

1 According to Comment I, using the term 'settlement' to describe the arrival of the British is

A an attempt to provoke social disharmony.
B preferable to using the word 'discovered'.
C unacceptable to the vast majority of Australians.
D offensive to Aborigines and Torres Strait Islanders.

COMMENT II

The problem with the so-called 'preferred terminology' is that it distorts the past. When the First Fleet departed Portsmouth in 1787, Governor Phillip and those who sailed with him did not see themselves as taking part in an 'invasion' which would lead to 'occupation' by force. Such terminology accurately describes Hitler's occupation of Poland and the acquisition by Josef Stalin and his communist henchmen of the Baltic States. In the late 1930s and early 1940s Nazi Germany and the Soviet Union were into 'invasion' and 'occupation'. To suggest that the same terminology should be used to describe the European settlement of Australia in 1788 distorts both language and history.

2 Comment II suggests that the decisive factor when considering whether to use the words 'invasion' or 'settlement' is

A the perspective of the historian.
B the reconciliation between truth and tact.
C what those who arrive see themselves as doing.
D how those who are already there view the new arrivals.

3 The particular examples of 'invasion' and 'occupation' used for comparison in Comme[illegible]n to

A draw a distinction between the motives behind invasions perpetrated by left-wing [illegible] authoritarian regimes.

B remind readers that conquests of the twentieth century had their inspiration in a long Europe[illegible] of imperialism.

C associate the words with regimes of modern history from which most Australians would want[illegible] dissociate themselves.

D open up the discussion to include other contexts where a debate is still going on about the interpretation of historical events.

COMMENT III

Australia was invaded; the invasion was resisted and that resistance was crushed. But the British were settlers as well. They came to stay and establish themselves on the land. One fact does not cancel out the other. The record shows that these issues were openly discussed in the nineteenth century both by those who approved of the process and those who didn't. Why is it so difficult for many of us today to accept things which were commonplace 150 years ago? It is due in part to the way history is taught and written. We now know much more about the past and have uncovered things which previous generations tried to forget in an effort to provide a history 'worthy' of the new nation. There will inevitably be concern that what children are being taught now is different from what they were taught a generation ago. But history must be allowed to move on free from interference from our anxious politicians.

4 How does Comment III view the words 'invasion' and 'settlement' in the context of the British arrival in Australia?

A The words are equally inappropriate.

B The two words can be used interchangeably.

C Each of the words legitimately describes an aspect of the events.

D The earliest British arrivals must be regarded as invaders, but later arrivals were settlers.

COMMENT IV

All historical accounts are also political accounts, telling a story about the past which makes sense and appeals to particular groups of people while repelling others. One preference is for a story about Australia's past which I would argue uses the history of pioneering and exploration as a crutch to lean on in the absence of some more compelling form of historical identity, such as a struggle for liberty. Good history teaching is about showing the limits and the context of any particular view of the past.

5 Comment IV argues that any view of historical events

A needs constant revision in the light of political changes.

B can only become consensual when all the facts are available.

C should be determined by the needs and purposes of the present.

D will always be conditioned by the values and perspective of the viewer.

6 What are the connotations of the word 'political', as it is used in the first line of Comm

A useful and pragmatic
B artificial and self-serving
C to do with power and ideology
D to do with institutions of government

7 Comment IV suggests that the interpretation of Australia's past as a history of exploration and pioneering arises from

A a blatant rejection of historical fact.
B the need to find a palatable national self-image.
C a partial sense of the truth which is as valid as any other.
D the fullest consideration of material available to the modern historian.

For questions 8–10 refer to Comments I–IV.

8 Which one of the comments seems most sympathetic to the interpretation of history originally recommended in the draft of the Year 5 social studies book?

A I
B II
C III
D IV

9 Which of the comments suggest that not only historical facts but also the views and values of the present are crucial in forming an interpretation of the past?

A Comment I only
B Comment II only
C Comments I and IV
D Comments II and III

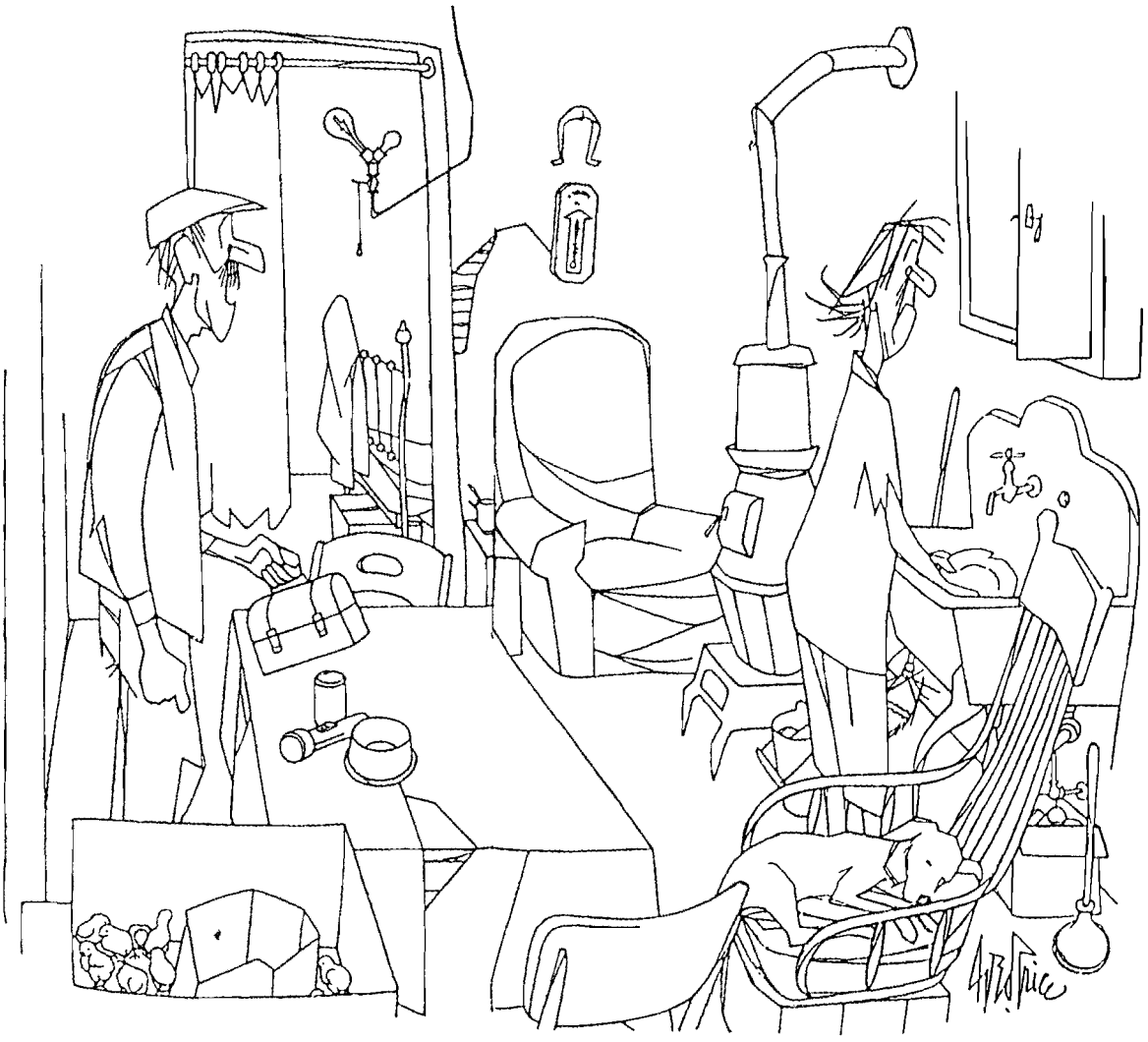
10 Which of the comments imply or state disapproval of Mr Goss's action in ordering the Year 5 social studies book to be rewritten?

A Comment II only
B Comment III only
C Comments I and III
D Comments II and III

Questions 11 and 12

To answer questions 11 and 12 you need to read the following quotation and study the cartoon.

> I expect to pass through this world but once; any good thing therefore that I can do, or any kindness that I can show to any fellow-creature, let me do it now; let me not defer or neglect it, for I shall not pass this way again.
>
> Stephen Grellet



'I heard a bit of good news today. We shall pass this way but once.'

11 The statement of Stephen Grellet is

- **A** a spur to action.
- **B** a spur to escape.
- **C** an expression of discontent.
- **D** an expression of contentment.

12 The statement of the speaker in the cartoon expresses

- **A** a positive view of the future.
- **B** a negative view of the future.
- **C** satisfaction with the present.
- **D** dissatisfaction with the present.

Questions 13– 17

What is the difference between requiring love of the neighbour and finding lovableness in the neighbour?

Suppose there were two artists, and the one said, 'I have travelled much and seen much in the world, but I have sought in vain to find a man worth painting. I have found no face with such perfection of beauty that I could make up my mind to paint it. In every face I have seen one or another little fault. Therefore I seek in vain.' Would this indicate that this artist was a great artist? On the other hand, the second one said, 'Well, I do not pretend to be a real artist; neither have I travelled to foreign lands. But remaining in the little circle of men who are closest to me, I have not found a face so insignificant or so full of faults that I still could not discern in it a more beautiful side and discover something glorious. Therefore I am happy in the art I practise. It satisfies me without my making any claim to being an artist.' Would not this indicate that precisely this one was the artist, one who by bringing a certain something with him found then and there what the much-travelled artist did not find anywhere in the world, perhaps because he did not bring a certain something with him! Consequently the second of the two was the artist. Would it not be sad, too, if what is intended to beautify life could only be a curse upon it, so that *art*, instead of making life beautiful for us, only fastidiously discovers that not one of us is beautiful. Would it not be sadder still, and still more confusing, if love also should be only a curse because its demand could only make it evident that none of us is worth loving, instead of love's being recognised precisely by its loving enough to be able to find some lovableness in all of us, consequently loving enough to be able to love all of us.

Kierkegaard, *Works of Love*

13 Which of the following most accurately describes the method by which Kierkegaard introduces his insight?

A logical abstraction
B personal reflection
C symbolic narrative
D philosophical argument

14 Kierkegaard's view of art is that it should

A reflect the reality of life.
B celebrate rather than criticise.
C mask the unpleasant aspects of existence.
D express individual not conventional insights.

15 Kierkegaard suggests that it would be 'confusing' (line 15) if love

A by its demands could lead to non-love.
B could actually give more than it demands.
C integrated the object and subject of desires.
D were ultimately recognisable only through unlovableness.

16 According to Kierkegaard the difference between requiring love of the neighbour and finding lovableness in the neighbour is

A one of degree not kind.
B a difference of attitude.
C a reflection of the limitations of imagination.
D the difference between perfection and reality.

17 The point of the parable is to suggest that

A the experience of love mirrors artistic achievement in that both require committed individual reflection.
B love, like art, finds its highest expression when the subject of attention is approached with generosity.
C the insights we gain from reflection on the nature of love help us to understand the complexities of artistic endeavour.
D human endeavour reaches its most noble height when critical and emotional sensibilities function in unity and not in conflict.

Questions 18–22

The passage below is from a letter to the editor of a scientific journal.

An organised movement against the use of non-human animals in scientific research has grown to maturity in the last few years. Most researchers have responded to the antivivisection movement merely by refuting allegations of mistreatment and by improving the care for their research animals. This cannot satisfy the antivivisectionists, who believe that antivivisection is only a small part of a much larger matter, namely, that of animal rights.

Whether we like it or not, the legitimacy of animal rights is very similar to that of human rights. Why do people have equal rights? There is no unequivocal answer to this question. Humankind arbitrarily decided to establish a situation of equal rights, presumably because this would be beneficial for social life. Why, then, do animals not have the same rights? Why are we entitled to exploit animals? The answer seems to be: because we arbitrarily decided that we are entitled to do so.

The legal supremacy of humans is an ethical choice (as opposed to a scientific observation) of our human society. The real issue in the antivivisection controversy is, therefore, a conflict of values. This is why verbal combats have led nowhere. The animal rights advocate argues that laboratory animals are kept captive for their whole lives, an observation that is true in most cases. But the biomedical researcher can tell us that laboratory animals live in air-conditioned rooms and are fed to satiation and protected from predators, whereas wild rats often lose their tails in winter because of frostbite and sometimes because of intraspecific cannibalism due to food shortage. The arguments could go on for decades. The proper course of action in disputes of this sort is not intellectual confrontation but public referendum.

18 The passage implies that, for antivivisectionists, respecting animal rights involves

A protecting animals from suffering.
B non-interference in animals' lives.
C attention to the details of animals' lives.
D minimising the dangers in animals' lives.

19 The passage suggests that researchers

A make dishonest claims.
B have no interest in animal welfare.
C ignore the fundamental position of antivivisectionists.
D underestimate the improvements required in laboratory conditions.

20 According to the passage the original motivation for the establishment of human rights was

A moral.
B altruistic.
C pragmatic.
D ideological.

21 According to the passage, the animal rights controversy is based on

A the sentimental rather than the rational.
B the rational rather than the sentimental.
C matters of fact rather than value judgments.
D value judgments rather than matters of fact.

22 Thomas Jefferson's original draft for the American Declaration of Independence says:

> 'all men are created equal and independent … from that equal creation they derive rights inherent and inalienable, among which are the preservation of life, and liberty, and the pursuit of happiness.'

Jefferson's view and the view presented in the passage about animal rights

A differ in their assumptions about the source of human rights.
B differ in their analysis of how human rights operate in society.
C are similar in their assumptions about the source of human rights.
D are similar in their analysis of how human rights operate in society.

Questions 23–30

The two passages in this unit are adapted from an essay by the composer and performer Lukas Foss (b. 1922).

PASSAGE I

Progress in the arts: a series of gifted mistakes perhaps. We owe our greatest musical achievements to an unmusical idea: the division of what is an indivisible whole, 'music', into two separate processes: composition (the making of music) and performance (the making of music), a division as nonsensical as the division of form and content. The history of music is a series of violations, untenable positions, each opening doors. And the methodical division of labour (I write it, you play it) served us well, until composer and performer became like two halves of a worm separated by a knife, each proceeding obliviously on its course.

Around 1915, composition withdrew underground, leaving the field to the performer and to the music of the past and creating a sterile state of affairs for the virtuoso performer. But now a creative investigation is in full swing, and correction of the sterilising aspects is under way. The factor at the root of the problem, the division of labour (performance/composition), will remain with us: the procedural advantages are too great to be sacrificed. But composers have had to abandon Beethoven's proud position: 'Does he think I have his silly fiddle in mind when the spirit talks to me?' Composers are again involved in performance, with performance. More—they work with handpicked performers toward a common goal.

23 In Passage I, Lukas Foss asserts that in theory musical performance is

A a lesser art than composition.
B inseparable from composition.
C a greater art than composition.
D equal to composition in importance.

24 The 'creative investigation' (line 10) appears to involve

A composers exploring different ways to perform.
B performers exploring different ways to compose.
C composers considering performers as an intrinsic part of the act of composition.
D performers demanding that composers understand and take account of their needs.

25 Beethoven's comment (lines 13–14) suggests that he regarded

A the performance of his music as irrelevant to composition.
B the division between composition and performance as a violation.
C the division between composition and performance as meaningless.
D only the finest of performers as being capable of doing justice to his compositions.

26 For Foss, it would be essential for a 'handpicked' performer (line 15) to have

A a solid grounding in the basic elements of composition.
B the ability to play a 'silly fiddle' better than Beethoven's performer.
C the incentive to work quickly and independently toward a common goal.
D an understanding of a composition that concurs with that of the composer.

27 The division of music into composition and performance is regarded by Foss as

- **A** conceptually absurd but practically useful.
- **B** an historical diversion which has outlived its usefulness.
- **C** a useful conceptualisation distinguishing between the form and content of music.
- **D** a mistake which was only tolerated because it was committed by great musicians.

PASSAGE II

In spite of experience, or perhaps because of it, I am among the most reluctant composers when it comes to introducing performer-freedom into my composition. Moments of incomplete notation do exist, but only where it is safe, as a form of shorthand for composer and performer; one avoids cluttering up the score with inessentials. This brings me to the notational dilemma of the 1940s and 1950s: the precise notation which results in imprecise performance. Can we speak at all of precise notation if the practical realisation can but approximate the complexities on the page? The dilemma lies in the need to notate every minute detail. Imagine asking the performer to feel a moment 'out of time', as it were, when it is notated slavishly 'in time'. Similarly, an effect of, say, chaos, must not be notated in terms of subtle order.

Performance requires the ability to 'interpret' while at the same time allowing the music to 'speak for itself'—at the root of this paradox is a phenomenon experienced by all performers: the emergence of the interpreter's originality through identification with the author and submersion in his work. And the degree of tension in a performance is dependent on the presence of such a dual effort on the performer's part. A crescendo to a climax is dramatic only if the performer is both the racehorse and the horseman holding the reins.

28 'Moments of incomplete notation do exist, but only where it is safe' (lines 2–3). In the context of this essay, when would it be safe?

In a situation where

- **A** an effect is required that defies conventional notation.
- **B** the sounds required are not to be produced by a musical instrument.
- **C** there is no ambiguity about what the composer requires of the performer.
- **D** the composition itself is conventional and well within the limits of the performer's expertise.

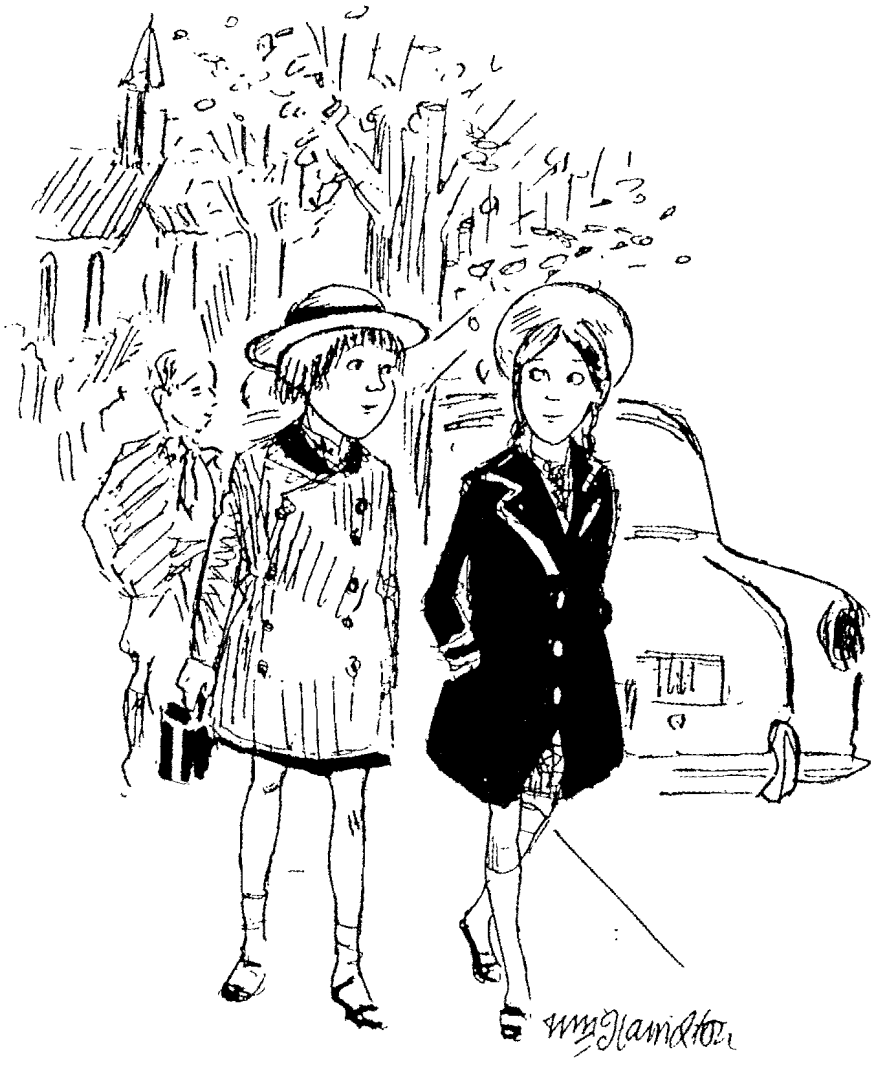
29 The analogy in the final sentence suggests that to achieve the desired effect fully, the performer must be

- **A** in full control of the performance.
- **B** at one with the composer's intentions.
- **C** able to lessen the tension by taking command.
- **D** able to execute a crescendo with superb facility.

30 Taken together, the two passages suggest that in Foss's view the relationship between composer and performer is ideally one in which

- **A** the performer freely interprets the composer's intentions.
- **B** the composer is initially inspired by performance but develops the composition independently.
- **C** composer and performer work together to ensure that performance actualises the composer's intention.
- **D** the composer and performer collaborate to such an extent that the distinction between them becomes meaningless.

Question 31



"'Screaming Eyeball' was a good movie but 'Bludgeon of Death' was a ***great*** *movie."*

31 The joke in this cartoon arises from the speaker

A comparing good and great films.
B attempting to compare such different films.
C not seeing a greater difference between the films.
D expressing admiration for such bloodthirsty films.

Questions 32–34

The table below shows costs associated with child-rearing in Australia using a method developed by Lov in 1983 called the basket-of-goods approach. This approach indicates how much parents would spend on th children if the child was to enjoy the fruits of the basket specified by the researcher. In this sense it provides an 'ideal' or desirable costing.

Basket-of-Goods Approach
Adjusted to Consumer Price Index figure, June quarter 1993

	Age of child				
	2 years	5 years	8 years	11 years	Teenage
Low income families (below average weekly wage)					
Per week	29.00	37.19	45.65	48.38	72.05
Per year	1511.55	1939.11	2377.28	2522.81	3756.60
Middle income families (average weekly wage and above)					
Per week	43.61	48.94	63.15	79.91	119.87
Per year	2273.71	2552.02	3292.40	4156.53	6249.97

Note: Included are food and clothing, fuel, household provisions, costs of schooling (not fees), gifts, pocket money and entertainment. NOT included are housing, transport, school fees or uniforms, child care, medical or dental expenses. Holidays are a component of the middle income figures only.

32 The costings used in the basket-of-goods approach are 'ideal' in that they are

A more accurate than most.
B low enough to be within the reach of most families.
C based on certain assumptions about the nature of parents' expenses.
D based on the assumption that expenditure is based on personal preference.

33 Which one of the following is the most likely method for updating the figures in the table to reflect price changes?

A gathering data on actual expenditure patterns
B applying mathematical formulae to the consumer price index
C applying the consumer price index to an updated version of the basket-of-goods
D revising the contents of the basket-of-goods to reflect new consumption patterns

34 The table assumes people on middle incomes are more likely than people on low incomes to

A buy higher priced goods.
B stay within their budgets.
C meet their families' needs.
D incur unforeseen expenses.

Questions 35–42

PASSAGE I: THE MASKS OF THE NOH DRAMA

The Noh drama of Japan, with its six hundred years of history, remains today a living moving dramatic form. People from all over the world have come to revere the Noh as a drama of simplicity, strength, subtlety, and harmony. The one element of the form that gives it its most intense beauty is the famous Noh mask. Although the workmanship and carving in these masks are superlative, they do not really appear in their best light when they are not in use. They come to life only when an excellent actor wears them in a performance. Of course, masks occur in the dramas of many parts of the world, but the Noh masks are the most advanced of them all.

The Noh often features instances in which spirits of another world, a supernatural world, arise and revisit this world. The mask is the point at which the soul of the other world meets the flesh of this world. Putting on a mask is much more than putting on mere make-up because when an actor puts on the mask, his soul turns inward and inward until it crystallises in a transformation of his very being. The mask also represents the point of convergence between the actor and the audience, because in the performance of the Noh, the mask is the most eye-catching element.

35 The central importance of the Noh mask in Noh drama lies in the

A symbolic meaning it carries for actor and audience.
B superlative artistry directed towards its production.
C traditions re-enacted with each mask's development.
D reverence with which all aspects of Noh are regarded.

36 Noh masks are intrinsic to the dramatic form because the

A masks carry no meaning outside of the Noh drama.
B masks enable the actor to take on the soul of the character.
C Noh dramatic form is a living and moving representation of life.
D skill of the craftsman determines the quality of the performance.

37 A common actor cannot use a really good mask because

A it is too subtle to be decorative.
B he cannot make himself one with it.
C he will not understand the traditions it embodies.
D its reputation is too demanding and therefore overpowering.

PASSAGE II: 'KUDEN' (TRADITION)

Kuden, or the feeling for traditional intensity, is not to be gained by mere teaching or mimicry, or by a hundred times trying, but must be learned by a grasp of the inner spirit. In a place, for instance, where a father comes to his lost son, walks three steps forward, pats him twice on the head and balances his stick, it is very difficult to get all this into grace and harmony, and it certainly cannot be written down or talked into a man by word of mouth.

Imitation must not be wholly external. There is a tradition of a young actor who wished to learn Sekidera Komachi, the most secret and difficult of the three plays, which alone are so secret that they were told and taught only by father to eldest son. He followed a fine old woman, eighty years of age, in the street and watched her every step. After a while she was alarmed and asked him why he was following her. He said she was interesting. She replied that she was too old. Then he confessed that he was an ambitious Noh actor and wanted to play Komachi.

An ordinary woman would have praised him, but she did not. She said it was bad for Noh, though it might be good for the common theatre, to imitate facts. For Noh he must feel the thing as a whole, from the inside. He would not get it copying facts point by point. All this is true.

You must lay great stress upon this in explaining the meaning and aesthetics of the Noh.

There is a special medium for expressing emotion. It is the voice.

Each pupil has his own voice; it cannot be made to imitate the voice of an old woman or a spirit (oni). It must remain always the same, his own; yet with that one individual voice of his he must so express himself as to make it clear that it is the mentality of an old woman, or whatever it happens to be, who is speaking.

It is a Noh saying that 'The heart is the form.'

38 Passage II suggests that the art of Noh lies in

A accurate imitation rather than mimicry.
B inherited rather than learned dramatic skills.
C psychological rather than emotional understanding.
D emotional understanding rather than accurate imitation.

39 A great Noh actor instructed his sons to be moral, pure and true in all their daily lives, otherwise they could not become the greatest actors. This is because, in Noh acting,

A art must imitate life.
B the spirit of the whole man is visible.
C wisdom is more important than observation.
D greatness comes from creative self-expression.

40 'It is a Noh saying that "The heart is the form."' (Passage II, line 23)

This suggests that Noh is

A the expression of inner life.
B the enactment of love, the most profound of emotions.
C based on the intuitive understandings of both actor and audience.
D an art of individual interpretation rather than one based on established rituals.

For the next two questions you need to consider Passage I and Passage II.

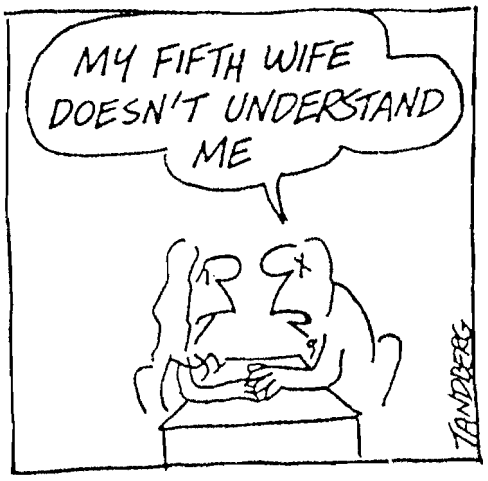
41 In the light of Passage II, the words 'crystallises in a transformation of his very being' (Passage II, 12–13) suggest the

A power of the mask to transform the actor's physical identity.
B profound sensitivity required for a male to play a female role.
C intense focus of the actor in creating an emotional incarnation.
D focus of Noh drama on the actor's self-expression in its natural and spontaneous form.

42 One way in which the masks contribute to Kuden is to

A give the actor and audience a physical picture of the role.
B direct the focus beyond the individual personality of the actor.
C draw on the actor's personal experiences to meet the demands of the role.
D distance the audience from involvement with the events and emotions portrayed.

Question 43



43 The point of this cartoon is that

A marriage must be based on understanding.
B the speaker has been unlucky in marriage.
C people look to others for understanding.
D the speaker is a poor husband.

Questions 44–49

This unit examines two approaches to research in the social sciences: positivism and interpretivism.

PASSAGE I

According to positivism, social sciences, to deserve the name 'science', must be developed on the lines of the natural sciences. As social facts exist independently of people's minds, they should be investigated independently of people's minds by being observed objectively. The social researcher should begin with a theory (or hypothesis) and should have a clear definition of the intended investigation which will test the hypothesis. The researcher aims to end up with general universal statements whose truth or falsity can be assessed by systematic observation and experiment, rather than with value judgments.

PASSAGE II

Interpretivists see social science as being very different from natural science. In social science, the subjects studied interact with their environment: they produce it; it is not 'pre-given'. Rather than observing social life from a distance, the social researcher should become immersed in the aspect of life to be studied. One way of doing this is through the process of 'verstehen', where the social researcher tries to 'become' a part of the subject matter. The interpretivist social researcher is not trying to control and direct but aims to be led by the subject matter. To describe findings the researcher may construct 'ideal types' or social actors who reflect behaviour typical of what is being studied. It is possible to make propositions about how an ideal type might behave under certain conditions. The social researcher has a great responsibility to reflect accurately, through the ideal types, the concept being studied.

44 According to Passages I and II, one major difference between the positivist researcher and the interpretivist researcher is that the positivist

- **A** follows an informal methodology whereas the interpretivist has no clearly discernible method.
- **B** predicts then tests a proposition whereas the interpretivist attempts to bring no preconceptions to the research.
- **C** sets out to examine social facts by intuition whereas the interpretivist uses a methodical and logical approach.
- **D** places high value on the detail of the subject matter to be researched whereas the interpretivist has a more global view.

45 According to the description of interpretivism, a social actor (Passage II, line 7) is a

- **A** researcher demonstrating findings by acting them out.
- **B** person engaged to act out particular behaviours observed by a social researcher.
- **C** model of what a researcher would like to find rather than what is actually found.
- **D** model distilled from a researcher's perceptions of several people with a particular trait.

46 Research into women migrants' experiences of health care in Australia could be cond[illegible] of

A a positivist approach only.
B an interpretivist approach only.
C either a positivist or an interpretivist approach.
D neither a positivist nor an interpretivist approach.

47 According to the definitions provided in Passages I and II, which one of the following descriptions o[illegible] positivism conflicts directly with the interpretivist approach?

A 'should begin with a theory'
B 'rather than with value judgments'
C 'assessed by systematic observation'
D 'aims to end up with general universal statements'

48 Defining categories of social phenomena on the basis of particular observations is an aim of

A positivism only
B interpretivism only.
C both positivism and interpretivism.
D neither positivism nor interpretivism.

49 'The social science researcher should aim for unbiased observation and avoid being influenced by personal judgments.'

This aim would be endorsed by

A positivism only
B interpretivism only.
C both positivism and interpretivism.
D neither positivism nor interpretivism.

Questions 50–58

The following passage is from the novel ***Elders and Betters*** *by Ivy Compton-Burnett.*

Julius was a red-haired, round-faced boy of eleven, with large, honest, greenish eyes and ordinary features grouped into an appealing whole. Dora was as like him as was compatible with a greater share of looks, the opposite sex and a year less in age. They both looked sound in body and mind, but a little aloof and mature for their years, as if they steered their own way through a heedless world. A nurse was regarded as a needless expense in their rather haphazard and straitened home; and the housemaid looked after them and a daily governess taught them, so that their spare time was uncontrolled. It was held that their amusement was their own affair, and confidence on the point was not misplaced, as their pastimes included not only pleasure, but religion, literature and crime. They wrote moral poems that deeply moved them, pilfered coins for the purchase of forbidden goods, and prayed in good faith to the accepted god and their own, perhaps with a feeling that a double share of absolution would not come amiss.

50 The kind of household described in this passage is

A loving and intimate.
B strict and conformist.
C casual and permissive.
D child-centred and sentimental.

51 The passage suggests that those responsible for bringing up Julius and Dora represent their system of care as

A loving and supportive.
B liberal and economical.
C wasteful, but necessary in order to keep up appearances.
D inadequate, but practical given their straitened circumstances.

52 The children regard crime as

A a means of survival.
B a forbidden pleasure.
C a variety of entertainment.
D an antidote to religion and literature.

53 The description of Julius and Dora's pastimes (lines 9–11) suggests that the

A children's aloofness and maturity hides a longing for affection.
B children's aloofness and maturity is induced by a mixture of guilt and piety.
C Elders' confidence about the children's private amusements is not misplaced.
D Elders' confidence about the children's private amusements is actually misplaced.

54 By grouping religion, literature and crime together, the writer suggests that

A they are all antidotes to the children's pleasure.
B they are all regarded by the Elders with disapproval.
C moral distinctions between them are arbitrary and artificial.
D the children do not make moral distinctions between them.

55 In saying that Julius and Dora may feel 'a double share of absolution would not come amiss' (lines 11–12) the writer suggests that the children

A have no genuine religious feeling.
B have a large capacity for genuine religious feeling.
C are vaguely aware that their activities might be viewed unfavourably.
D hypocritically hide behind their youth, knowing they are behaving badly.

56 Julius and Dora's pastimes indicate that the children are

A naive and inventive.
B devious and calculating.
C uncontrollable and tiresome.
D affectionate and eager to please.

57 The writer views the values and attitudes that govern the children's upbringing with

A critical irony.
B warm approval.
C anger and disbelief.
D uncritical detachment.

58 In the passage one of the linguistic means by which the writer suggests the quality of the relationship between the Elders and the children is the use of

A syntax: the terse and formal sentence structure reflects the severe and unaffectionate atmosphere.
B the passive voice: the Elders' thoughts and actions are not conveyed directly, but as impersonal edicts.
C metaphor and simile: the juxtaposition of unusual images accentuates the eccentric quality of the relationship.
D personification: the objects of the children's amusement are given living identities as if to compensate for the Elders' inattention.

Questions 59–67

The following passage is adapted from Jonathan Raban's account of his visit to New York City.

Within hours of my arrival, I was pumped full of propaganda. Don't loiter—always walk purposefully and signal that you have an imminent destination. Keep to the outer edge of the sidewalk. Avoid doorways. Never make 'eye contact'. If asked the time, or for directions, don't reply. Don't go north of 96th, south of Canal or west of Ninth Avenue. Stick to the 'white' subways, like the Lexington Avenue line, and never use the subway system after dark. Treat every outing on the New York streets as a low-flying raid over enemy territory.

It was a tiring exercise. My fixed stare kept on slipping, to include faces, shop windows, restaurant menus. On West 22nd at Broadway I found a vacant fire hydrant, and settled on it, as into an armchair, like the Street People did, to watch the crowd file past. Everyone moved with the same stiff clockwork action; everyone wore the same boiled look on their face. As they approached my fire hydrant, they accelerated slightly from the waist down, locked their eyes into horizontal position, and swept by giving me an exaggeratedly wide berth. I tried making eye contact, and managed to catch a few pairs of pupils off guard; they swerved away in their sockets, as quick as fish.

It was interesting to feel oneself being willed into non-existence by total strangers. I'd never felt the force of such frank contempt—and all because I was sitting on a fire hydrant. Every one of these guys wanted to see me wiped out. I was a virus, a bad smell, a dirty smear that needed cleaning up. After only a minute or two of this, I began to warm with reciprocal feeling: had I stayed on my hydrant for an hour, I'd have been aching to get my fist round a tyre-lever or the butt of a .38, just to let a zombie know that I was human too.

59 The instructions given to the writer (lines 1–6) were supposed to

A help him to avoid trouble.
B help him fit into New York society.
C persuade him to stay off the streets.
D give him a sense of New York's layout.

60 The writer suggests that the advice (lines 1–6) was given to him in a manner that was

A self-mocking.
B gentle but serious.
C dramatic and insistent.
D balanced and objective.

61 The word 'propaganda' (line 1) suggests a deliberate effort to persuade to a point of view. The point of view embedded in this 'propaganda' is

A commitment to promoting the rule of law amid urban chaos.
B a belief in the establishment of civil liberties for all members of society.
C a desire to protect the interests of one sector of society against encroachment.
D a view of society as a battleground on which conflicting ideologies fight for dominance.

62 The writer suggests that those who advised him about how to behave on the streets wa

A convert him to their own view of their society.
B make him reflect on his own values and attitudes.
C reassure him about his ability to survive urban violence.
D prevent him from enjoying the excitement and diversity of street life.

63 The description of the moving crowd (lines 9–14) suggests that the people in it feel

A degraded.
B bored.
C confident.
D frightened.

64 The people in the crowd filing past the fire hydrant seem to want to give the impression that they are

A fearful.
B evasive.
C purposeful.
D threatening.

65 'I began to warm . . .' (line 18)

The warmth referred to here is a result of

A rising anger.
B a feeling of well-being.
C the close, polluted atmosphere.
D looking 'boiled' like the passers-by.

66 The writer's experience leads him to feel that he has gained some insight into the

A causes of urban decay.
B motives of his advisers.
C motives for street violence.
D reason people end up on the streets.

67 The last paragraph suggests that the writer is imagining

A what it must feel like to live in New York all the time.
B how vulnerable pedestrians are made to feel.
C what it must feel like to be a Street Person.
D how terrifying a street attack would be.

Questions 68 –71

The following passage is adapted from a book on alchemy.

Alchemy is often dismissed as an immature, empirical and speculative precursor of chemistry which had as its object the transmutation of base metals into gold. But, although chemistry did evolve from alchemy, the two sciences have extremely little in common. Whereas chemistry deals with scientifically verifiable phenomena, the mysterious doctrine of alchemy pertains to a hidden reality of the highest order which constitutes the underlying essence of all truths and religions. The perfection of this essence is termed the Absolute; it can be perceived and realised, as the Beauty of all Beauty, the Love of all Love, and the High Most High, only if consciousness is radically altered and transmuted from the ordinary (lead-like) level of perception to a subtle (gold-like) level of perception, so that every object is perceived in its archetypal form, which is contained within the Absolute. The realisation of the eternal perfection of everything everywhere constitutes the Universal Redemption. Alchemy is a rainbow bridging the chasm between the earthly and heavenly planes, between matter and spirit. Like the rainbow, it may appear within reach, only to recede if one chases it merely to find a pot of gold.

68 The kind of alchemy discussed in this passage is dependent on

A a change in awareness.
B a change in ethics and values.
C rigorous and arduous enquiry.
D a sense of love, beauty and exaltation.

69 According to the writer, for alchemists the 'Absolute' is the

A hidden realm of reality where phenomena are concrete and finite.
B hidden realm of reality containing the archetypal forms of phenomena.
C ephemeral realm where phenomena are transient and often transmuted into other forms.
D temporal realm where archetypal forms of phenomena are unrestricted and independent of the spiritual world.

70 The kind of alchemy discussed in the passage is best described as a

A hedonistic and idealistic pursuit.
B disciplined and arduous exercise.
C pragmatic and utilitarian enterprise.
D mystical and transcendent awareness.

71 According to the writer the hidden reality is

A illusionary.
B imponderable.
C permanent and knowable.
D transitory and impenetrable.

Questions 72–75

The material in this unit concerns household and family size in Australia. It is drawn from an Australian Bu of Statistics publication based on census data. Some of the questions that follow refer to a specific table or figure Where there is no indication, draw on any of the material as appropriate.

Table 1 Households: Household Type and Size, 1986 (Per cent)

	HOUSEHOLD SIZE (number of people in household*)					
HOUSEHOLD TYPE	**1**	**2**	**3**	**4**	**5**	**6 or more**
1. 1 family	1.2	35.6	21.6	23.9	12.1	5.6
2. 2 or more families	—	—	0.8	22.1	23.9	53.1
3. Group (2 or more unrelated people)	—	75.8	17.7	4.8	1.2	0.6
4. One person	100.0	—	—	—	—	—

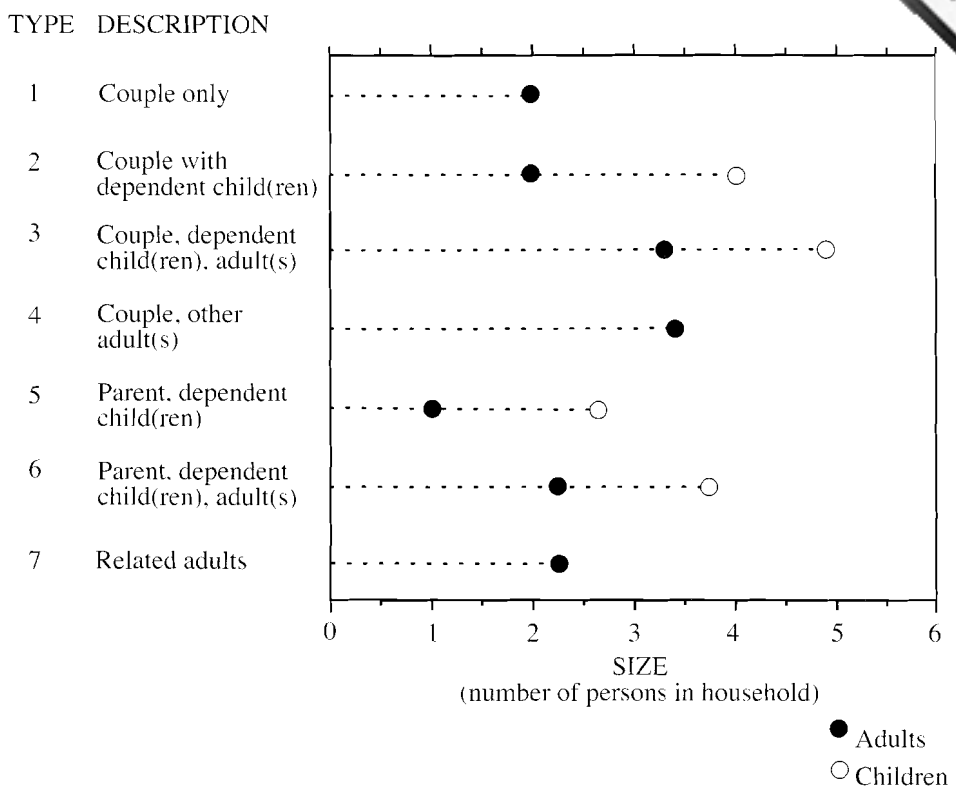
* Households in private dwellings only, excluding households in caravan parks, as enumerated on census night. No adjustment has been made for members temporarily absent or visitors to the household.

Table 2 Households: Household Type, Australia and Selected Countries (Per cent)

HOUSEHOLD TYPE	**Australia 1986**	**New Zealand 1986**	**Canada 1986**	**Great Britain 1986**	**USA 1985**
1. 1 family	75.2	73.9	72.7	71.0	n.a.*
2. 2 or more families	1.9	1.5	1.1	1.0	n.a.
Total family households	*77.1*	*75.4*	*73.8*	*72.0*	*71.9*
3. Group (2 or more unrelated people)	4.1	6.0	4.7	4.0	4.2
4. One person	18.8	18.6	21.5	24.0	23.9
Total non-family households	*22.9*	*24.6*	*26.2*	*28.0*	*28.1*
Total	**100.0**	**100.0**	**100.0**	**100.0**	**100.0**

* not available

Figure 1 Average Family Size by Family Type, 1986



72 Which one of the following was the most common household type and size in Australia in 1986?

A a family household of two people
B a non-family household of two people
C a household of at least two families, containing six or more people
D a family household of five people containing a couple, dependent child(ren) and adult(s)

73 According to Figure 1, the average number of dependent children in family type 3 is

A about two.
B about five.
C about six.
D between three and four.

74 In order to estimate the percentage of Australian households comprised of three or more unrelated people, you would need to refer to

A Table 1 only.
B Table 2 only.
C Tables 1 and 2 only.
D Tables 1 and 2 and Figure 1.

75 Which of the following is the most plausible explanation for the percentage figure of 1.2 [illegible] erical column of Table 1?

A 1.2% of single people regard themselves as a family
B 1.2% of one-person households are family households
C in 1.2% of one-family households only one person was at home on census night
D in 1.2% of households the respondent to the census did not know how many other people were in house

3 Written Communication

Writing Test A

Consider the following comments and develop a piece of writing in response to one or more of them.

Your writing will be judged on the quality of your response to the theme; how well you organise and present your point of view, and how effectively you express yourself. You will not be judged on the views or attitudes you express.

****

Riches are not an end of life, but an instrument of life.

Henry Ward Beecher

That some should be rich, shows that others may become rich, and, hence, is just encouragement to industry and enterprise.

Abraham Lincoln

Few rich men own their own property. The property owns them.

R. Ingersoll

He who knows how to be poor knows everything.

Jules Michelet

Wealth is not of necessity a curse, nor poverty a blessing. Wholesome and easy abundance is better than either extreme; better for our manhood that we have enough for daily comfort; enough for culture, for hospitality, for charity.

R.D. Hitchcock

Writing Test B

Consider the following comments and develop a piece of writing in response to one or more of them.

Your writing will be judged on the quality of your response to the theme; how well you organise and present your point of view, and how effectively you express yourself. You will not be judged on the views or attitudes you express.

****

I can usually judge a fellow by what he laughs at.

Wilson Mizner

You grow up the day you have your first real laugh – at yourself.

Ethel Barrymore

Perhaps I know why it is man alone who laughs: He alone suffers so deeply that he had to invent laughter.

Friedrich Wilhelm Nietzsche

Against the assault of laughter, nothing can stand.

Mark Twain

In the end, everything is a gag.

Charlie Chaplin

4 Reasoning in Biological and Physical Scie

Unit 1

Questions 1 – 4

The hormonal environment in the uterus affects gender development in mice. Figure 1 represents ten numbered mouse embryos developing *in utero*. The positions of male and female embryos in the uterus are assigned randomly.

Female embryos located between two males (i.e. 2M embryos), though remaining clearly female throughout and after development, tend to develop more masculinised anatomy and behaviour than female embryos located between a male and a female (i.e. 1M embryos). In turn, 1M embryos develop relatively more masculinised features than female embryos located between two females (i.e. 0M embryos).

An analogous pattern is seen for males, with 2F males, though still clearly male throughout and after development, developing the most feminised features.

In this unit:

- 2M, 1M and 0M refer to females and 2F, 1F and 0F refer to males; and
- 1M and 1F can also occur when there is only one neighbouring embryo.

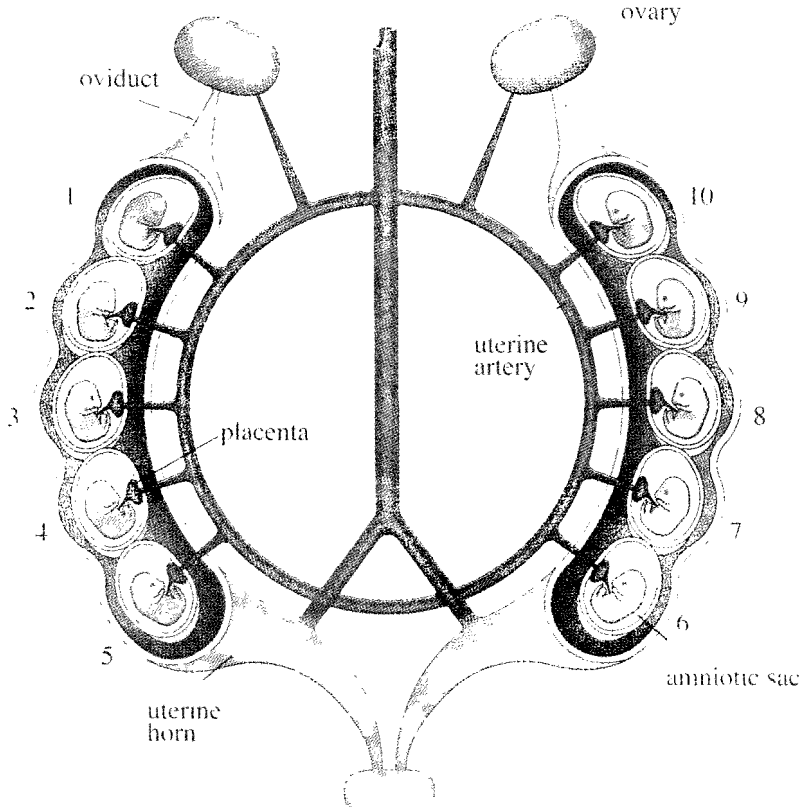


Figure 1

Suppose embryo 9 is 1M, embryo 7 is 2M, embryo 4 is 2F and embryo 2 is 1F.

1 Of the following, the information presented suggests most strongly that in mice differe[illegible]ent of secondary sexual characteristics in members of the same sex is a result of differences in

A uterine temperature.
B location of the embryo with respect to the ovary.
C levels of maternally produced hormones reaching the embryos.
D levels of embryo-produced hormones reaching adjacent embryos.

2 Of embryos 1, 2, 3, 4 and 5, how many are male?

A three
B two
C one
D none

3 Of the following embryos, which one will develop the most feminine features?

A embryo 2
B embryo 4
C embryo 9
D embryo 10

4 In mice, the primary sexual characteristics of an individual are determined by

A genotype.
B hormones.
C an interaction between hormones and genotype.
D neither **A** nor **B** nor **C**.

Questions 5–9

The ability of an atom that is in a bond to attract electrons to itself is called its *electronegativity*. Table 1 shows the electronegativity values of the atoms commonly found in organic molecules.

Table 1

Atom	Fluorine	Oxygen	Chlorine	Nitrogen	Sulfur	Carbon	Hydrogen	Phosphorus
Electro-negativity value	3.98	3.44	3.16	3.04	2.58	2.55	2.20	2.19

In a covalent bond, the atom that is more electronegative will have a slight negative charge (denoted by $\delta-$) while the atom that is less electronegative will have a slight positive charge (denoted by $\delta+$). Thus, the bond formed is a *dipolar bond*. The greater the difference between the electronegativities, the more polar is the bond. For example, the bond between a fluorine atom and a carbon atom ($^{\delta-}F–C^{\delta+}$) will be more polar than a bond between a nitrogen atom and a hydrogen atom ($^{\delta-}N–H^{\delta+}$).

In most organic molecules, the greatest electronegativity difference occurs most commonly in bonds that have a hydrogen atom at one end and an atom of oxygen or nitrogen at the other end. In such bonds, the hydrogen atom has the slight positive charge and so will be attracted to the lone pairs of electrons on the atoms of oxygen and nitrogen that occur in other bonds in the same molecule or in different molecules. This attraction is called a *hydrogen bond*. Hydrogen bonds are not as strong as either ionic bonds or covalent bonds but they are much stronger than the dispersion forces.

5 Of the following, the most polar bond will be a covalent bond formed between atoms of

A chlorine and fluorine.
B sulfur and oxygen.
C phosphorus and nitrogen.
D carbon and chlorine.

6 In one part of a molecule, there is a carbon-oxygen double bond (C=O) while in another part, there is a nitrogen-hydrogen single bond (N–H).

If these two parts of the molecule were sufficiently close together, there would be

A two hydrogen bonds formed involving all four atoms.
B an attraction of the nitrogen atom in one bond to the oxygen atom in the other.
C an attraction of the hydrogen atom in one bond to the oxygen atom in the other.
D a repulsion between the carbon atom in one bond and the nitrogen atom in the other.

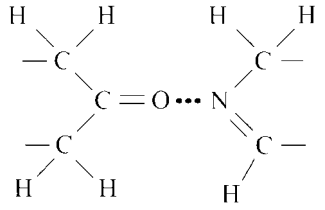
7 Covalent bonds occurring in amino acids include that between an atom of carbon and n[illegible] and that between an atom of sulfur and hydrogen (S–H).

The positively charged ends of these two bonds would be, respectively, the atoms of

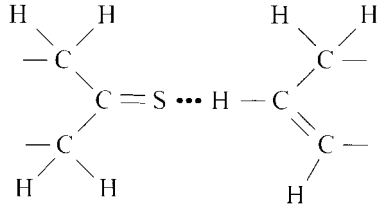
A carbon and sulfur.
B carbon and hydrogen.
C nitrogen and sulfur.
D nitrogen and hydrogen.

8 Of the following, the attractive interaction between atoms of two molecules that are the same distance apart (indicated by ...) would be strongest in

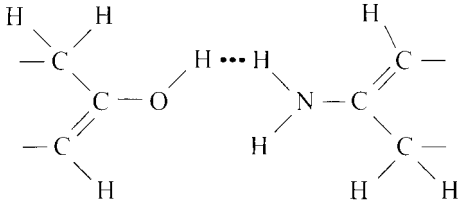
A



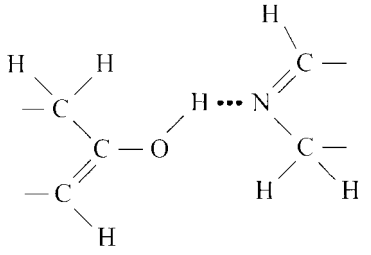
B



C



D



9 Of the following, the factor that has the **least** effect on the strength of a hydrogen bond in a molecule is the

A type of atom to which the hydrogen atom is covalently bonded.
B distance that the hydrogen atom is from the atom on the other part of the molecule.
C number of other hydrogen atoms attracted to the atom on the other part of the molecule.
D type of atom in the other part of the molecule to which the hydrogen atom is attracted.

Questions 10–13

A doctor asks a nurse to determine the mass of a bed-ridden patient without moving the patient off the bed (Figure 1). The nurse has available a weighing scale which can support the pair of legs of the bed at one end or the pair at the other end, but not both pairs simultaneously.

To determine the mass of the patient he first places the pair of legs at X on the scale and notes a reading of 700 N. He then places the pair of legs at Y on the scale and notes a reading of 800 N. He knows from a previous determination that the mass of the bed and bedding is 90 kg.

With this information, he is able to compute the mass of the patient.

Assume that the bed is stationary during weighing and the acceleration due to gravity is 10 m s^{-2} .

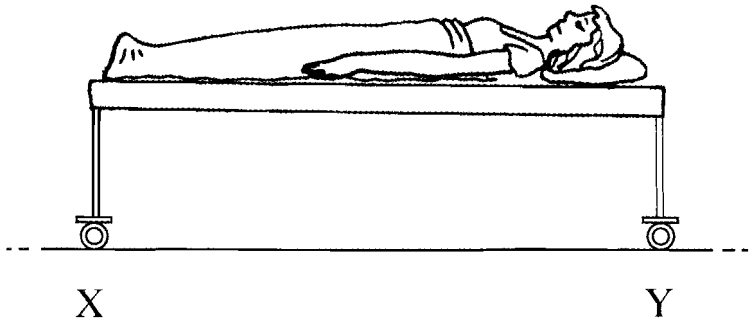


Figure 1

10 The total force exerted by the floor on the bed is

A less than 750 N .
B 750 N .
C 1500 N .
D more than 1500 N .

11 The mass of the patient is

A less than 60 kg .
B 60 kg .
C 75 kg .
D more than 75 kg .

12 Suppose the length of the bed, the horizontal distance between X and Y in Figure 1, is L.

At what horizontal distance from Y is the centre of gravity of the patient, bed and bedding, considered as a single body, located?

A $\frac{7}{15}L$.
B $\frac{8}{15}L$.
C $\frac{1}{2}L$.
D $\frac{1}{8}L$.

13 Suppose the nurse uses two identical weighing scales instead of one, and that he places [illegible] at X on scale A and at the same time the pair of legs at Y on scale B.

In this case, the readings on the two scales would be

	scale A	*scale B*
A	700 N .	800 N .
B	750 N .	750 N .
C	less than 700 N .	more than 800 N .
D	more than 700 N .	less than 800 N .

UNIT 4

Questions 14 and 15

Many organic compounds undergo oxidation-reduction (redox) reactions. This involves a change in the oxidation numbers of the carbon atoms. One method of calculating these oxidation numbers is to follow these rules:

I At the start, the oxidation number of each carbon atom is assumed to be zero.

II A bond to another carbon atom does not change the oxidation number.

II Each bond to an atom that is more electronegative than carbon (e.g. fluorine, oxygen, nitrogen, chlorine, bromine) increases the oxidation number by 1.

IV Each bond to an atom that is less electronegative than carbon (e.g. hydrogen, phosphorus, iodine, sulfur, all metals) decreases the oxidation number by 1.

V A multiple bond has a multiple effect.

14 By calculating the oxidation numbers of all of the carbon atoms in each of the following reactions, determine which one is a redox reaction.

A	$2H_2$	+	CO	$\rightarrow$	CH_3OH		
B	HCOOH	+	NH_3	$\rightarrow$	$HCONH_2$	+	H_2O
C	NaOH	+	CO	$\rightarrow$	HCOONa		
D	CH_3Cl	+	H_2O	$\rightarrow$	CH_3OH	+	HCl

15 According to the rules listed above, the oxidation number of a carbon atom that has only one carbon atom bonded to it can be

A any integer from +3 to –3 .
B any integer from +4 to –4 .
C any odd integer from +3 to –3 .
D any even integer from +4 to –4 .

Questions 16 and 17

Figure 1 shows a model that represents certain aspects of lung function.

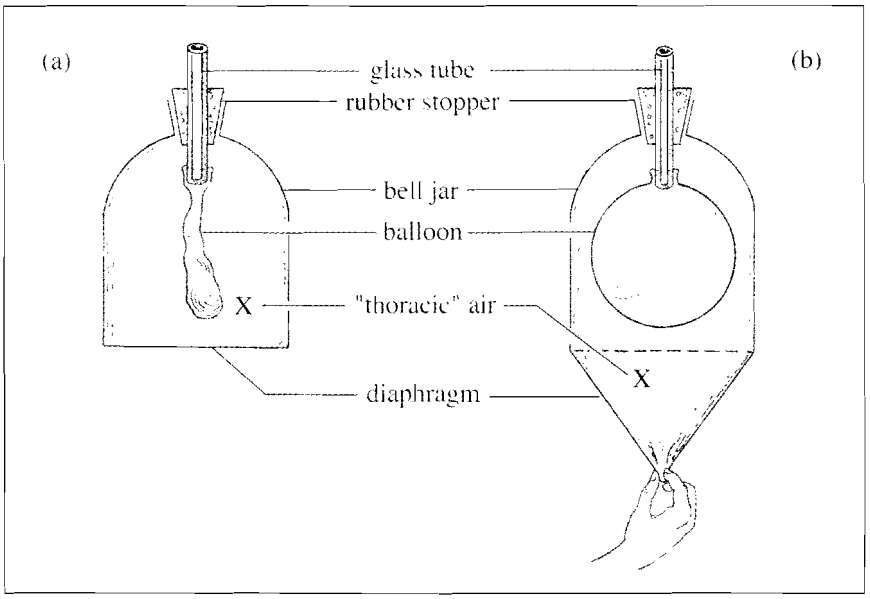


Figure 1

'Thoracic air' is air in the space between the balloon and the bell jar/diaphragm.

16 Of the following, a lung is best represented by the

A bell jar.
B balloon.
C bell jar and balloon.
D bell jar and diaphragm.

17 In the sequence of events that leads to the inflation of the balloon in Figure 1, which one of the following occurs earliest?

A The amount of air inside the balloon increases.
B The air pressure inside the balloon decreases.
C The amount of thoracic air increases.
D The thoracic air pressure decreases.

Questions 18 and 19

When blood enters the typical mammalian kidney some of the plasma passes through tiny pores into the nephrons (long thin tubes), leaving behind in the blood the rest of the plasma and blood cells. Thus, the concentration of small molecules in the newly formed plasma filtrate in the kidney nephrons is close to what it was in the blood plasma.

As this filtrate passes down the nephron tubes, some substances are absorbed from the filtrate, passing back into the blood, and other substances are secreted into the filtrate from the blood. (These substances move across the wall of the nephron.) By the time the filtrate (now urine) reaches the bladder, its composition is markedly different from that of plasma.

For various concentrations of plasma glucose in a dog, Figure 1 indicates the concentration of glucose in newly formed filtrate and urine.

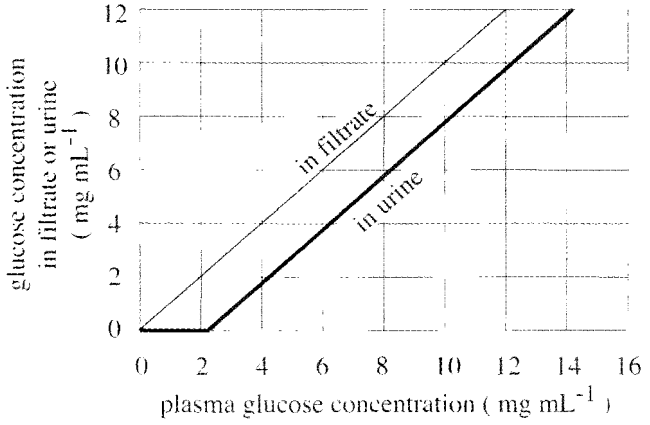


Figure 1

18 For glucose at a plasma concentration of 1.0 mg mL^{-1} (Figure 1), the glucose concentration in filtrate is higher than in urine because

A glucose is actively transported back into the blood.
B glucose is actively transported from the blood into the filtrate.
C water progressively moves into the nephrons and dilutes the glucose.
D water is progressively removed from the nephrons and returns to the blood.

19 Figure 1 indicates that all glucose is absorbed from the filtrate

A below a filtrate concentration of about 2.2 mg mL^{-1}.
B above a filtrate concentration of about 2.2 mg mL^{-1}.
C below a urine concentration of about 2.2 mg mL^{-1}.
D above a urine concentration of about 2.2 mg mL^{-1}.

Questions 20–26

Paper chromatography is the process that separates a mixture of compounds by allowing them to be soaked by a piece of absorbent paper. A spot of the mixture is placed near the bottom left-hand corner of the paper and allowed to dry. The paper is then placed in a container of solvent so that the spot is above the solvent level. The solvent will be soaked up by the paper, dissolving the compounds as it passes over them. Because of their different structures, some of the compounds will be more soluble in the solvent and less attracted to the paper than others. This means that as the solvent travels up the paper, it will carry the compounds with it at varying rates, allowing them to separate out.

The paper must be taken out of the solvent before the upper level of the solvent has reached the top of the paper. The paper may then be dried and placed in a different solvent after being rotated by 90°. More separation of the compounds may occur but this time it will be at 90° to the original separation.

The distance that a compound moves up the paper from the starting point divided by the distance that the solvent moves up from the starting point is called the R_f value of the compound.

$$R_f = \frac{\text{distance that the compound moves up the paper from the starting point}}{\text{distance that the solvent moves up the paper from the starting point}}$$

The R_f value applies to a particular compound being carried up by a particular solvent on a particular type of paper. Distances are measured between the centres of the spots.

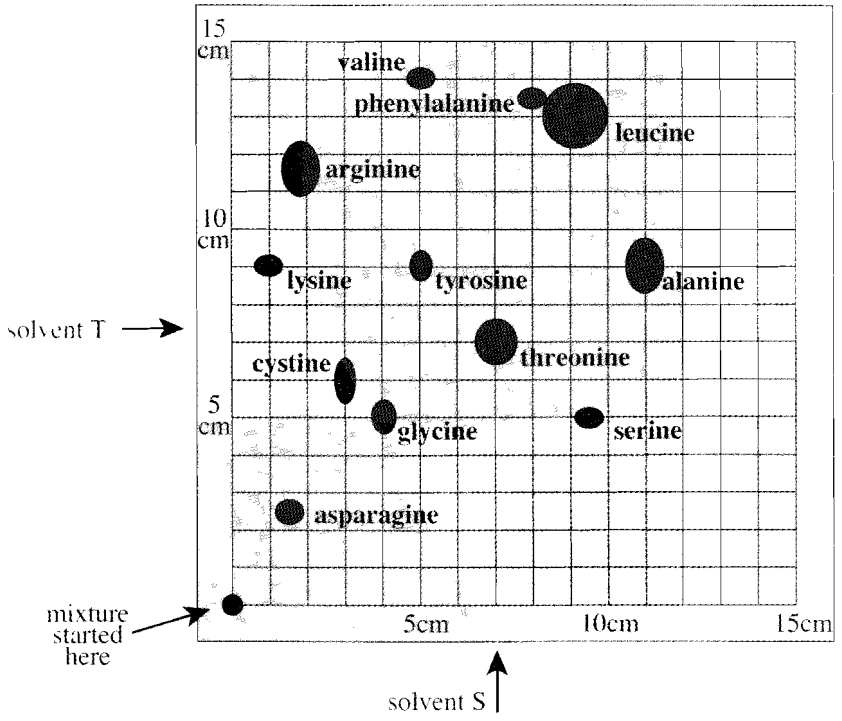


Figure 1

Figure 1 shows the result produced for a mixture of amino acids that was started near the bottom left-hand corner, placed in solvent S until the solvent had soaked 15.0 cm up the paper (from the starting point) and allowed to dry. The paper was then rotated 90° so that its left-hand edge was now at the bottom, placed in another solvent (solvent T), and left until this solvent had soaked 12.0 cm up (to the right of) the paper. The paper was removed from the solvent, dried, and the spots of the amino acids located and identified.

All adjacent grid lines on the paper chromatograph in Figure 1 are 1.0 cm apart.

20 The R_f value of cystine on this paper is

A 0.20 for solvent S and 0.50 for solvent T.
B 0.25 for solvent S and 0.40 for solvent T.
C 0.40 for solvent S and 0.25 for solvent T.
D 0.50 for solvent S and 0.20 for solvent T.

21 In Figure 1, the highest R_f value for the following amino acids is for

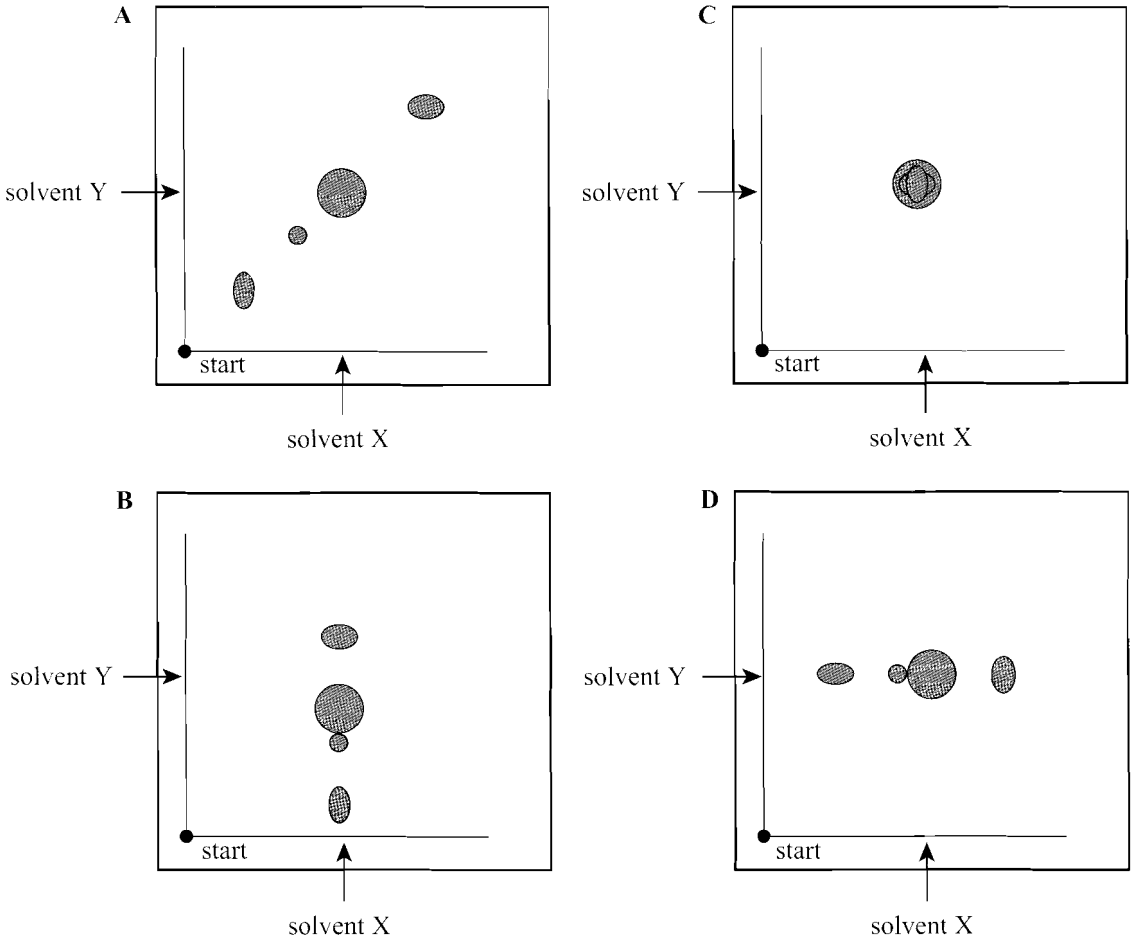
A leucine in solvent S.
B leucine in solvent T.
C phenylalanine in solvent S.
D phenylalanine in solvent T.

22 An amino acid in Figure 1 that has the same R_f value in both solvents S and T is

A glycine.
B threonine.
C leucine.
D phenylalanine.

23 Four amino acids are found to have the same R_f values for solvent X but different R_f values for solvent Y.

If an experiment such as that described at the start of this unit was carried out on a mixture of these four amino acids, they would most likely appear on a paper chromatograph as



24 Five amino acids—alanine, glycine, lysine, serine and threonine—are mixed and a spot of [illegible] placed in the starting position of another piece of the same type of absorbent paper as was illustrated [illegible]

In order to completely separate the five amino acids in this mixture,

A solvent S alone must be used.
B solvent T alone must be used.
C both solvents S and then T must be used.
D a solvent other than S or T must be used.

25 Consider these two statements concerning the amino acids shown in Figure 1.

I Tyrosine has a greater affinity for solvent S than does threonine.
II Tyrosine has a greater affinity for solvent T than does threonine.

A Both statements I and II are true.
B Statement I is true but statement II is not true.
C Statement II is true but statement I is not true.
D Neither statement I nor II is true.

26 Consider these three statements concerning lysine and the two solvents S and T shown in Figure 1.

I Lysine has a greater affinity for solvent S than for the paper.
II Lysine has a greater affinity for solvent T than for the paper.
III Lysine has a greater affinity for solvent S than for solvent T.

A All three statements, I, II and III, are true.
B Statement I is true but statements II and III are not true.
C Statement II is true but statements I and III are not true.
D Statements I and III are true but statement II is not true.

Question 27

Cheetahs are members of the cat family and are only found in certain narrow ranges of the African Savan
Consider the experiment summarised in Figure 1. Cheetahs I and II are not siblings nor is one the parent of th
other.

The experiment depicted in Figure 1 was repeated with several other randomly selected pairs of cheetahs and domestic cats with the same result in each case.

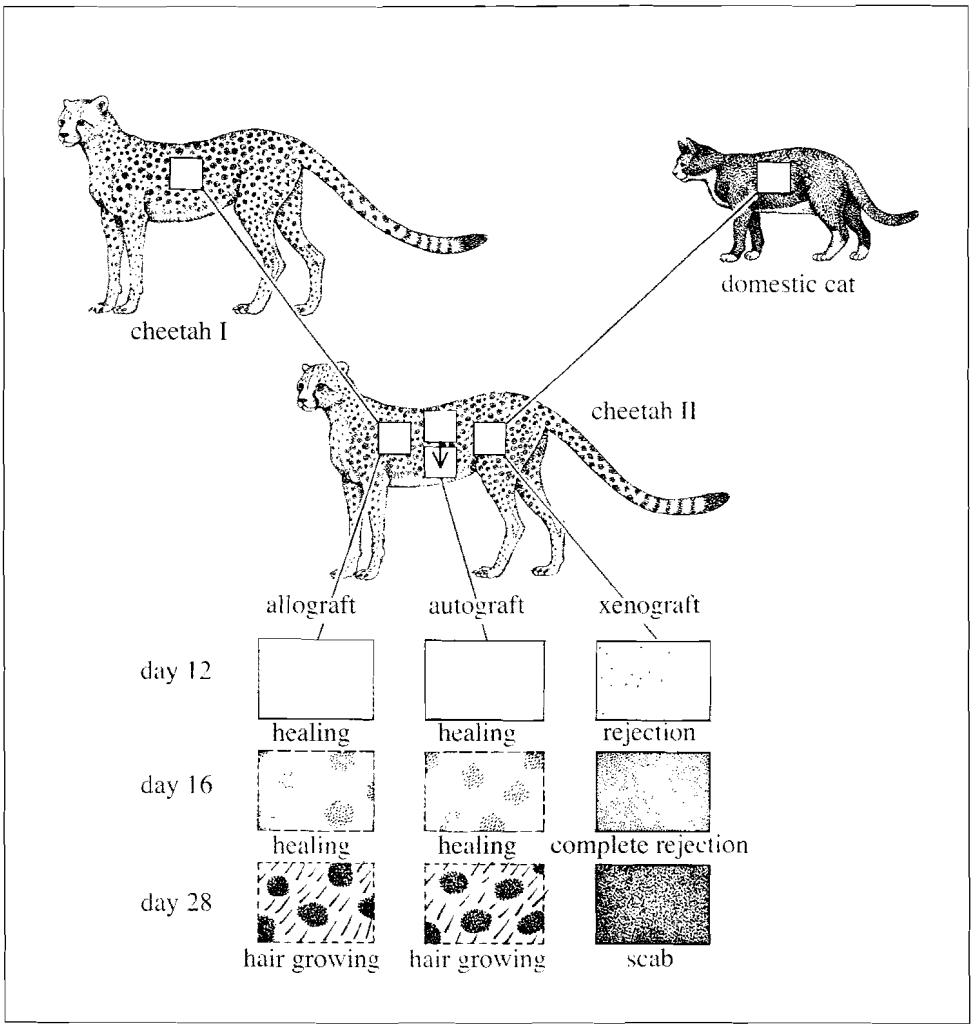


Figure 1

27 The experiment indicates that, of the following, tissues whose antigens must have been significantly different from each other were

A the allograft and the non-transplanted tissue of cheetah I.
B the autograft and the non-transplanted skin of cheetah I.
C the allograft and the autograft.
D none of the above.

Questions 28–31

In order to fly, a moth raises the temperature of the flight muscles in its thorax. To produce the heat required to achieve a flight temperature, it shivers pre-flight by repeatedly contracting major upstroke and downstroke flight muscles.

Figure 1 illustrates how a sphinx moth's thoracic temperature rises from various initial resting temperatures, T_0 (where T_0 equals either 15, 20, 25 or 30 °C).

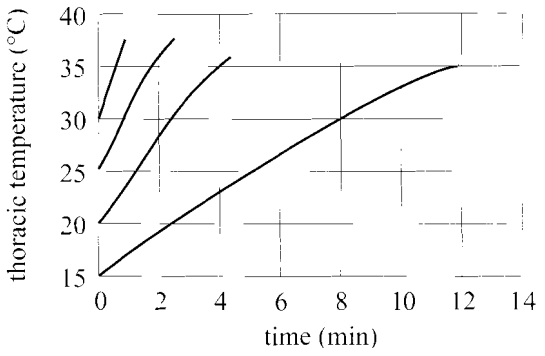


Figure 1

28 For which T_0 is there the greatest increase in thoracic temperature per minute?

A $T_0 = 15$ °C
B $T_0 = 20$ °C
C $T_0 = 25$ °C
D $T_0 = 30$ °C

29 Consider the line in Figure 1 corresponding to an initial resting temperature of 20 °C.

During the first two minutes, of the following, the heat loss from the moth's thorax is most likely to have been

A equal to the heat production in the thorax.
B less than the heat production in the thorax.
C less than the heat loss from the abdomen.
D equal to the heat loss from the abdomen.

Questions 30 and 31 refer to the following additional information:

Figure 2 indicates the rate of oxygen consumption by bumblebee queens when they are involved in incubation (warming) of their broods at different ambient (environmental) temperatures.

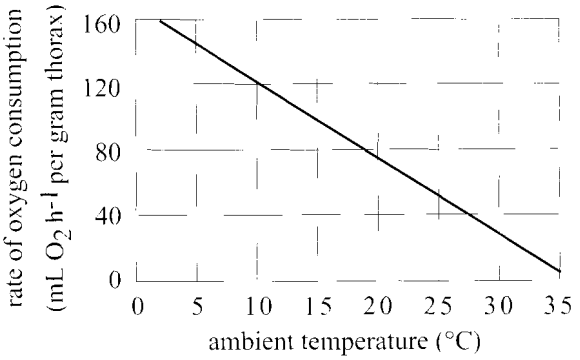


Figure 2

30 Which one of the following is most clearly indicated by Figure 2?

As ambient temperature rises, the

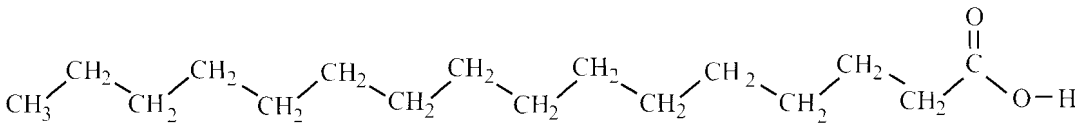
A queen uses more anaerobic respiration.
B queen uses more aerobic respiration
C rate of metabolic respiration decreases.
D rate of metabolic respiration increases.

31 At 10 °C, oxygen consumption each minute in a 0.2 g bumblebee queen thorax would be

A 120 mL.
B 24 mL.
C 2 mL.
D neither **A** nor **B** nor **C**.

Questions 32–35

The simplest of the lipids are the *fatty acids*, found in the fatty tissue of animals and in the membranes of cells. All fatty acids are long chain α-carboxylic acids, i.e. they have the organic acid group (–COOH) attached to one end of a hydrocarbon chain that has between ten and thirty carbon atoms. Figure 1 shows a typical fatty acid, palmitic acid.



$CH_3(CH_2)_{14}$ palmitic acid

Figure 1

As the fatty acid indicated in Figure 1 has an alkyl chain that is saturated and contains no side chains or branches, its molecules can pack closely together and form semicrystalline solids at room temperature. Many fatty acids are unsaturated, with some having more than one double bond. Such bonds alter the shape of the molecules and prevent them from packing as closely together as the saturated molecules.

The common names and the chemical formulae of a range of fatty acids are shown in Table 1.

Table 1

Common name	Chemical formula	Common name	Chemical formula
capric acid	$C_9H_{19}COOH$	linoleic acid	$C_{17}H_{31}COOH$
lauric acid	$C_{11}H_{23}COOH$	oleic acid	$C_{17}H_{33}COOH$
myristic acid	$C_{13}H_{27}COOH$	stearic acid	$C_{17}H_{35}COOH$
gaidic acid	$C_{15}H_{29}COOH$	arachidonic acid	$C_{19}H_{31}COOH$
palmitic acid	$C_{15}H_{31}COOH$	arachidic acid	$C_{19}H_{37}COOH$
linolenic acid	$C_{17}H_{29}COOH$	cerotic acid	$C_{25}H_{51}COOH$

Relative Atomic Masses: H = 1.0, C = 12.0, O = 16.0, I = 126.9 .

32 A group of three fatty acids that are all saturated is

A capric acid, stearic acid and cerotic acid.
B gaidic acid, oleic acid and arachidic acid.
C lauric acid, myristic acid and gaidic acid.
D palmitic acid, linoleic acid and arachidonic acid.

33 The number of double bonds in arachidonic acid is

A one.
B two.
C three.
D four.

34 Cottonseed oil contains large amounts of polyunsaturated fatty acids. When this oil is used to make margarine, the fatty acids are changed chemically in order to increase their melting points.

One change that would achieve this would be

A decreasing the pH of the mixture of fatty acids.
B adding alkyl side chains to the hydrocarbon chain.
C reducing the number of double bonds in the hydrocarbon chain.
D reducing the number of carbon atoms in the hydrocarbon chain.

35 The *iodine value* is a measure of the number of double bonds in a fatty acid – one molecule of iodine reacts with one double bond. The iodine value is the mass (in gram) of iodine that reacts with 100 g of the fatty acid.

The iodine values of capric acid, gaidic acid and arachidonic acid are in the order

A capric acid > gaidic acid > arachidonic acid.
B gaidic acid > arachidonic acid > capric acid.
C capric acid > arachidonic acid > gaidic acid.
D arachidonic acid > gaidic acid > capric acid.

Questions 36–41

A graph of the velocity of a 100 metres sprinter throughout the 10.0 seconds that it took him to run his ra shown in Figure 1. Assume the sprinter ran in a straight line.

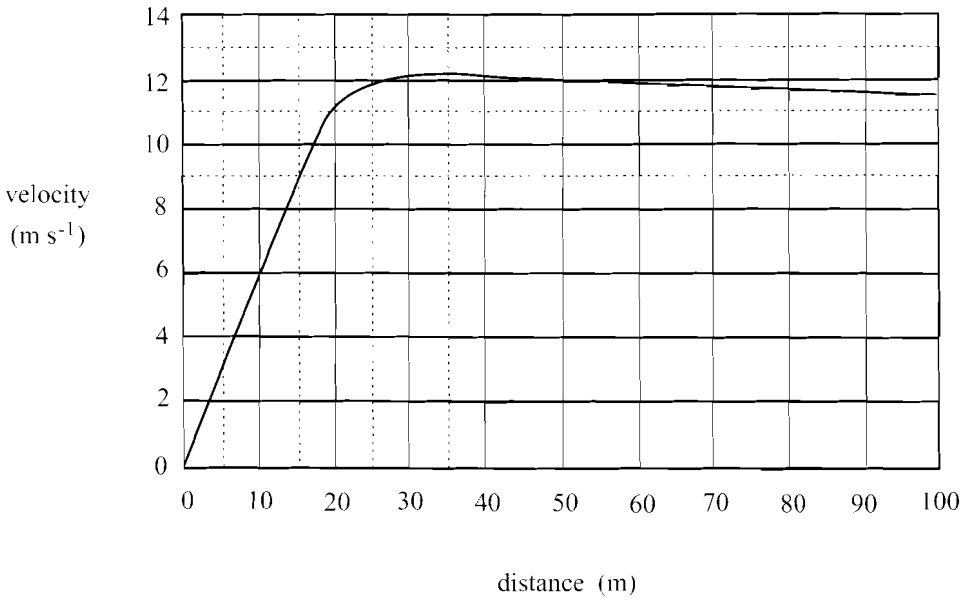


Figure 1

For questions where the acceleration is constant or approximately constant, the following equations may be helpful.

$$s = ut + \frac{at^2}{2} \qquad v = u + at \qquad v^2 = u^2 + 2as$$

where s = distance from origin, u = initial velocity, v = final velocity, a = acceleration,

t = time.

36 The best of the following estimates of the time that the runner took to run the final 50 metres is

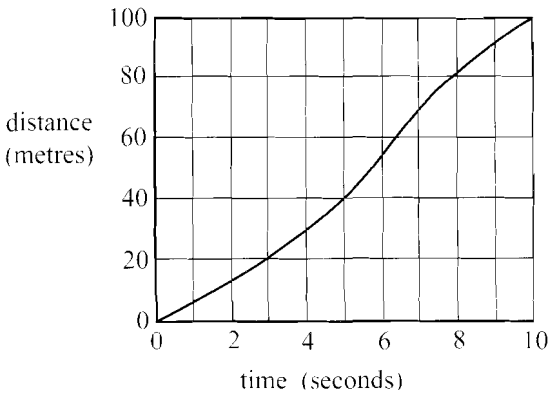
A 4.0 s .
B 4.3 s .
C 4.7 s .
D 5.0 s .

37 The best of the following estimates of the average (mean) acceleration of the runner over the first 15 metres is

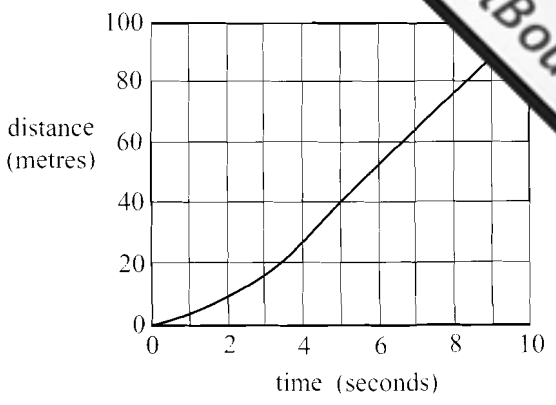
A 0.6 m s^{-2} .
B 0.9 m s^{-2} .
C 1.5 m s^{-2} .
D 2.5 m s^{-2} .

38 The graph that best represents distance versus time for this runner is

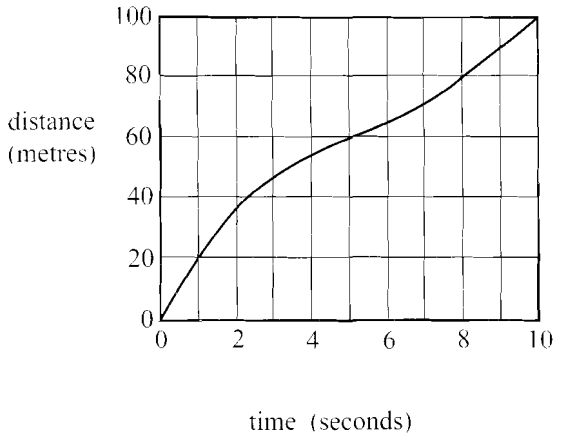
A



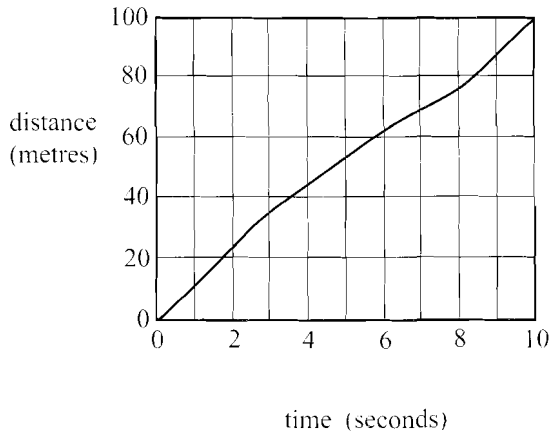
C



B



D



39 The best of the following estimates of the time that the runner took to run the first 20 metres is

A 1.1 s .
B 2.2 s .
C 3.6 s .
D 4.4 s .

40 Of the following, the distance that the runner travelled during the first 5.0 seconds is closest to

A 30 m .
B 40 m .
C 50 m .
D 60 m .

41 In another race the runner ran 200 metres in a straight line in 19.5 seconds. For the first 100 metres, his velocity changed with distance as shown in Figure 1.

If his acceleration was constant for the last 100 metres, the best of the following estimates of his velocity as he crossed the finishing line is

A 11.0 m s^{-1} .
B 10.5 m s^{-1} .
C 9.6 m s^{-1} .
D 9.2 m s^{-1} .

Questions 42–48

Figure 1 represents the respiratory system of a typical bird. The main tube (*trachea*) that starts at the back of t mouth and transports air towards the lungs splits into two tubes called the *bronchi*. Each bronchus passes through one of the two lungs (**without** gas exchange occurring) and ends in an air sac, the *abdominal sac*.

Other air sacs also connect to the main bronchi. The *abdominal* and the *caudal thoracic sacs* are termed the *posterior sacs*. The *cranial thoracic*, *interclavicular* and *cervical sacs* are termed the *anterior sacs*.

In Figure 1(b), which simplifies the main elements of Figure 1(a), the posterior sacs are labelled P and the anterior sacs are labelled Q, and the relative positions of the sacs with respect to the lungs and bronchi are indicated.

The sacs are poorly vascularised (i.e. lack capillaries) and have no folds or ridges. Air fills these sacs at various stages of the respiratory cycle and passes between the sacs and the lungs.

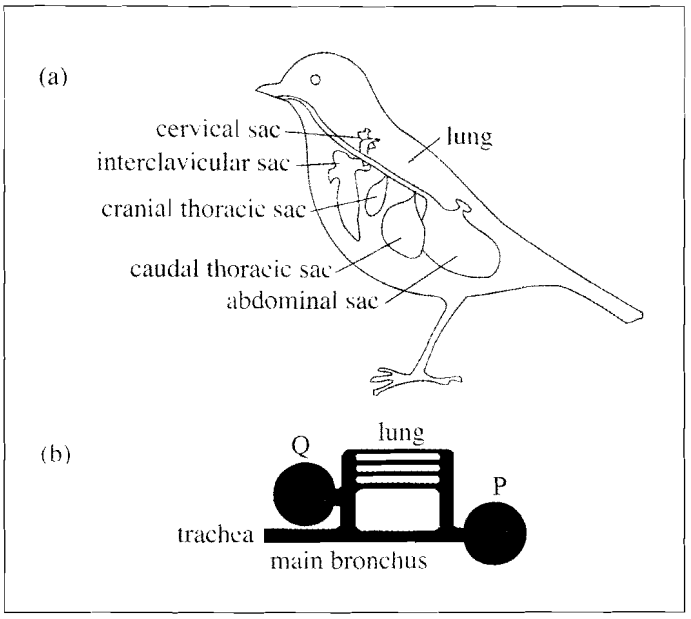


Figure 1

In the lungs, air coming from the posterior sacs travels through *parabronchi* (Figure 2), which are the smallest units of the bird lung. The parabronchi are tubes through which air flows, whereas the mammalian *alveoli* are *culs de sac* (dead ends). Thus air travels in one direction through a bird's parabronchi, and through its respiratory system in general, but retraces its path through the mammalian system.

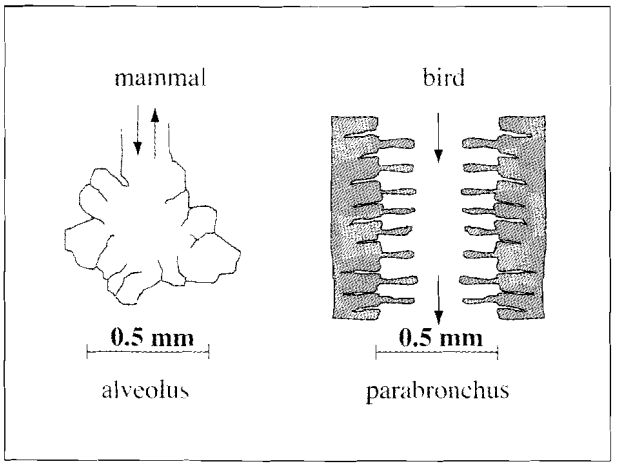


Figure 2

In the bird, inspiration (inhalation) results whenever all the sacs expand and expiration [illegible] results whenever all the sacs contract.

Breathing in the bird consists of pairs of cycles (represented in Figure 3), involving stages (a), [illegible] in order. Figure 3 indicates what happens to a single inhaled breath of radioactively labelled air (sha[illegible] two consecutive breathing cycles.

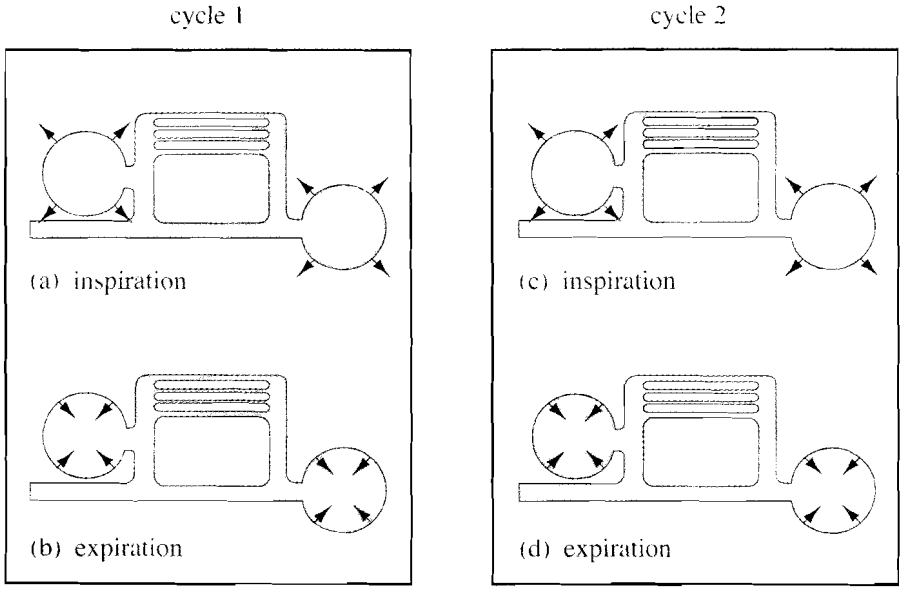


Figure 3

Note: In the human, air from the single trachea passes into the two bronchi—one for each lung—and the bronchi split into fine bronchiole tubes that lead to the alveoli. Air enters the human lungs when the diaphragm is lowered and the rib cage expands, reducing the pressure in the lungs.

42 For the single breath of radioactively labelled air, gas exchange in the bird occurs mainly during stage

A (a).
B (b).
C (c).
D (d).

43 Unlike the human respiratory system, in the respiratory system of the bird

A the lungs are not vascularised.
B the diaphragm operates only during exhalation.
C air gets into the blood by mechanisms not involving diffusion.
D air does not trace the same path during inhalation and exhalation.

44 Which one of the following human structures is most similar in function to the bird's sacs?

A single lung
B diaphragm
C single rib
D trachea

45 Air is exhaled from the bird during

A stage (b) only.
B stage (d) only.
C both stages (b) and (d).
D neither stage (b) nor (d).

46 A large bird and a human, both breathing at a constant rate of 10 inhalations per minute, each begin to inhale radioactively labelled air. Assume that the durations of inhalation and exhalation are equal.

Compared with when it first begins to be exhaled from the bird, radioactively labelled air will first begin to be exhaled from the human

A at the same time.
B three seconds earlier.
C six seconds earlier.
D twelve seconds earlier.

47 Members of which one of the following pairs have the **least** similar function?

	human	*bird*
A	lung	sacs
B	lung	lung
C	alveoli	parabronchi
D	bronchioles	parabronchi

48 According to the information provided, which one of the following is likely to be the most important reason that anterior and posterior sacs contract simultaneously and expand simultaneously?

A to help air flow in the correct directions
B to maintain a high air pressure in the lungs
C so that only one breath of air is in the respiratory system at any one time
D because regulation by the central nervous system generally involves synchrony

Questions 49–51

The activation energy for a reaction, E_a, can be determined from the Arrhenius equation by measuring the constants k_1 and k_2 at two different temperatures T_1 and T_2.

$$2.303 \log_{10}\left(\frac{k_2}{k_1}\right) = \frac{E_a}{R}\left(\frac{T_2 - T_1}{T_1 T_2}\right)$$ where R is the gas constant, 8.31 J mol $^{-1}$ K^{-1}

49 Figure 1 shows the energies of the reactants and the products of a reaction as well as the energy of the transition state that occurs during the reaction.

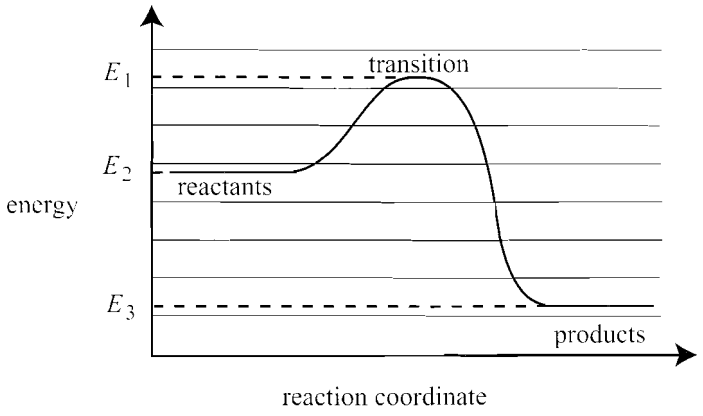


Figure 1

The activation energy is represented in Figure 1 by

A $E_1 - E_2$.
B $E_1 - E_3$.
C $E_2 - E_3$.
D $(E_1 - E_2) - (E_2 - E_3)$.

50 Assume that the rate of a reaction is ten times faster at 32 °C than it is at 22 °C.

The best of the following estimates of the activation energy for this reaction, calculated from the Arrhenius equation, is

A 200 J.
B 2000 J.
C 20 kJ.
D 200 kJ.

51 Assume that the rate of a reaction increases by a factor of 10 when the temperature increases by 3 °C. For a larger temperature increase (from the same initial temperature), the rate of the same reaction is found to increase by a factor of 100.

Which of the following temperature increases would most likely produce a 100-fold increase in the rate of this reaction?

A 6 °C
B 10 °C
C 20 °C
D 30 °C

Questions 52– 54

Figure 1 presents oxygen dissociation curves for blood in muscle capillaries for a range of mammals. Not
Hb represents haemoglobin. The oxygen partial pressure in the capillaries of such mammals is around 40 mm H
whereas the oxygen partial pressure is around 100 mm Hg in their lungs.

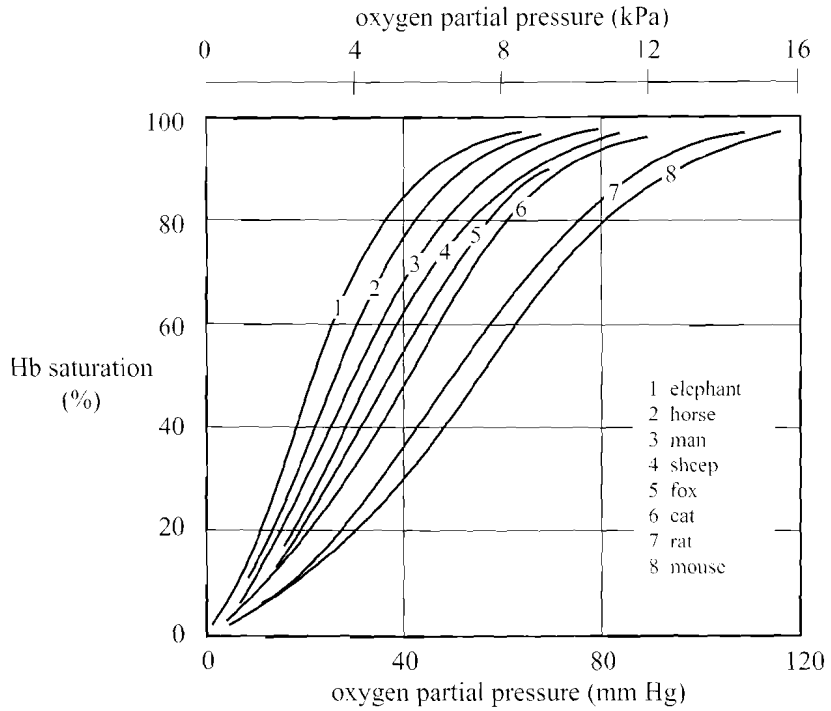


Figure 1

52 In the muscle capillaries of a mammal, the oxygen partial pressure is 40 mm Hg and the Hb saturation is 62%.

Of the following, Figure 1 suggests that this mammal is most likely to be a

A bat.
B wolf.
C camel.
D rabbit.

53 Of the following, Figure 1 is most consistent with the fact that, in general, smaller mammals have

A thicker capillary walls than do larger mammals.
B a more rapid metabolic rate than do larger mammals.
C smaller surface area/volume ratios than do larger mammals.
D capillaries of more variable cross-section area than do larger mammals.

54 In mammals, a haemoglobin molecule consists of four subunits, each of which c[illegible]ygen molecule.

The sigmoid shape of the oxygen dissociation curve indicates that when a fully saturated [illegible] molecule loses oxygen from one subunit

A the Hb binds CO_2 .
B the Hb binds HCO_3 .
C it becomes easier to lose the second and third oxygen molecules.
D it becomes more difficult to lose the second and third oxygen molecules.

UNIT 15

Question 55

55 Consider the movement of some of the constituents of animal cells when the cells are placed in pure water.

Which one of the following is likely to move first and fastest across the cell membrane?

A glucose
B water
C amino acids
D sodium ions

UNIT 16

Question 56

A particular gene regulates the flow of chloride ions through membranes. People who are homozygous for a recessive defective allele of this gene display a disease called cystic fibrosis, which produces the diagnostic sign of high levels of chloride in the sweat.

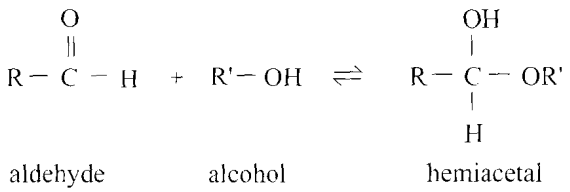
One in twenty Australians is a carrier of the defective allele (i.e. is heterozygous).

56 Which one of the following is the best estimate of the chance that the first child of an Australian couple chosen at random has cystic fibrosis (i.e. is homozygous for the defective allele)?

A $\frac{1}{80}$
B $\frac{1}{400}$
C $\frac{1}{1600}$
D $\frac{1}{6400}$

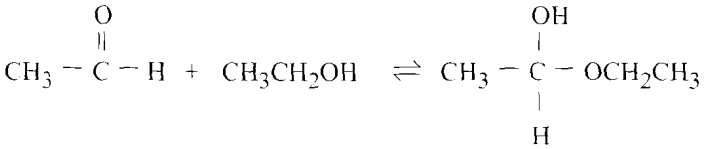
Questions 57– 59

A general reaction of an alcohol with an aldehyde is that of hemiacetal formation, which can be represe follows:



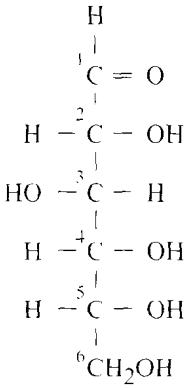
aldehyde alcohol hemiacetal

For example, the following equilibrium mixture forms when acetaldehyde (CH_3CHO) is added to ethanol (CH_3CH_2OH):



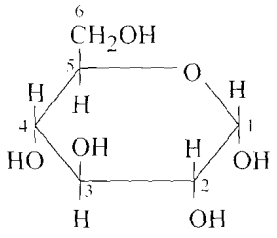
hemiacetal

When the two functional groups needed to make a hemiacetal, the hydroxyl (OH) group and the aldehyde (CHO) group, are in the same molecule, internal addition can take place, leading to the formation of a cyclic hemiacetal. For example, the C5 hydroxyl group of D–glucose (Figure 1) can add to the aldehyde group (CHO) to give a six-membered cyclic hemiacetal (Figure 2).



(aldehyde form)

Figure 1



(hemiacetal)

Figure 2

57 Which one of the following structures represents the hemiacetal that exists at equilibrium of propanal (CH_3CH_2CHO) and ethanol (CH_3CH_2OH)?

A $CH_3\underset{\displaystyle OH}{\underset{|}{C}}HCH_2CH_2CH_2OH$

B $CH_3CH_2\underset{\displaystyle OH}{\underset{|}{C}}HCH_2CH_2OH$

C $CH_3CH_2\underset{\displaystyle OH}{\underset{|}{C}}HOCH_2CH_3$

D $CH_3CH_2CH_2O\underset{\displaystyle OH}{\underset{|}{C}}HCH_3$

58 Which one of the following pairs of compounds can be used to form the hemiacetal

$CH_3CH_2CH_2\underset{\displaystyle OH}{\underset{|}{C}}HOCH_2CH_3$?

A $CH_3CH_2\overset{\displaystyle O}{\overset{\|}{C}}H$ and $CH_3CH_2CH_2OH$

B $CH_3CH_2\overset{\displaystyle O}{\overset{\|}{C}}H$ and $CH_3\underset{\displaystyle OH}{\underset{|}{C}}HCH_3$

C $CH_3CH_2CH_2\overset{\displaystyle O}{\overset{\|}{C}}H$ and CH_3CH_2OH

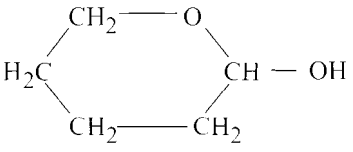
D $CH_3\overset{\displaystyle O}{\overset{\|}{C}}H$ and $CH_3CH_2CH_2CH_2OH$

59 Consider these three molecules

(I) $CH_3OCH_2CH_2OH$

(II) CH_3OCH_2OH

(III)



The hemiacetal structure is found in

A I only.
B II only.
C III only.
D II and III only.

Questions 60 and 61

A circuit for measuring the transfer of charge between two capacitors is shown in Figure 1. The circuit consists of two parts, a left part and a right part, which can be joined at the terminal points X and Y, as indicated. The right part of the circuit contains a capacitor C_2 connected in parallel to a voltmeter with a very high resistance. The left part contains a capacitor C_1.

Suppose C_1 had a capacitance of 0.05 μF and C_2 had a capacitance of 0.1 μF. Initially C_1 was fully charged by connecting it to a 0.4 V battery while C_2 was left uncharged. C_1 was then disconnected from the battery and the two parts joined, allowing charge to transfer from C_1 to C_2.

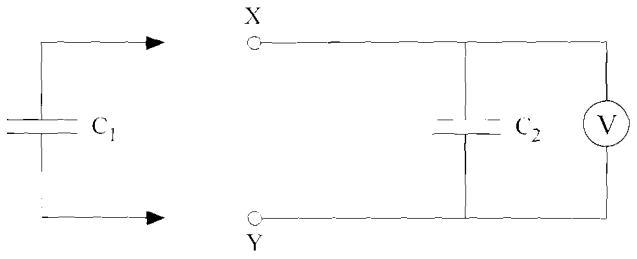


Figure 1

The charge on a capacitor, Q, can be determined from the formula $Q = CV$.

60 After being fully charged, and before the two parts were joined, C_1 carried a charge of

A 2×10^{-8} C.
B 1×10^{-7} C.
C 8×10^{-6} C.
D 1×10^{-5} C.

61 The percentage of charge that was transferred from C_1 to C_2 after the two parts were joined was closest to

A 30%.
B 50%.
C 70%.
D 90%.

Questions 62 and 63

Consider a method for determining the concentration of bilirubin in a sample of serum which also co haemoglobin.

In this method the absorbance values of the serum at 455 nm or 575 nm due to both bilirubin and haemoglobin are measured. Two equations are required to express the effect of both pigments.

$$A_{455} = (K_{b455} \times C_b) + (K_{h455} \times C_h) \qquad (1)$$

$$A_{575} = (K_{b575} \times C_b) + (K_{h575} \times C_h) \qquad (2)$$

where

C_b is the concentration of bilirubin in the sample;
C_h is the concentration of haemoglobin in the sample;
A_{455} and A_{575} are the absorbances at 455 and 575 nm; and
K_{b455}, K_{b575}, K_{h455} and K_{h575} are the absorption constants of bilirubin and haemoglobin solutions at 455 and 575 nm, respectively.

Let the constants have the following values:

$K_{b455} = 0.80$
$K_{b575} = 0.01$
$K_{h455} = 0.01$
$K_{h575} = 0.01$

Assume C_b and C_h have units of mg/100 mL.

62 For A_{455} to equal A_{575}

A $C_h = 80C_b$.
B $C_b = 80C_h$.
C $C_h = 0$.
D $C_b = 0$.

63 In order to determine the concentration of bilirubin, as well as measuring absorbance at 455 nm, the absorbance is measured at 575 nm because

A bilirubin absorbs strongly at this wavelength.
B haemoglobin absorbs strongly at this wavelength.
C bilirubin absorbs equally at this wavelength and at 455 nm.
D haemoglobin absorbs equally at this wavelength and at 455 nm.

Questions 64–67

Figure 1 outlines the cascade of reactions that occurs to produce a blood clot that stops blood flow from a
Note the different arrows (see the Key) relating to:

- conversion of one substance to another; and
- activation of a reaction (except when there is negative feedback, in which case inhibition occurs).

A – sign in a circle associated with an arrow means positive (stimulatory) feedback.

A – sign in a circle associated with an arrow means negative (inhibitory) feedback.

Factors V and VIII are actually cofactors, each of which helps another factor to do its job.

In the figure, the involvement of factor V or factor VIII is signalled by a '+' sign (e.g. + factor V).

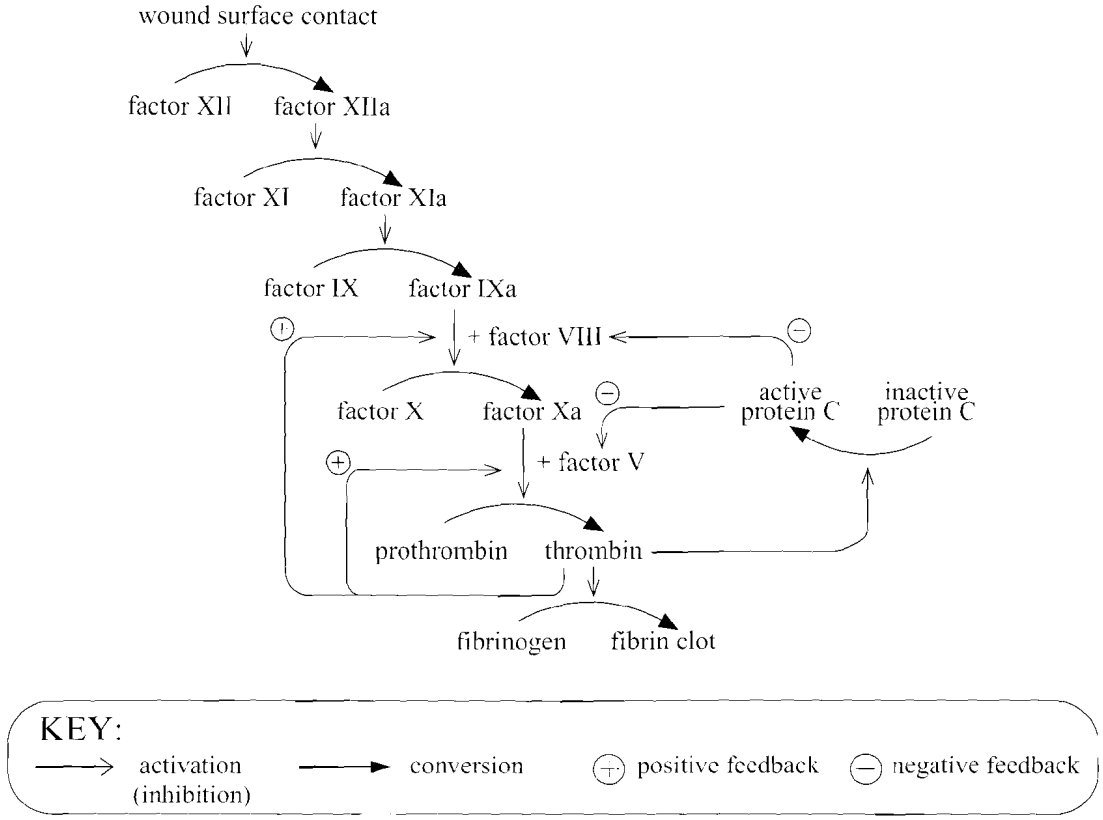


Figure 1

64 Which one of the following is a precursor for (i.e. a substance that is converted to) facto

A active protein C
B factor Xa
C thrombin
D neither **A** nor **B** nor **C**

65 Which one of the following is the most likely role of factor VIII?

A It enhances of the activity of factor IXa.
B It helps in the conversion of factor IXa to factor Xa.
C It is a cofactor for the conversion of factor IX to factor X.
D It provides positive feedback for the factor X to factor Xa reaction.

66 From when the wound surface contact begins, which one of the following is likely to first occur after the longest period of time?

A conversion of fibrinogen to fibrin clot
B the effect of negative feedback
C the effect of positive feedback
D activation of protein C

67 In biological regulatory mechanisms, positive feedback

A is a more useful mechanism than negative feedback.
B usually occurs in the absence of negative feedback.
C is unlikely to occur in the absence of negative feedback.
D is likely to occur in all the same pathways as negative feedback.

Questions 68–70

Four hundred millilitres (mL) of a strong brine solution at room temperature was poured into a measuring
(Figure 1). A piece of ice of mass 100 g was then gently placed in the brine solution and allowed to float
(Figure 2). Changes in the surface level of the liquid in the cylinder were then observed until all the ice
melted.

Assume that the densities of water, ice and the brine solution are 1000 kg m^{-3}, 900 kg m^{-3} and 1100 kg m^{-3}, respectively.

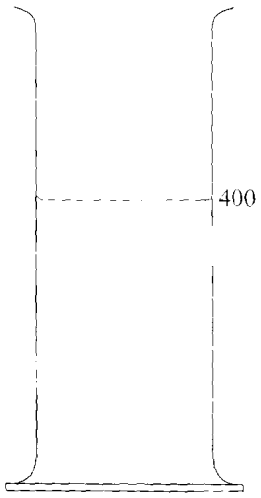


Figure 1

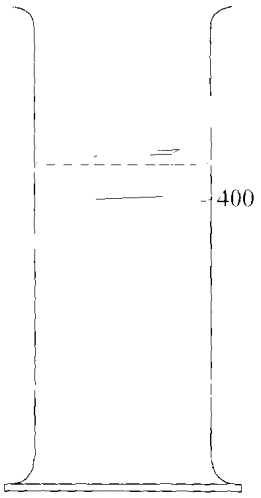


Figure 2

68 After the ice was placed in the brine solution and before any of it had melted, the level of the brine solution was closest to

A 485 mL .
B 490 mL .
C 495 mL .
D 500 mL .

69 The level of the brine solution after all the ice had melted was

A 490 mL .
B 495 mL .
C 500 mL .
D 505 mL .

70 Suppose water of the same volume and temperature had been used instead of the brine solution.

In this case, by the time all the ice had melted, the water level would have risen by

A 90 mL .
B 95 mL .
C 100 mL .
D 105 mL .

Question 71

Consider the following equation relating to temperature regulation in a typical mammal:

$$H_{tot} = \pm H_c \pm H_r \pm H_e \pm H_s$$

in which

H_{tot} = metabolic heat production (always positive)

H_c = conductive and convective heat exchange (+ for net loss)

H_r = net radiation heat exchange (+ for net loss)

H_e = evaporative heat loss (+ for net loss)

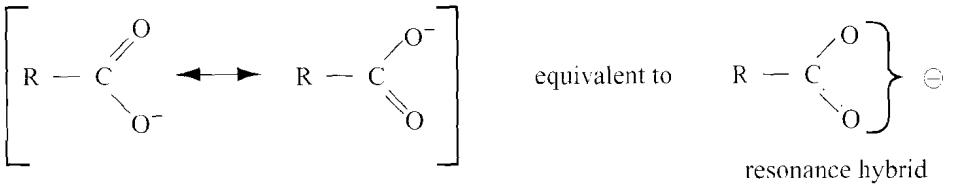
H_s = storage of heat in the body (+ for net heat gain by body)

71 Which one of the following responses could the body make to decrease the body temperature of a person in a hot Turkish bath where ambient temperature is 40 °C and the air is fully saturated?

A increasing H_e
B increasing H_c
C increasing H_{tot}
D none of the above

Questions 72–74

Sometimes it is possible to write more than one arrangement of valence electrons around a group of atoms to give structures of equal or comparable stability. For example, two equivalent structures could be written for the carboxylate ion as shown below.



The phenomenon that necessitates more than one arrangement of the electrons in a molecule to be written is called *resonance*. Resonance is indicated by a *double-headed arrow* (◄——►) between the contributing structures. The carboxylate ion is said to be a resonance hybrid of two structures.

The following rules may be applied in writing resonance structures:

I Only electrons may be shifted to adjacent atoms or bond positions.

II Resonance structures in which an atom carries more than its quota of electrons are not contributors to the real structures.

III The more important resonance structures show each atom with a complete octet and with as little charge separation as possible.

72 Which one of the following presents a pair of resonance structures?

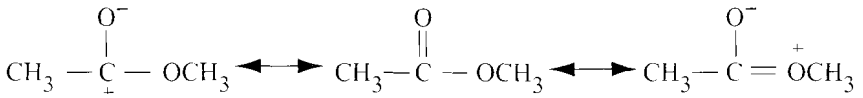
A $CH_3-C(OH)=CH_2$ and $CH_2=C(OH)-CH_3$

B $CH_3-C(=O)-CH_3$ and $CH_2=C(OH)-CH_3$

C $CH_3-C(=\overset{+}{O}H)-CH_3$ and $CH_3-\overset{+}{C}(OH)-CH_3$

D $CH_3-C(=O)-\bar{C}H_2$ and $\bar{C}H_2-C(=O)-CH_3$

73 Consider the resonance structures I, II and III shown below.

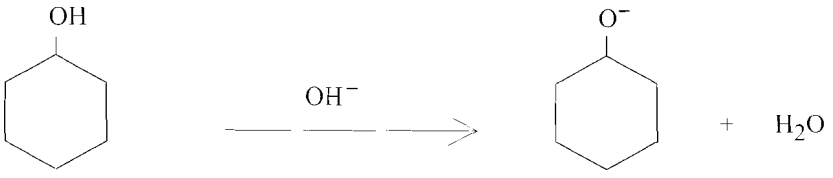


I II III

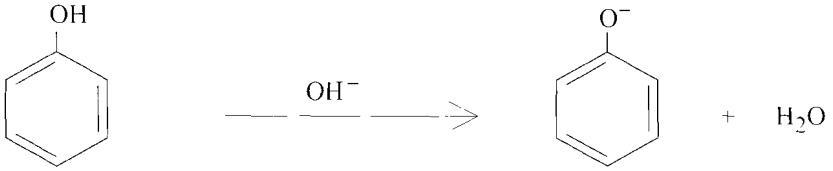
Which one is the major contributor to the real structure?

A I
B II
C III
D they contribute equally

74 Consider the following two reactions:



cyclohexanol $K_a \simeq 10^{-18}$ cyclohexoxide ion



phenol $K_a = 1.3 \times 10^{-10}$ phenoxide ion

Which one of the following best explains why phenol is a much stronger acid than cyclohexanol?

A The phenoxide ion is a monocyclic aromatic.
B The phenoxide ion is less stable than the cyclohexoxide ion.
C The negative charge on the phenoxide ion is delocalised over the benzene ring.
D A phenoxide ion is more soluble in a hydroxide solution than is a cyclohexoxide ion.

Questions 75 and 76

Experiments show that when a charged body is suspended in a suitable hollow uncharged conductor by a [illegible] which is an electrical insulator, charges are induced on the inner and outer surfaces of the conductor.

Figure 1 illustrates a nested arrangement of four cylindrical conductors (seen side-on in cross-section) in whic[illegible] the cylinders are separated by electrical insulators. A body carrying a charge of $-Q$ is suspended in the smallest cylinder.

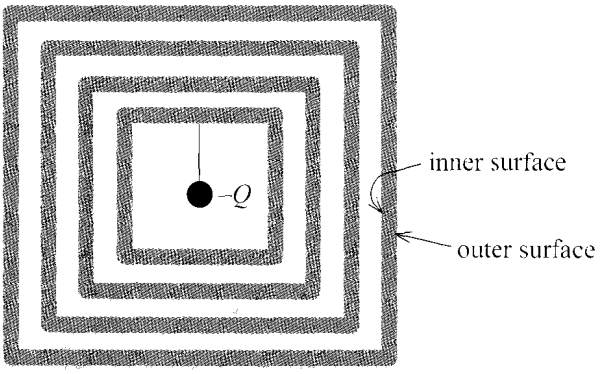


Figure 1

75 The induced charge on the outer surface of the smallest cylinder is

A equal to $+Q$.
B between 0 and $+Q$.
C between $-Q$ and 0.
D equal to $-Q$.

76 The induced charge on the outer surface of the largest cylinder is

A equal to $+Q$.
B between 0 and $+Q$.
C between $-Q$ and 0.
D equal to $-Q$.

Questions 77 and 78

The rate of a chemical reaction is defined as the change in concentration of a reactant or a product per unit ti the compound Q is one of the reactants then

$$\text{rate} = k\,[\text{Q}]^n \text{ where } k \text{ is the rate constant and } n \text{ is the order of the reaction.}$$

The order of the reaction can only be found experimentally. If $n = 2$, the reaction is said to be a *second order* reaction. For a second order reaction, the relationship between the concentration of Q at the start of the reaction, $[\text{Q}]_0$, to its concentration at any other time t, $[\text{Q}]_t$, is

$$\frac{1}{[\text{Q}]_t} = kt + \frac{1}{[\text{Q}]_0}$$

77 The following data were collected for the reaction $\text{X} + \text{Y} \rightarrow \text{P}$.

Experiment number	[X] moles per litre	[Y] moles per litre	Initial rate M min^{-1}
1	0.10	0.10	0.20
2	0.10	0.20	0.40
3	0.20	0.20	1.60

The rate law for this reaction is

A rate = $k\,[\text{X}]^2$.
B rate = $k\,[\text{X}]\,[\text{Y}]$.
C rate = $k\,[\text{X}]\,[\text{Y}]^2$.
D rate = $k\,[\text{X}]^2\,[\text{Y}]$.

78 The initial concentration of compound T is 0.100 M. Its reaction rate is second order with the value of the rate constant, k, being 4×10^{-1} M^{-1} min^{-1}.

The time taken for the concentration of T to be reduced to 0.050 M is

A 2.5 minutes.
B 5.0 minutes.
C 25 minutes.
D 50 minutes.

Questions 79–82

Sleeping sickness—a disease endemic in Africa—is transmitted to a mammalian host via a bite from a ts
The bite transfers the pathogenic microorganism *Trepanosoma brucei* (trypanosomes) which lives in the
blood. Typically, in the host there occur stages when there are high levels of trypanosomes in the blood (producin
severe symptoms) and stages when there are few trypanosomes in the blood (producing milder symptoms).

In an experiment, tsetse flies carrying trypanosomes bit rabbits, infecting them (for the first time). Blood samples were taken from the rabbits over the next 22 days. Special techniques were used to separate from each blood sample:

(i) a fixed quantity of plasma; and

(ii) all the trypanosomes present in a fixed quantity of whole blood (i.e. plasma plus blood cells).

Figure 1 summarises the antibody–antigen reactions that occurred between (i) the plasma collected each day and (ii) the trypanosomes from whole blood collected on certain days (i.e. days 3, 4, 5, 7, 9, 11 and 14).

The degree of reaction between antibodies in the plasma and antigens on the surface of the trypanosomes is given by the *agglutination titre*. The greater the specific antibody reaction by antibodies in the plasma against the antigens on trypanosomes, the greater the titre. For example, when day 11 plasma was mixed with day 11 trypanosomes there was no antibody reaction (titre = 0), but when day 20 plasma was mixed with day 11 trypanosomes there was a strong reaction (titre greater than 1280).

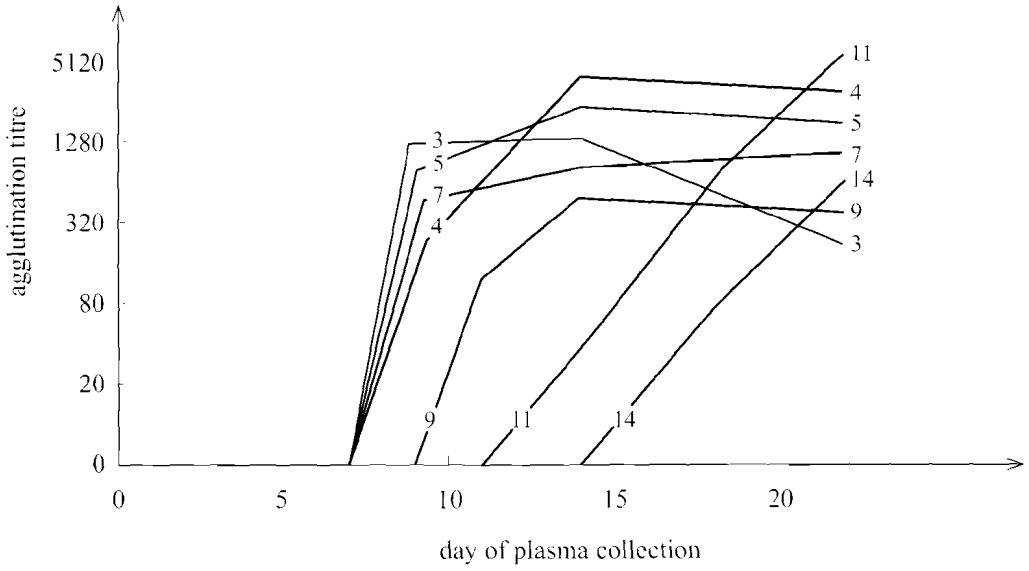


Figure 1

79 Antibody to trypanosomes most likely first appeared in rabbit blood on day

A 1 .
B 3 .
C 4 .
D 7 .

80 Figure 1 indicates that on day 15 the rabbit had the greatest immunity against

A day 1 trypanosomes.
B day 4 trypanosomes.
C day 11 trypanosomes.
D day 14 trypanosomes.

81 The reaction between day 3 trypanosomes and the plasma collected from the rabbits on progressive days (from 7 to 9 inclusive) increased because

A the level of rabbit plasma antigen increased.
B trypanosomes increasingly produced more antibody.
C the level of antigen on day 3 trypanosomes increased.
D antibody against trypanosomes increasingly appeared in the rabbits' blood.

82 According to all the evidence provided, which one of the following best explains the alternation between episodes of severe and mild symptoms of sleeping sickness?

A The rabbit's immune system is damaged by trypanosomes.
B Trypanosomes evolve to become resistant to the antibiotics used against them.
C The antigens on the trypanosomes in the rabbits' blood change from time to time.
D When ill, the victim of sleeping sickness is periodically infected by new pathogenic microbes.

Questions 83–86

Chemists sometimes represent three-dimensional tetrahedral structures (Figure 1(a)) with two-dimen diagrams called Fischer projections (Figure 1(b)). By convention, the vertical lines represent bonds going into page and the horizontal lines represent bonds coming out of the page.

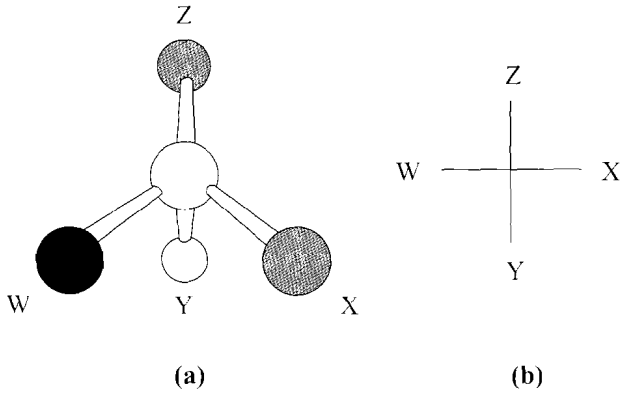


Figure 1

To determine if two Fischer projections are superimposable, one can be rotated and compared to the other. Two types of rotation that will retain the overall arrangement of the molecule are

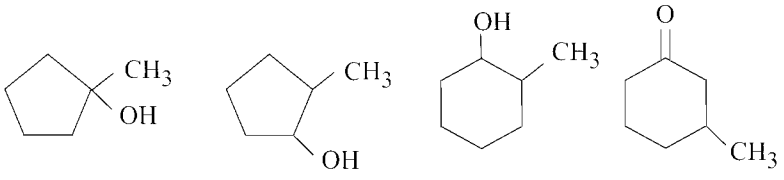
- the whole projection is rotated 180° and
- one atom or group is fixed and the positions of the other three groups in the Fischer projection are rotated (clockwise or anticlockwise).

A carbon atom bonded to four different atoms or groups is called a *chiral* carbon. The arrangement of the atoms or groups can be designated *R* or *S* according to the following rules.

(i) The atoms bonded onto the chiral carbon are given a priority in the order of their atomic numbers; the higher the atomic number, the higher the priority. (If two or more atoms bonded to the chiral carbon are identical, priority is determined by referring to the next atom in each of the groups.)

(ii) The molecule is observed from the side opposite the atom or group with the lowest priority. If the order of the other three atoms or groups in decreasing priorities is clockwise, the arrangement is designated *R*; if anticlockwise, the arrangement is designated *S*.

83 For the compounds I, II, III and IV,



I **II** **III** **IV**

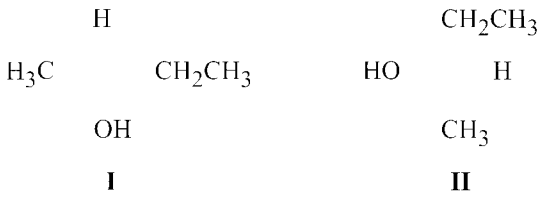
those that have chiral carbons are

A I and II only.
B I, III and IV only.
C II, III and IV only.
D I, II, III and IV.

84 Which one of the following correctly lists the groups or atoms in order of decreasing priority?

A $-CH=CH_2 > -C(CH_3)_3$
B $-OH > -CHO$
C $-CH_2Br > -Br$
D $-CH_3 > -NH_2$

85 Which one of the following statements is true about the Fischer projections of compounds I and II shown below?

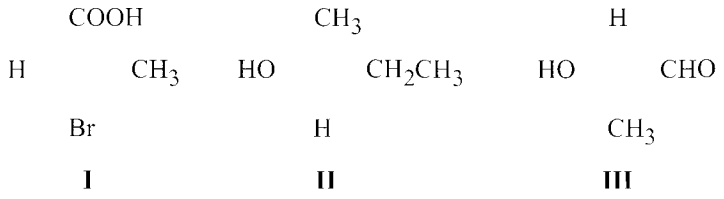


I **II**

Compounds I and II

A are superimposable on each other.
B are mirror images of each other.
C are not related to each other.
D each have more than one chiral carbon.

86 Consider the Fischer projections of the following three compounds I, II, and III.



I **II** **III**

The *S* configuration is found in

A I only.
B II only.
C III only.
D I and II only.

Questions 87–91

When a cockroach walks or runs, flexor muscles contract to bend each leg so that it can swing forward (*swing phase*) and, *alternately*, extensor muscles contract to straighten each leg so that it pushes backwards against the ground (*stance phase*), forcing the animal forward. When the animal moves at a given speed, all the legs have the same stance phase duration and all the legs have the same swing phase duration, but not all the legs are in the same phase.

Figure 1 is a model that attempts to account for the observations described above. The *flexor burst-generator* for a leg is proposed to be a group of nerve cells that acts like a pacemaker, firing periodically even without CNS stimulus. *Cuticle stress-receptors* are active when there is a significant load on the leg, such as occurs when the leg is pushing against the ground. Impulses from the *hair receptors* become significant as the swing phase nears completion.

Points (P–Y) are indicated on various nerves/pathways involved.

Answer the following questions according to the model and information presented.

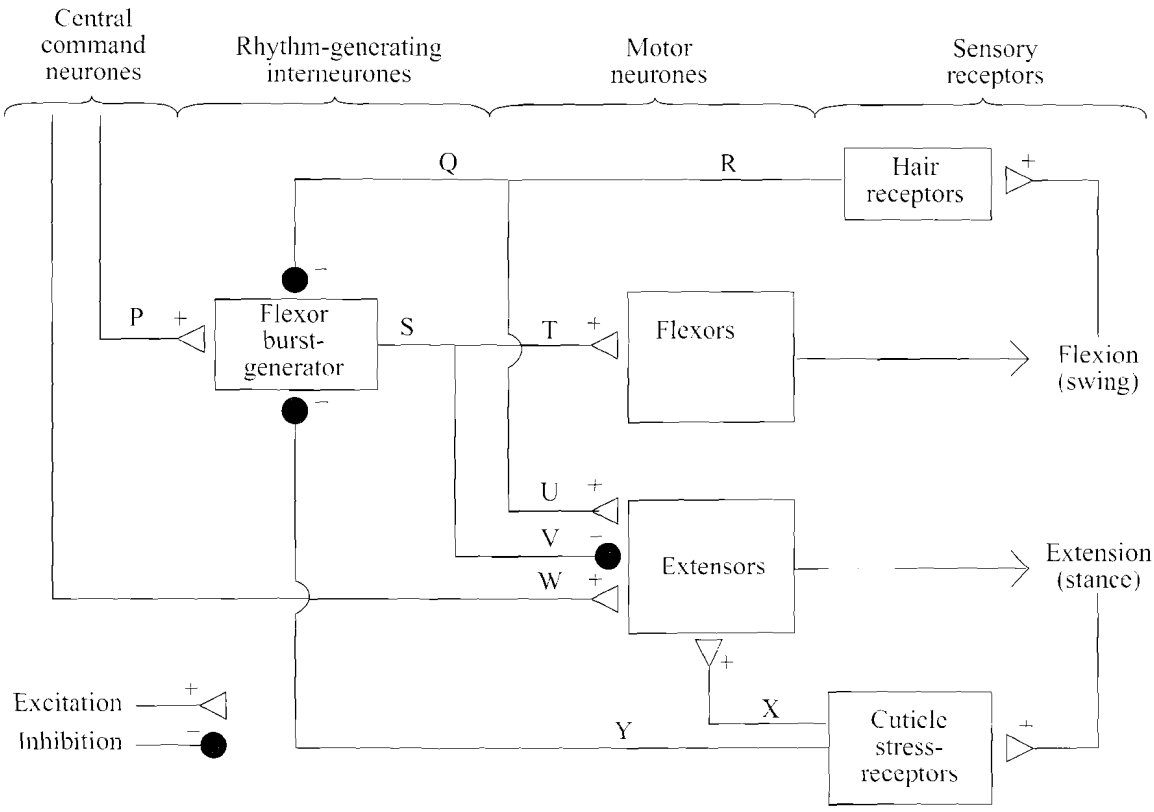


Figure 1

Note: The swing phase corresponds to the time when the foot is off the ground. The stance phase starts when a foot returns to the ground and finishes when the foot leaves the ground once again.

87 Of the following, the element(s) that most directly trigger(s) a switch from swing to st

A cuticle stress-receptors.
B hair receptors.
C flexors.
D flexor burst-generator.

88 When the central command neurones are stimulating the flexor burst-generator during the swing phas impulses travel past point S, which of the following would be active?

The nerve(s)/pathway marked at

A T only.
B Y only.
C T and V only.
D T, V and Y.

89 Of the following situations, nerve impulses pass point S at the most frequent rate

A when impulses from the cuticle stress-receptors are most frequent.
B when impulses from the hair receptors are most frequent.
C in the middle of the stance phase.
D in the middle of the swing phase.

90 If the nerve(s)/pathway were cut through at point W, extension could

A not be initiated.
B not produce stance.
C be initiated and terminated.
D be initiated but not terminated.

91 The load is removed from a leg at the end of the stance phase.

Of the following, the most immediate increase in the rate at which impulses travel past a point occurs at

A X .
B Y .
C U .
D V .

Questions 92 and 93

When the sparingly soluble ionic solid, CaF_2, is added to water to give a saturated solution, the following equ exists between the undissolved compound and its ions in solution.

$$CaF_2(s) \rightleftharpoons Ca^{2-}(aq) + 2\ F^-(aq) \qquad (1)$$

The equilibrium expression for the reaction is

$$\frac{[Ca^{2+}][F^-]^2}{[CaF_2]} = K_{eq} \qquad (2)$$

Since the concentration of a substance in its pure solid phase is a constant, expression (2) will simplify to

$$[Ca^{2-}][F^-]^2 = K_{eq}[CaF_2] = Ksp \qquad (3)$$

where K_{sp} represents the product of two constant terms, K_{eq} and $[CaF_2]$, and is called the *solubility product constant*.

As with all such reactions, K_{sp} of a salt is the product of the molar concentrations of the ions in saturated solution, each concentration raised to a power that equals the number of ions obtained from one formula unit of the salt.

92 The F^- ion of CaF_2 is a weak base; it is the conjugate base of the weak acid HF.

As a result, CaF_2 is more soluble in

A acidic solution.
B neutral solution.
C strongly basic solution.
D weakly basic solution.

93 A solution of NaF is added to a solution that contains equimolar concentrations each of BaF_2, SrF_2 and MgF_2 ions.

Given the following solubility products at 25 °C, what will be the order of precipitations?

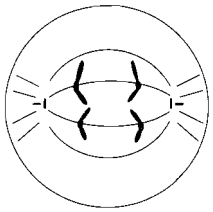
Compound	K_{sp}
BaF_2	1.7×10^{-6}
SrF_2	2.5×10^{9}
MgF_2	7.9×10^{-8}

A BaF_2 then SrF_2 then MgF_2
B BaF_2 then MgF_2 then SrF_2
C SrF_2 then MgF_2 then BaF_2
D SrF_2 then BaF_2 then MgF_2

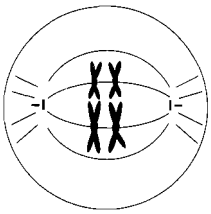
Question 94

94 Which one of the following represents the latest stage in the meiotic division of a diploid cell whose nucleus usually contains four chromosomes (i.e. 2n = 4)?

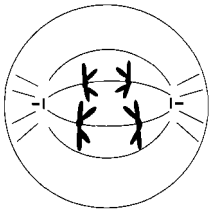
I



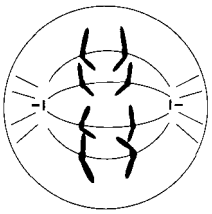
II



III



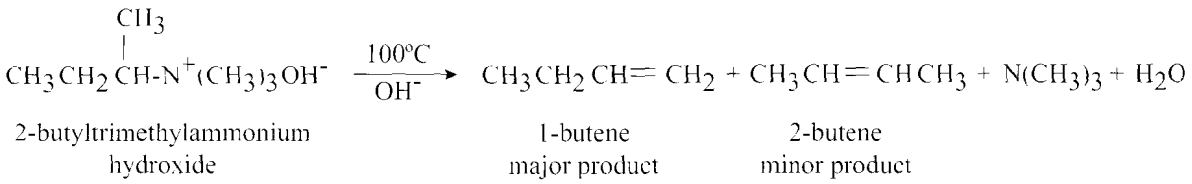
IV



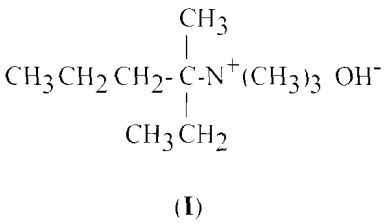
A I
B II
C III
D IV

Questions 95–98

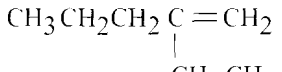
The choline ion, $(CH_3)_3N^+CH_2CH_2OH$, is involved in the transmission of nerve impulses in the aut nervous system in humans. It is called a quaternary ammonium ion as the nitrogen atom has four organic g attached to it. Like all quaternary ammonium ions, choline forms an alkene when heated in the presence hydroxide ions. The alkene formed in the greatest proportion is the one that is **least** substituted with alkyl groups. For example, heating 2-butyltrimethylammonium hydroxide will produce much more 1-butene than 2-butene.



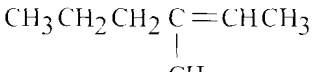
95 Consider trimethyl(3-methyl-3-hexyl) ammonium hydroxide (**I**).
Three possible alkenes that it could produce when heated with a base would be 2-ethyl-1-pentene (**II**), 3-methyl-2-hexene (**III**) and 3-methyl-3-hexene (**IV**).



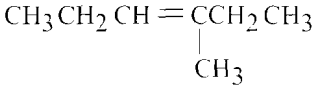
(I)



(II)



(III)



(IV)

The major product is most likely to be

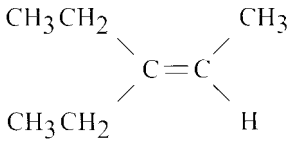
A (**II**).
B (**III**).
C (**IV**).
D (**III**) and (**IV**) equally.

96 The only alkene produced when choline hydroxide is heated with a base would be hydroxyethylene ($CH_2 = CHOH$) but it immediately rearranges to form acetaldehyde, CH_3CHO.

The reason that only the one alkene would be produced is because

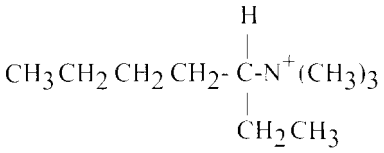
A the other three alkyl groups attached to the nitrogen atom are all the same.
B ethylenes do not exist in isomeric forms and so only one structure is possible.
C the other three alkyl groups attached to the nitrogen atom each have one carbon atom.
D the functional group (OH) in choline is extremely basic, like the reaction conditions.

97 The major hydrocarbon product formed when a certain quaternary ammonium ion is he… e is

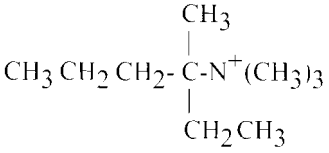


The structure of the quaternary ammonium ion that could give this as the major product is

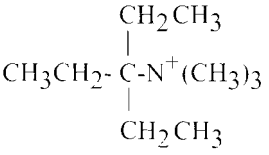
A



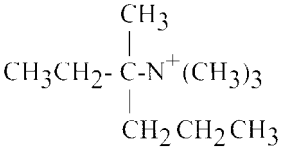
B



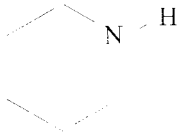
C



D



98 The cyclic amine, piperidine, can be converted into a quaternary ammonium salt and then heated with an excess of a strong base.

piperidine 

If this reaction is allowed to proceed to completion, the major hydrocarbon product obtained is most likely to be

A cyclopentane.
B 1-pentene.
C 1-pentyne.
D none of **A** or **B** or **C**.

Questions 99–101

An equation of state that has been used to model the behaviour of a fixed amount of a real gas is

$$\left(P + \frac{a}{V^2}\right)(V - b) = ZT$$

In the equation, Z, a and b are constants, and P represents pressure, V represents volume, and T represents temperature. The constant Z depends on the amount of gas.

Consider what the dimensions of a and b are in terms of the fundamental quantities of mass (M), length (L) and time (T).

99 The dimensions of b are

A L^3.
B L^6.
C $M L^{-1} T^{-2}$.
D $M^{-1} L T^2$.

100 The dimensions of a are

A L^6.
B $M L^5 T^{-2}$.
C $M L^{-1} T^{-2}$.
D $M L^{-5} T^{-1}$.

101 The value of the constant Z could be expressed in terms of the unit

A W.
B $W N s^{-1}$.
C $N J K^{-1}$.
D $J K^{-1}$.

Questions 102 and 103

When any physical or chemical change occurs, it can be described using three thermodynamic quantities: the change in Gibbs free energy (ΔG), the change in enthalpy (ΔH), and the change in entropy (ΔS). The relationship between these three quantities is given by the equation

$$\Delta G = \Delta H - T\,\Delta S$$

where T is the temperature (in Kelvin).

102 For the change that occurs when steam condenses,

A both ΔS and ΔH are positive.
B both ΔS and ΔH are negative.
C ΔS is positive and ΔH is negative.
D ΔS is negative and ΔH is positive.

103 The oxidation of mercury can be expressed by the equation

$2\ Hg\ (l) + O_2\ (g) \rightarrow 2\ HgO\ (s)$ ($\Delta H = -91$ kJ and $\Delta S = -172\ J\ K^{-1}$)

This reaction

A may occur spontaneously at any temperature.
B will not occur spontaneously no matter what the temperature.
C may only occur spontaneously for temperatures above a certain minimum value.
D may only occur spontaneously for temperatures below a certain maximum value.

Questions 104 and 105

Figure 1 indicates the effect on the normal bacterial population in the digestive system of a bluebottle fly (*C. vicina*) maggot of a drenching with Salmonella bacteria (*S. typhimurium*). The lower line (I) on the figure indicates the size of the introduced Salmonella population and the upper line (II) indicates the size of the whole bacterial population in the digestive system of the developing fly.

The normal bacterial population in the digestive system of the fly does not contain significant numbers of Salmonella.

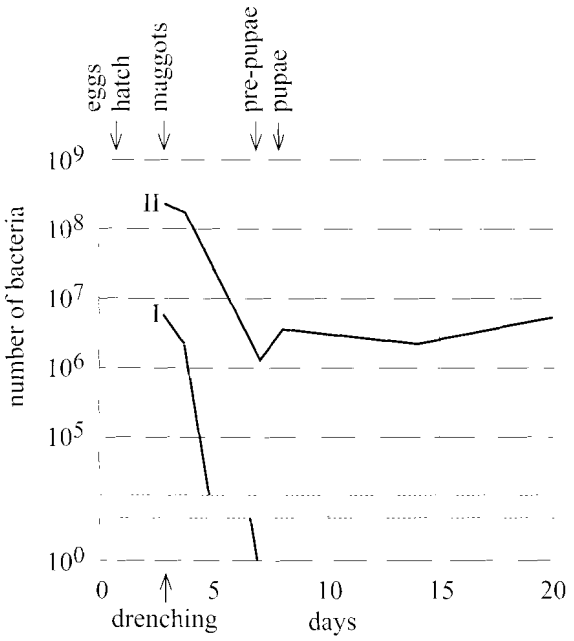


Figure 1

104 Of the following. the greatest decline in Salmonella numbers occurs during the

A fourth day.
B fifth day.
C sixth day.
D seventh day.

105 Which one of the following is the best estimate of the reduction in the size of the normal bacterial population between drenching and day 7?

A 100
B 10 000
C 1 000 000
D 100 000 000

Questions 106 –108

The rate at which gas molecules diffuse to fill a volume can be determined by *Graham's Law of Diffusion*. It states that 'the rate of diffusion of a gas is inversely proportional to the square root of its density if the conditions of temperature and pressure are constant'.

$$D \propto \frac{1}{\sqrt{d}}$$

where D is the rate of diffusion of a gas and d is the density of that gas.

106 As the densities of neon and krypton at standard temperature and pressure are 0.90 kg m^{-3} and 3.74 kg m^{-3} respectively, then the rate of diffusion of neon is about

A one-quarter of the rate of diffusion of krypton.
B one-half of the rate of diffusion of krypton.
C twice the rate of diffusion of krypton.
D four times the rate of diffusion of krypton.

Questions 107 and 108 refer to the following additional information:

Effusion is the passing of a gas out through a very small hole in its container. The rate of effusion obeys the same law as the rate of diffusion. However, the rate of effusion is easier to measure as it is inversely proportional to the time taken for a known volume to be released.

107 Two gases, X and Y, have densities of d_X and d_Y respectively, both measured at the same temperature and pressure. Each gas is placed, in turn, into a suitable apparatus and the time taken for a certain volume to be released is measured.

If the time taken to release a certain volume of gas X is t_X and the time taken to release the same volume of gas Y is t_Y, then the ratio $\frac{t_X}{t_Y}$ is

A $\sqrt{\frac{d_X}{d_Y}}$
B $\sqrt{\frac{d_Y}{d_X}}$
C $\frac{d_X}{d_Y}$
D $\frac{d_Y}{d_X}$

108 At a certain temperature and pressure, 50 mL of a gas whose molecular formula is unknown took 250 seconds to pass through a small hole. Under precisely the same conditions, 50 mL of argon took 100 seconds to pass through the same hole.

If the atomic mass of argon is 40, then the molar mass of the unknown gas is

A 16 .
B 40 .
C 100 .
D 250 .

Questions 109 and 110

Three small identical metal spheres carry electric charges, $+Q$, $+2Q$, and $+3Q$. The centres of the spheres lie in a straight line at fixed positions R, S and T, such that the distance between the spheres at R and S is d_1 and that between the spheres at S and T is d_2 (Figure 1). Assume that the distances between the spheres is large in comparison with their size, and that the charges on the spheres act like point charges.

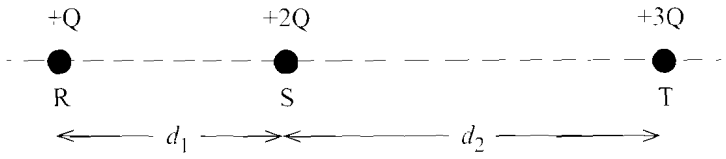


Figure 1

109 The sphere at S will experience a zero net electric force when d_2 is equal to

A $3d_1$.

B $\frac{d_1}{3}$

C $\sqrt{3}\, d_1$.

D $\frac{d_1}{\sqrt{3}}$

110 A small metal sphere (identical to those at R, S, T) carrying a charge of $-2Q$ is first brought into contact with the sphere at R, and then into contact with the sphere at S, and finally into contact with the sphere at T.

After making contact with the three spheres, in the stated order, the charge on the sphere at T is

A $+3Q$.

B $+\frac{15Q}{4}$.

C $+\frac{15Q}{8}$.

D $+4Q$.

5 Notes on Assessment of Written Commun

The Written Communication section of GAMSAT is a test of the ability to produce and develop ideas

It involves two thirty-minute writing tasks. Each task offers a number of ideas relating to a common them theme will be general rather than specific in nature. The first task deals with socio-cultural issues while the sec deals with more personal and social issues. In selecting topics for the writing tasks every effort is made to minimis factors which might disadvantage candidates from non-English-speaking backgrounds.

Performances on the Written Communication section of GAMSAT are assessed against the criteria shown below. Markers take into account both the quality of a candidate's thinking about a topic and the control of language demonstrated in the development of a piece of writing. Although both these factors are important, more emphasis is given to generative thinking (thought and content) than to control of language (organisation and expression).

Candidates are not assessed on the 'correctness' of the ideas or attitudes they display.

CRITERIA FOR THE ASSESSMENT OF GAMSAT WRITING

THOUGHT AND CONTENT

(the quality of what is said)

- what is made of and developed from the task
- the kinds of thoughts and feelings offered in response to the task

ORGANISATION AND EXPRESSION

(the quality of the structure developed and the language used)

- the shape and form of the piece
- the effectiveness and fluency of the language

6 Answers to Multiple Choice Questions

Reasoning in Humanities and Social Sciences

1	D	21	D	41	C	61	C
2	C	22	A	42	B	62	A
3	C	23	B	43	D	63	D
4	C	24	C	44	B	64	C
5	D	25	A	45	D	65	A
6	C	26	D	46	C	66	C
7	B	27	A	47	A	67	C
8	A	28	C	48	C	68	A
9	C	29	B	49	C	69	B
10	C	30	C	50	C	70	D
11	A	31	D	51	B	71	C
12	D	32	C	52	C	72	A
13	C	33	B	53	D	73	A
14	B	34	A	54	D	74	C
15	A	35	A	55	C	75	C
16	B	36	B	56	A		
17	B	37	B	57	A		
18	B	38	D	58	B		
19	C	39	B	59	A		
20	C	40	A	60	C		

Reasoning in Biological and Physical Sciences

1	D	29	B	57	C	85	A
2	A	30	C	58	C	86	D
3	D	31	D	59	D	87	B
4	A	32	A	60	A	88	C
5	B	33	D	61	C	89	D
6	C	34	C	62	D	90	C
7	B	35	D	63	D	91	D
8	D	36	B	64	D	92	A
9	C	37	D	65	A	93	C
10	C	38	C	66	B	94	A
11	B	39	C	67	C	95	A
12	A	40	B	68	B	96	B
13	A	41	C	69	C	97	C
14	A	42	B	70	C	98	D
15	C	43	D	71	D	99	A
16	B	44	B	72	C	100	B
17	D	45	C	73	B	101	D
18	A	46	C	74	C	102	B
19	A	47	A	75	D	103	D
20	C	48	A	76	D	104	A
21	C	49	A	77	D	105	D
22	A	50	D	78	C	106	C
23	D	51	A	79	D	107	A
24	B	52	B	80	B	108	D
25	B	53	B	81	D	109	C
26	D	54	C	82	C	110	C
27	D	55	B	83	C		
28	D	56	C	84	B		