University of Cambridge Local Examinations Syndicate

Biomedical Admissions Test

Wednesday   3 November 2004   Morning   One hour

SECTION 1   Aptitude and Skills

Instructions to Candidates

Please read this page carefully, but do not open the question paper until you are told that you may do so.

A separate answer sheet is provided for this section. Please check you have one. You also require a soft pencil and an eraser.

Please first write your name, date of birth, Biomedical Admissions Test candidate number and centre number in the spaces provided on the answer sheet. Please write very clearly.

Please also write your BMAT candidate number in the spaces below.

BMAT Candidate Number

Speed as well as accuracy is important in this section. ***Work quickly, or you may not finish the paper.*** There are no penalties for incorrect responses, only points for correct answers, so you should attempt all 35 questions. Unless otherwise stated, all questions are worth one mark.

Answer on the sheet provided. Many questions ask you to show your choice between options by shading a circle (or circles, if specified in the question). If questions ask you to write in words or numbers, be sure to write clearly in the spaces provided. If you make a mistake, erase thoroughly and try again.

Any rough work should be done on this question paper.

Calculators are NOT permitted.

Please wait to be told you may begin before turning this page.

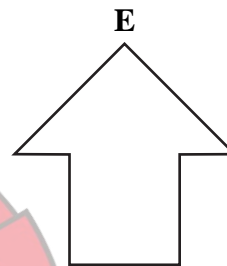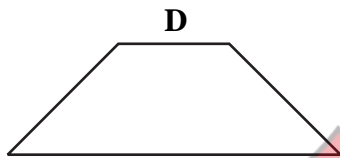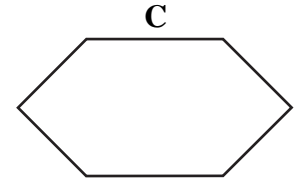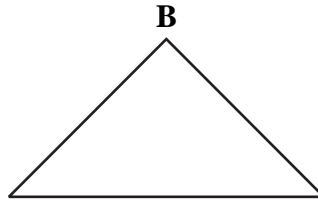*This paper consists of 18 printed pages and 2 blank pages.*

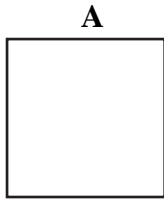**BLANK PAGE**

1   A seminar room has four identical tables, the shape of each being an isosceles right-angled triangle.

Which one of these arrangements is not possible when the four tables are put together?

(not to scale)

2   Nutritionists say that we should eat more fruit and vegetables per day and reduce our intake of fat to help prevent major illnesses. As fruit and vegetables are relatively expensive compared to fatty foods, it is unlikely that families on very low incomes will follow this advice. If the government really wants to improve the health of the nation, it will have to consider taxing foods which are high in fat.

Which of the following, if true, would most strengthen the argument in the passage above?

A   Many people prefer eating fatty foods to fruit and vegetables.

B   Advertisers tend to focus on promoting fatty foods.

C   Levels of smoking have reduced in response to higher prices.

D   It is difficult to persuade children of the health benefits of eating less fat.

E   Governments tend to take measures which have short term results.

3 Of the 100 screws in my work box:

> 60 are cross-headed and 40 are slot-headed
> 70 are 3 mm diameter, 20 are 4 mm diameter and 10 are 5 mm diameter
> 80 are 50 mm long, 5 are 35 mm long and 15 are 20 mm long.

What is the smallest number of cross-headed, 3 mm diameter, 50 mm long screws that there could be in the box?

A   0

B   10

C   30

D   31

E   60

4 The government now insists that all primary schools spend at least one hour per day on literacy and numeracy work, and stipulate that a substantial part of the time is spent in whole class teaching. These changes have helped to raise standards in literacy and numeracy. Therefore, whole class teaching is clearly more beneficial than small group or individual work.

Which of the following best expresses the flaw in the argument in the passage?

A   It assumes that the teaching method is the cause of the improved standards.

B   It ignores the additional work teachers have had to take on.

C   It assumes that literacy and numeracy were low before the changes.

D   It relies on short term measurements of improvement.

E   It overlooks the benefits of small group and individual work.

5 Tom and Suki are brother and sister and go to the same school which is 2 km from their home. Suki leaves each morning 10 minutes before Tom and walks. Tom cycles to school by the same route at four times Suki's walking speed and arrives there 5 minutes before her.

How far from home is Suki when Tom leaves?

A $\frac{1}{2}$ km

B $\frac{2}{3}$ km

C   1 km

D $1\frac{1}{3}$ km

E $1\frac{1}{2}$ km

6   Recent research has shown that people who keep pets tend to live longer than those who do not. The explanation seems to be that factors such as increased exercise (for dog or horse owners), the soothing properties of stroking a furry animal (such as a cat) and the emotional benefits of affectionate relationships combine to benefit human longevity. Everyone who can own a pet, should do so. Obviously this suggestion is not appropriate to people who are allergic to animals.

Which of the following is an assumption of the above argument?

A   People who have allergies can never have pets.

B   The more pets a person keeps, the longer s/he will live.

C   Dogs, horses and cats are always affectionate to humans.

D   People who have never kept pets may not appreciate their benefits.

E   Everyone should try to live longer.

7   Alf and Bill are gardeners. They work together and share profits equally. They recently built a fence for a client. Alf bought all the materials at a total cost of £240. The client paid Bill £780 on completion of the work.
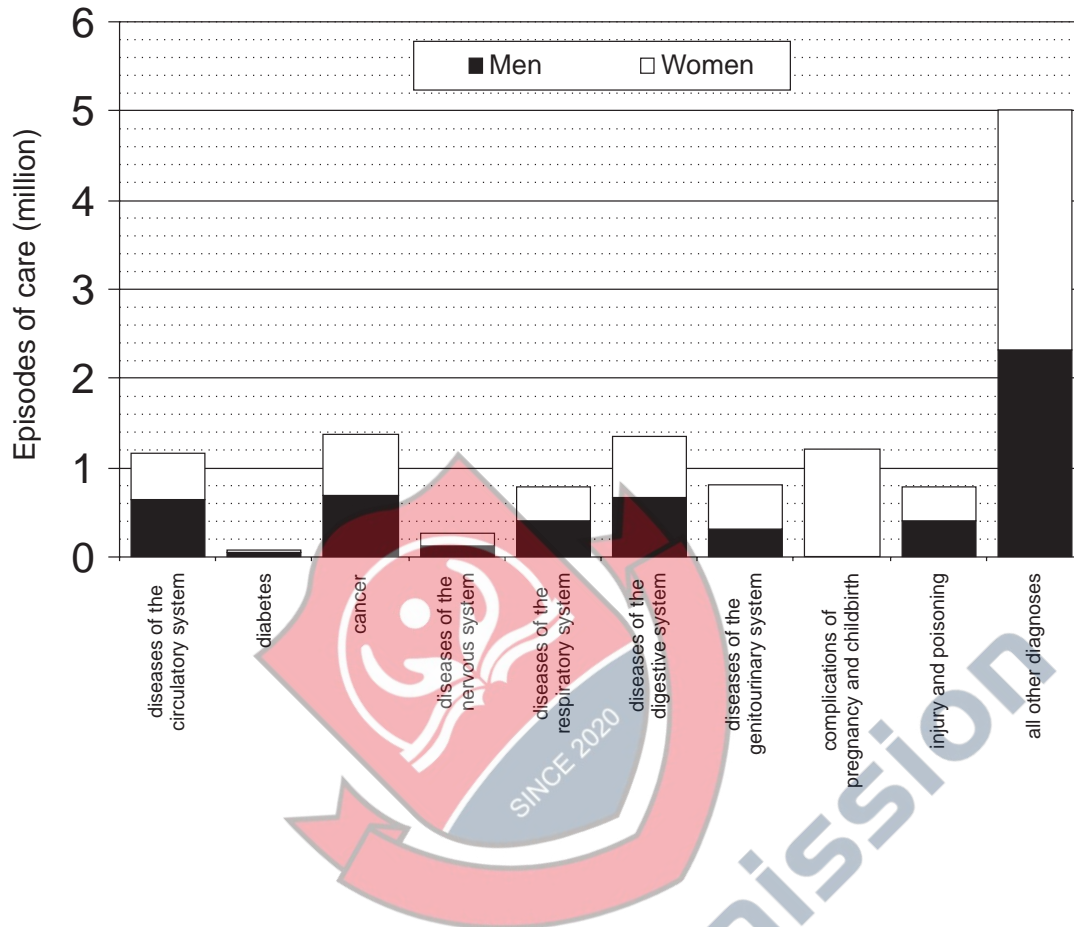
How much does Bill owe Alf?

A   £240

B   £270

C   £390

D   £510

E   £540

PLEASE TURN OVER

Questions 8 to 11 refer to the following information:

The graph below shows the number of stays in national health service hospitals in England by diagnosis and sex in 2002/3.

The table below shows the actual number of days in hospital for the same data.

Main diagnosis	Days in hospital
Diseases of the circulatory system	7,625,301
Diabetes	368,780
Cancer	4,343,199
Diseases of the nervous system	1,742,156
Diseases of the respiratory system	3,892,460
Diseases of the digestive system	3,533,337
Diseases of the genitourinary system	2,207,105
Complications of pregnancy and childbirth	1,988,492
Injury and poisoning	4,954,304
All other diagnoses	21,781,029
All diagnoses	**52,436,163**

8   What is the approximate total number of episodes of care in hospital for all causes? (Give your answer to the nearest 0.5 million.)

9   Assuming men and women spend equal average times in hospital for the same condition, what is the average stay in hospital for cancer?

    A   3.1 days

    B   4.1 days

    C   6.6 days

    D   6.9 days

10   Lung cancer accounts for 1/7 of all episodes of care for cancer, and the incidence among men is 50% higher than among women. Approximately how many episodes of care for lung cancer are there for men?

    A   120,000

    B   200,000

    C   300,000

    D   370,000

    E   740,000

11   The average stay for cancer is half that for diseases of the circulatory system. Which of the following facts might contribute to this difference? (Shade **all** that apply.)

    A   Much cancer treatment only requires a short stay in hospital.

    B   The number of episodes of care for circulatory diseases is nearly twice that for cancer.

    C   The distribution of stay times for circulatory diseases is heavily weighted towards long stays.

    D   More people die from circulatory problems than from cancer.

_____

12   The score in a quiz game is calculated as follows:

Correct answer	3 points
No answer	0 points
Incorrect answer	-1 point.

The quiz consists of 12 questions and John scores 18 points.

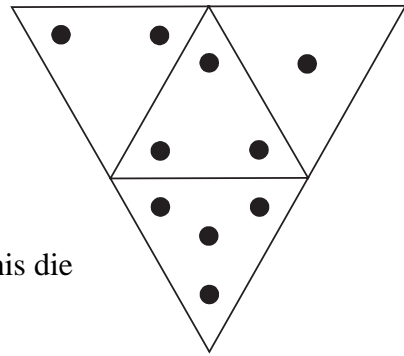How many correct answers could he have given? (Shade **all** that apply.)

A   5

B   6

C   7

D   8

E   9

13   Very conveniently, from an evolutionary standpoint, water freezes with its molecules bonding to form a very open lattice. This unusual structure is such that the density of water ice is less than that of liquid water, which is why ice floats, unlike other solids with tighter structures such as iron. (An iron bar placed in molten iron will sink.) Where and when the oceans freeze, ice forms a layer of insulation on the surface which holds in the heat of the liquid below. Without this protection the seas would freeze solid, from the bottom up; and life as we know it, which began in water, would not exist.

It is claimed in the passage that the unusual molecular structure of water ice is:
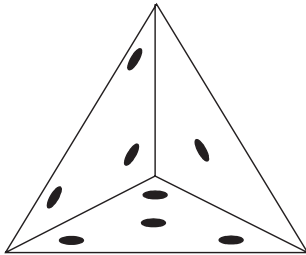
A   a sufficient, but not necessary condition for life as we know it.

B   a necessary, but not a sufficient condition for life as we know it.

C   both a necessary and sufficient condition for life as we know it.

D   neither a necessary nor sufficient condition for life as we know it.

14 The diagram alongside shows a flat piece of cardboard that may be folded to make a tetrahedral (pyramidal) die.
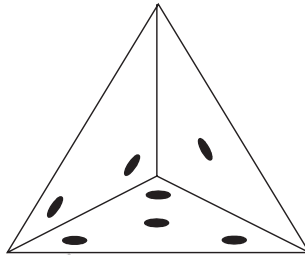

Which of the diagrams below could not show a view of this die when viewed from above a vertex?
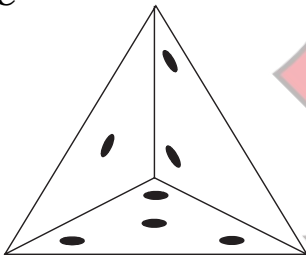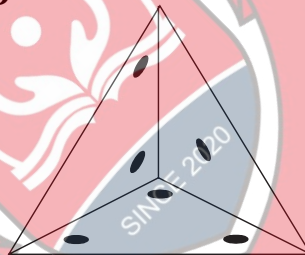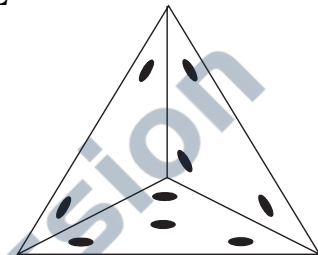
A   **B**

C   **D**   **E**

15 The use of animals for experiments for medical research has been criticised by many animal rights campaigners as morally wrong. Some campaigners use extreme tactics to gain public attention. But they ignore the many benefits which advances in medicine have for animals themselves. The development of antibiotics, for example, has helped animals as well as humans. If the animal population as a whole derives benefit from experiments on only a small minority of animals, those experiments are morally acceptable.

Which of the following expresses the conclusion of the above passage?

A   Animal rights are less important than human rights.

B   Animals benefit from the results of experimentation.

C   There is clear moral justification for all animal experiments.

D   Only those animal experiments that benefit animals as well as humans are acceptable.

E   The use of animals for experiments in non-medical research is morally wrong.

16 Annie, Barbara, Colin and David all attend regular clinics where they are encouraged to lose weight.

At the beginning of the year, they weighed 65, 80, 75 and 70 kg respectively. During the year, all had a change in weight of more than 5 kg. Colin lost more than either Barbara or Annie. David actually put on weight.

Which **one** of the following is **not** a possible increasing order of their weights at the end of the year?

A   ABCD

B   CABD

C   CBAD

D   ACBD

17 The worst of what ensued when the Exxon Valdez spilled 40,000 tons of crude oil into Alaska's coastal waters in 1989 is not that it was the most damaging oil spill in history but that it isn't yet history. Despite the intense research on the ecosystem, this 10,000-square-mile tapestry of icefields, mountains, forests and sea is far from recovered. Lingering and unanticipated injuries abound. A 2001 study found more than 100 tons of toxic oil remaining on dozens of the beaches, oil that seeps out with every tide, and that – because incomplete weathering left behind higher concentrations of toxins – is even more poisonous now than when it gushed from the ripped tanker. This oil will remain on these beaches for decades to come.

   [Adapted from: *The Lingering Lessons of the EV*, by Marybeth Holleman. *Ecologist*: May 2004. p 12]

Which of the following most closely identifies the main conclusion of the argument?

A   The worst aspect of the Exxon Valdez oil spill is that its consequences are not yet played out.

B   Despite the research on the coastal ecosystem, the affected environment has not returned to normal.

C   Much of the damage caused by the Exxon Valdez oil spill was due to the particular nature of the coastal line.

D   The harmful effects of the oil are greater now than they were when the Exxon Valdez spilled its cargo.

E   There will be oil on Alaska's beaches decades from now.

18 The rate of reaction between marble and acid can be greatly increased by crushing marble chips into powdered form. This is because of the larger total surface area of marble that is exposed to the acid.

If a marble chip can be modelled as a $1\,\text{cm} \times 1\,\text{cm} \times 1\,\text{cm}$ cube that can be crushed into $0.1\,\text{mm} \times 0.1\,\text{mm} \times 0.1\,\text{mm}$ cubes of powder, how much extra surface area is exposed by crushing the chip?

A $54\,\text{cm}^2$

B $59.94\,\text{cm}^2$

C $594\,\text{cm}^2$

D $599.9994\,\text{cm}^2$

E $5\,999\,994\,\text{cm}^2$

19 Increases in blood pressure associated with old age are endemic in developed countries, but are rarely seen in underdeveloped countries where people tend to maintain a high level of physical activity throughout their lives. At the other end of the age-range, obesity and diabetes are more common among young people in developed countries, where largely sedentary lifestyles give limited opportunity for exercise.

Which one of the following can be drawn as a conclusion from the passage above?

A Further gains in longevity in developed countries will not be achievable without a change in lifestyle.

B People who do not take sufficient exercise will suffer from obesity and diabetes.

C People gain no benefit from physical activity unless it continues into old age.

D Lifelong exercise is associated with maintaining good health.

E Young people are more affected by lack of exercise than old people.

PLEASE TURN OVER

Questions 20 to 23 refer to the following information:

The table below shows the results of a survey into salt intake as estimated by measuring urinary sodium levels. The results are expressed cumulatively. The recommended maximum daily intake of salt is 6 grams.

Daily salt consumption estimated from total urinary sodium by sex and age, 2000/01, Great Britain

Salt consumption	MEN						WOMEN				
	19-24	25-34	35-49	50-64	All		19-24	25-34	35-49	50-64	All
(grams per day)	cum %	cum %	cum %	cum %	cum %		cum %	cum %	cum %	cum %	cum %
3 or less	-	5	2	5	4		4	6	5	7	6
6 or less	2	20	13	18	15		17	29	31	38	31
9 or less	37	34	39	42	39		66	59	68	69	66
12 or less	60	57	58	65	60		84	81	85	91	86
15 or less	81	73	80	83	79		90	92	96	96	95
18 or less	100	89	91	91	91		92	97	100	99	98
Mean	11.0	11.4	11.1	10.5	11.0		9.1	8.7	8.0	7.5	8.1
Number in survey	62	152	170	183	567		60	129	203	187	580

Notes: *Respondents who reported making a full 24-hour urine collection.*
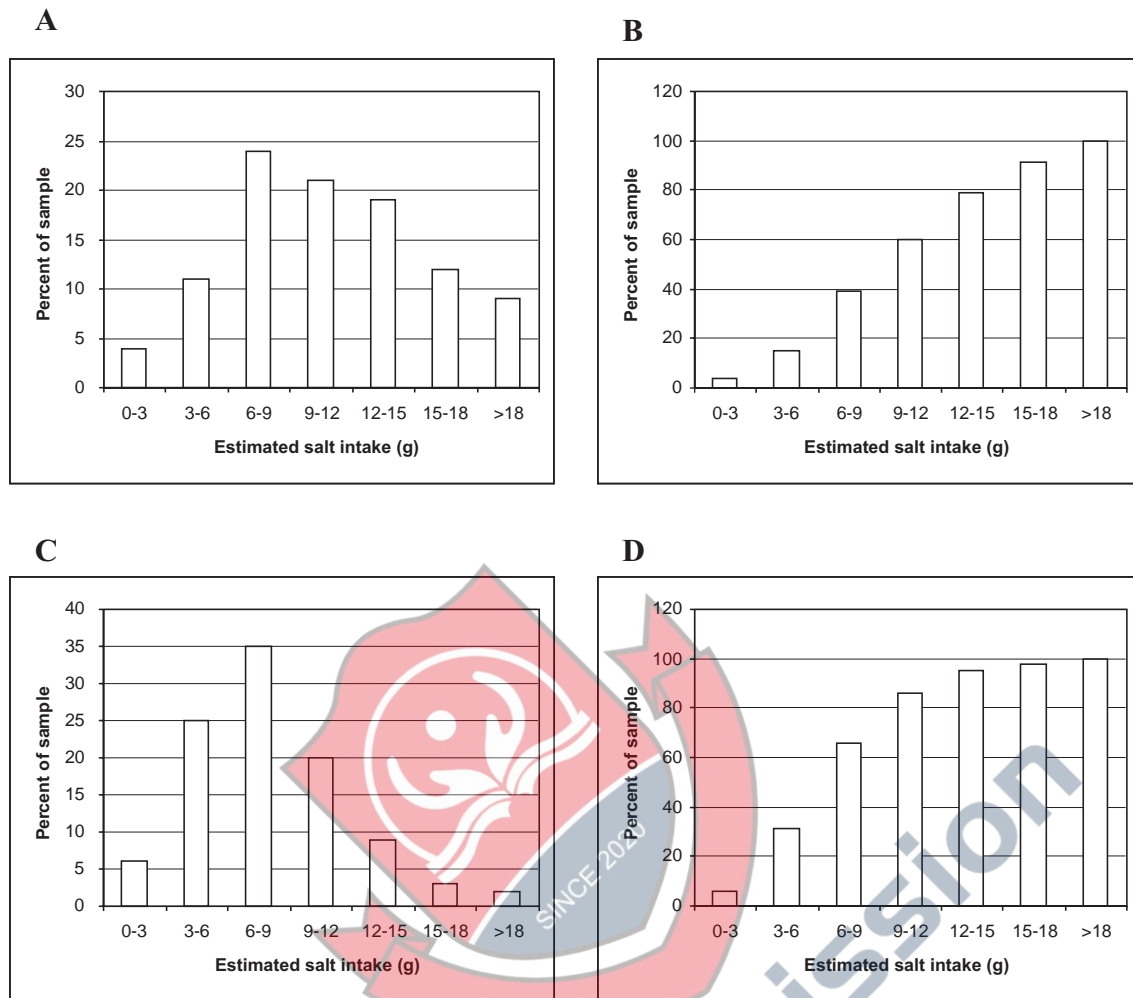
Source: *Office for National Statistics (2003) The National Diet and Nutrition survey: adults aged 19 to 64 years. Volume 3. Vitamin and mineral intake and urinary analysis, The Stationery Office: London.*

20 What was the total number of men in the survey who were estimated to take the maximum recommended daily intake or less?

   A 15

   B 23

   C 62

   D 85

   E 108

21 Calculate (by interpolation) the median salt intake for women in the survey (the median is the amount taken by 50% or less of those in the survey). Express your result to the nearest 0.1g.

22 Which of the following bar charts represents the estimated consumptions of salt for men (of all ages)?

A

B

C

D

23 The percentages shown in the 'All' columns are calculated as the total number of men or women in the survey with less than each estimated salt intake expressed as a percent of the total sample. If these percentages were to be used as estimates for 19-64 year-olds in the population, which one of the following is a plausible explanation as to why the figures might be biased?

A The figures are expressed cumulatively instead of showing the actual values.

B The numbers in the survey are not evenly distributed across the age range.

C The total salt intake of each group is given by the number in the group multiplied by the salt intake.

D The age ranges vary from 5 years to 15 years.

E There are no figures for people under 19 or over 64.

———————————

24   A doctor's surgery lasts from 9 am to 11 am. The appointments system allows her 5 minutes per patient. 20 minutes is kept free at the end of the surgery for emergency appointments. On a particular morning the doctor arrives late. 20 patients have been booked for routine appointments, but 2 do not attend. 1 patient takes 12 minutes to see, but the rest are given the normal 5 minutes. An urgent phone call takes 8 minutes. Surgery was completed at 11 am despite a 5 minute emergency appointment.

By how many minutes was the doctor late?

25   Gardeners are being encouraged to use alternatives to peat, as peat harvesting endangers the wetland habitats of wading birds. But gardening has become the most popular hobby in the UK, with thousands of people visiting garden centres to buy – among other things – peat-based compost. The habitats of wading birds will therefore inevitably decline if gardening continues to be so popular.

Which **one** of the following is an underlying assumption of the above argument?

A   Gardening will remain the UK's most popular hobby.

B   Gardeners will ignore encouragement to use alternatives to peat.

C   The declining habitats of wading birds are being ignored by environmentalists.

D   Garden centres cannot provide cheap alternatives to peat.

E   The habitats of wading birds are under greater threat than those of other wildlife.

26   Two lighthouses can be seen from the sea-front at Shoreton. Both lights switch on and off in regular repeating patterns. One is on for 3 seconds then off for 8 seconds, whilst the other is on for 2 seconds then off for 7 seconds.

15 seconds ago both lights became visible at precisely the same moment.

In how many seconds from now will both lights next disappear from view together?

A   32

B   47

C   62

D   84

E   131

27 An open cylindrical container made from sheet metal of uniform thickness has a mass of 800 g. When completely filled with water the total mass is 15.6 kg.

What would be the total mass of a cylindrical container full of water made from the same sheet metal (of the same thickness) but with double the diameter and double the height?

- **A** 118.4 kg
- **B** 121.6 kg
- **C** 124.8 kg
- **D** 128 kg
- **E** 131.2 kg

28 Doctors in Great Britain can work for the public health service, a commercial service, or both. 30% of doctors in Great Britain work, at least some of the time, for the commercial sector. On the basis of this information alone, deduce which of the following statements are true of doctors in Great Britain.

1   Some doctors work only in the public health service.
2   More doctors work in the public health service than the commercial sector.
3   Some doctors spend more time on commercial work than in the public health service.

- **A** 1 only
- **B** 2 only
- **C** 1 and 2 only
- **D** 2 and 3 only
- **E** 1, 2 and 3

29 Nathan pours 250 ml of sodium chloride solution into a beaker from a bottle labelled "concentration 30 g/l". He accidentally spills 50 ml and decides to replace it, but inadvertently tops up the beaker with 50 ml from a different bottle, this one labelled "concentration 20 g/l".

What is the concentration of the solution Nathan now has in his beaker?

- **A** 24 g/l
- **B** 25 g/l
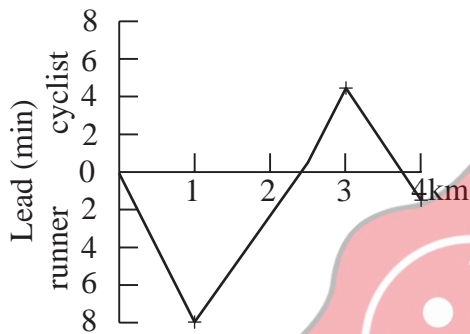- **C** 26 g/l
- **D** 27 g/l
- **E** 28 g/l

30 A runner and a cyclist are having a race. The course (in order) includes a flat section of 1 km, a muddy section of 1.5 km, an uphill section of 500 m and a downhill section of 1 km.

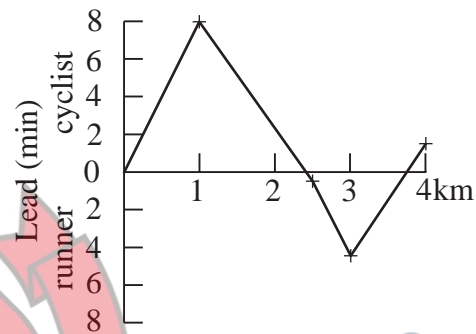The speeds they achieve on each section of the course are as follows:

	Flat	Mud	Uphill	Downhill
Runner	6 km/hr	4 km/hr	3 km/hr	8 km/hr
Cyclist	30 km/hr	3 km/hr	2 km/hr	40 km/hr

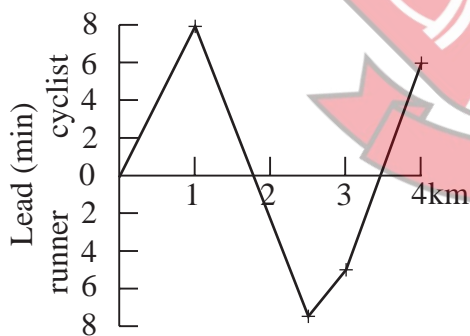Which of the following graphs represents who leads during the race and by how much?
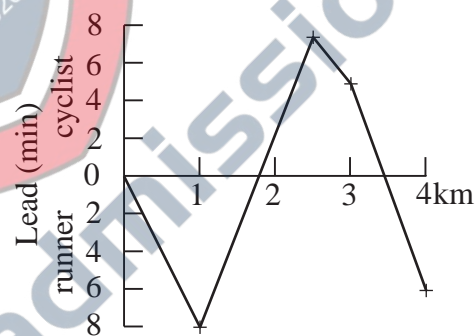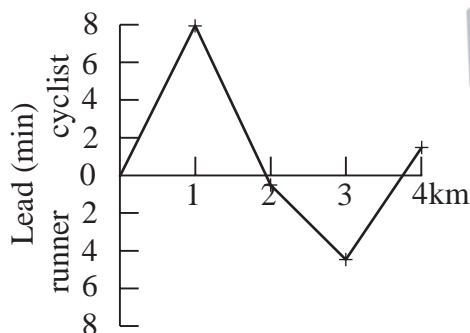
A

B

C

D

E

31 Which **two** of these statements are equivalent?

  A Anne is not older than Susan.

  B Susan is younger than Anne.

  C Susan is at least as old as Anne.

  D Anne is not younger than Susan.

PLEASE TURN OVER

Questions 32 to 35 refer to the following information:

In the United States, the number of serious auto accidents is declining. Countrywide, between 1980 and 1993, auto accident fatalities fell from 51,091 to 40,115, and property claims per 100 insured vehicles fell from 4.94 to 4.00, a decrease of 19 per cent. Credit for this remarkable improvement must go to the efforts of federal and state regulators to reduce automobile accidents and increase passenger safely. Laws mandating the wearing of seatbelts, the installation of airbags, a more robust construction of the car body, enhanced vehicle safety standards, better road design, and campaigns against drunk driving have all helped.
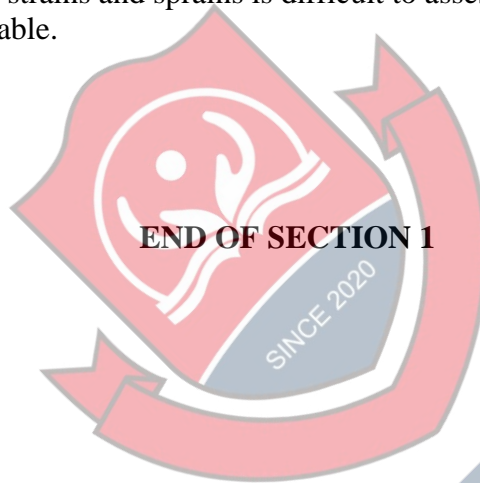
Despite these impressive improvements in road safety, however, Americans now make more claims for bodily injury, referred to as BI. Between 1980 and 1993, the number of BI claims per 100 insured vehicles rose 33 per cent to 29.3, and the likelihood of a BI claim being filed in an accident that involved a property damage claim rose 64 per cent in the same time period.

The 'whippies', as the insurance industry calls whiplash claimants, account for this huge increase in BI claims. For the purpose of insurance statistics, whiplash is recorded as "sprains and strains," and since these sprains and strains nearly all involve the neck and the back, it is reasonable to equate them with whiplash. From 1987 to 1992, claims in the US for sprains and strains increased in proportion to other injuries. In 1987, 75 per cent of BI claims were for sprains and strains, and 45 per cent for "all other injuries." By 1992 sprains and strains had risen to 83 per cent, and all other injuries had fallen to 40 per cent. This trend is no isolated oddity, for similar changes have happened elsewhere. In Japan annual collision deaths peaked at 4900 in 1993 and fell to little over 4200 by 1997, while over the same period the number of whiplash claims rose from 228,000 to 252,000.

[Source: *Whiplash and other useful injuries*, Andrew Malleson. McGill Queens University Press, Montreal. p 254.]

32   What was the percentage decrease in fatalities in Japan between 1993 and 1997? Give your answer to the nearest whole number.

33   The data concerning the proportions of different BI claims in paragraph 3 would be puzzling without which **one** of the following explanations ?

    A   Whiplash accounted for most of the injuries classified as strains and sprains.

    B   Some of the claims were for sprains and strains along with other injuries.

    C   Not all of the claims made to insurance companies were for genuine injuries.

    D   The number of minor injuries has risen in contrast with number of fatal accidents.

34 Estimate the number of BI claims per 100 insured vehicles in 1980. Give your answer to the nearest whole number.

35 Which **one or more** of the following offer some explanation for the apparent anomaly in the trend for bodily injury claims, especially strains and sprains, as against property claims. (Shade **all** that apply.)

A Doctors are divided in their opinion as to whether or not whiplash is a *bona fide* condition.

B Many lawyers have introduced a no-win-no-fee service to claimants seeking compensation for personal injury.

C The severity of strains and sprains is difficult to assess whereas damage to a vehicle is directly observable.

END OF SECTION 1

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