

BioMedical Admissions Test

4500/11

Wednesday 3 November 2010

Morning

1 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 complete the answer sheet with your BMAT candidate number, centre number, date of birth and name.

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. All questions are worth one mark.

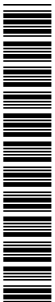
Answer on the sheet provided. Most questions ask you to show your choice between options by shading a circle. If questions ask you to write in words or numbers, be sure to write clearly in the spaces provided. If you make a mistake, erase thoroughly and try again.

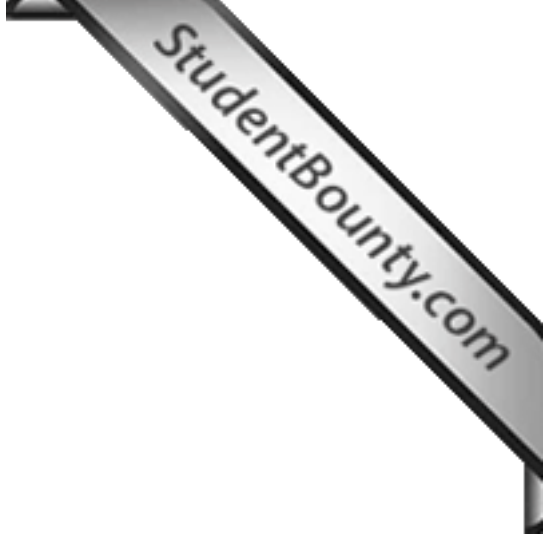
Any rough work should be done on this question paper.

Dictionaries and calculators may NOT be used.

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

This paper consists of 26 printed pages and 2 blank pages.





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- 1 The height and weight of three children were measured and the table below used to find their BMI. Unfortunately some of the data have been lost. We know that Alex is 162cm tall and has a BMI of 22, and Charlie is 150cm tall and has a BMI of 24. The combined weight of the children is 172kg.

Children's Metric BMI Tables

		BMI																						
		13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35
Height (cm)	144	26	29	31	33	35	37	39	41	43	45	47	49	51	53	55	58	60	62	64	66	68	70	72
	147	28	30	32	34	36	38	41	43	45	47	49	51	54	56	58	60	62	64	66	69	71	73	75
	150	29	31	33	35	38	40	42	45	47	49	51	54	56	58	60	63	65	67	69	72	74	76	78
	153	30	32	35	37	39	42	44	46	49	51	53	56	58	60	63	65	67	70	72	74	77	79	81
	156	31	34	36	38	41	43	46	48	51	53	55	58	60	63	65	68	70	73	75	77	80	82	85
	159	32	35	37	40	42	45	48	50	53	55	58	60	63	65	68	70	73	75	78	80	83	85	88
	162	34	36	39	41	44	47	49	52	55	57	60	62	65	68	70	73	76	78	81	83	86	89	91
165	35	38	40	43	46	49	51	54	57	59	62	65	68	70	73	76	78	81	84	87	89	92	95	

Weight (kg)

What is Alex's BMI?

- A 25
- B 26
- C 27
- D 28
- E 29

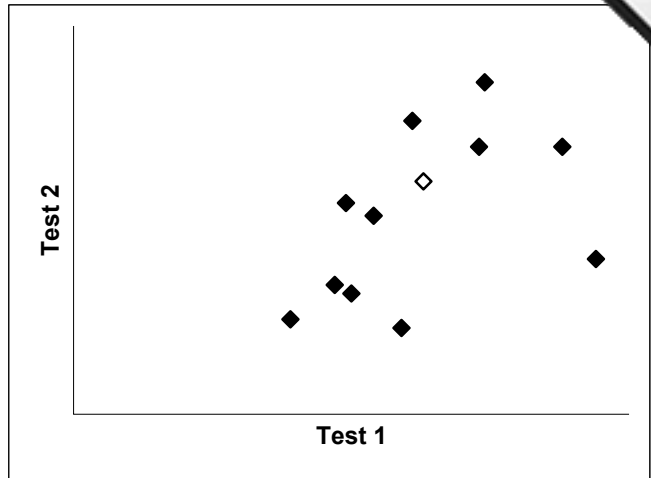
- 2 Societies with a flourishing arts sector (including visual art, theatre, music and dance) tend to be more democratic, more egalitarian, economically more robust and to have more fulfilled, healthier citizens. So, if we want to live in the most democratic, egalitarian and economically robust society, we should demand that the Government subsidises the arts to a level which enables them to flourish.

Which one of the following illustrates a flaw in the above argument?

- A There may be other important demands on government money.
- B A flourishing arts sector may influence citizens' psychological health.
- C A strong economy may be a precondition of a flourishing arts sector.
- D Some of the arts (for example, opera) may be seen as non-egalitarian.

- 3 The pupils in a class took two tests. The results and the teacher's scatter graph are below:

	Test 1	Test 2
Aisha	88	62
Benjamin	74	77
Carla	61	68
David	73	62
Erin	63	54
Ferdinand	49	49
Georgina	54	46
Hazel	94	36
Irena	47	30
Jermaine	50	28
Katya	39	22
Lawrence	59	20



Whose results are shown by the white diamond?

- A Carla
- B David
- C Erin
- D Georgina
- E Ferdinand

- 4 62 trillion spam emails are sent every year, amounting to emissions of more than 17 million tonnes of carbon dioxide, one of the main contributors to global warming. More effective spam filtering could reduce the amount by 75%, which would be the equivalent of taking 2.3 million cars off the road. This would not deal with the extra energy being used to send out the messages in the first place, however. A better strategy would be to fight spam at the source. When one global web hosting firm was taken offline after it was found to have ties to spammers, global spam volume fell briefly by 70%.

Which one of the following is a conclusion that could be drawn from the above passage?

- A** It is always better to fight problems at the source.
- B** Reducing spam is a higher priority than easing congestion on the roads.
- C** Action to deal with global warming should include tackling spam as one of the strategies.
- D** Spam filtering systems should be improved as much as possible.
- E** Action to stop spam will never have long lasting effects.
- 5 I need to make 72 cakes for when my guests visit tomorrow. I make the cakes in batches of 12. It takes me 40 minutes to prepare each batch and then they need to be in the oven for 25 minutes (during which time I can be working on the next batch). Once they have finished baking, I need to spend 5 minutes putting the cakes out to cool before the oven is ready for the next batch. It is now 1pm.

What time should I finish?

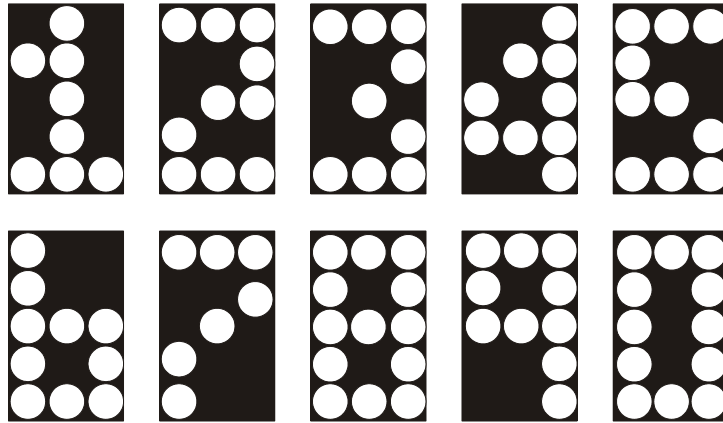
- A** 4:55pm
- B** 5:00pm
- C** 5:30pm
- D** 5:55pm
- E** 6:00pm

- 6 Scientists have created a model to show how the climate would be affected if, in fifty years, the world suddenly stopped the burning of fossil fuels which produces CO₂ emissions. The model assumed that by then CO₂ concentrations in the atmosphere would be double pre-industrial levels. The scientists calculated that although levels of CO₂ would fall as the oceans absorbed it, only one quarter of the CO₂ in the atmosphere would have been absorbed in this way by the time the oceans had reached saturation point. The result would be a very small reduction in average global temperatures over the next 1000 years, there would be regular droughts, and sea levels would rise by up to a metre. So if the calculations as to the amount of CO₂ that the oceans can absorb are correct, we cannot avoid the disastrous consequences of climate change.

Which of the following identify/identifies a weakness in the above argument?

- 1 It will be impossible suddenly to stop the burning of fossil fuels throughout the world.
 - 2 It may be possible to reduce carbon dioxide levels significantly during the next fifty years.
 - 3 Some predictions made in the past about climate change have not turned out to be accurate.
- A** 1 only
- B** 2 only
- C** 3 only
- D** 1 and 2
- E** 2 and 3
- F** 1, 2 and 3

- 7 On a darts scoreboard, each number is made up by some of the lights in a 5 x 3 grid. The correct appearance of each number is shown below:



Darts scores consist of three digits and the score can be anything between 002 and 501.

One night, for one player's score, the first of the three digits was faulty and three of the lights were permanently on. All other lights were working normally. The score showed 805.

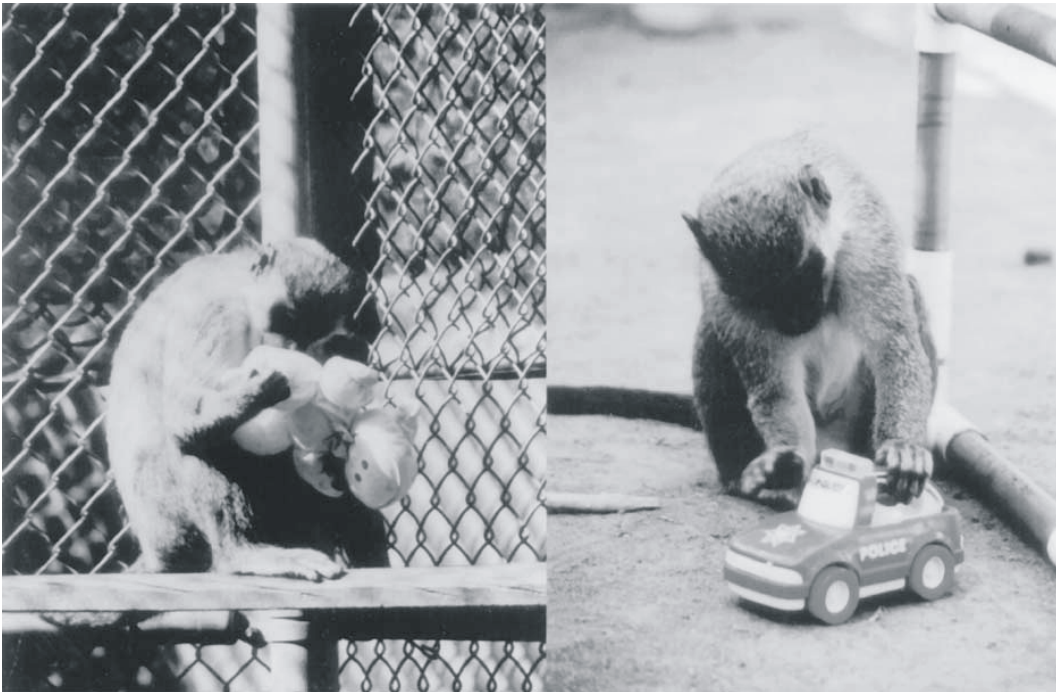
How many different values could the actual score have been?

- A 1
- B 2
- C 3
- D 4
- E 5
- F 6

Questions 8 - 11 refer to the following information:

Throughout the world, boys and girls prefer to play with different types of toys. Boys typically like to play with cars and trucks, while girls typically choose to play with dolls. Why is this? A traditional sociological explanation is that boys and girls are socialised and encouraged to play with different types of toys by their parents, peers, and “society”. Growing scientific evidence suggests, however, that boys’ and girls’ toy preferences may have a biological origin.

In 2002, Gerianne M. Alexander of Texas A&M University and Melissa Hines of City University in London stunned the scientific world by showing that vervet monkeys showed the same sex-typical toy preferences as humans. In an incredibly ingenious study, published in *Evolution and Human Behaviour*, Alexander and Hines gave two stereotypically masculine toys (a ball and a police car), two stereotypically feminine toys (a soft doll and a cooking pot), and two neutral toys (a picture book and a stuffed dog) to 44 male and 44 female vervet monkeys. They then assessed the monkeys’ preference for each toy by measuring how much time they spent with each. Their data demonstrated that the male vervet monkeys showed significantly greater interest in the masculine toys, and the female vervet monkeys showed significantly greater interest in the feminine toys. The two sexes did not differ in their preference for the neutral toys.



Female monkey with doll

Male monkey with car

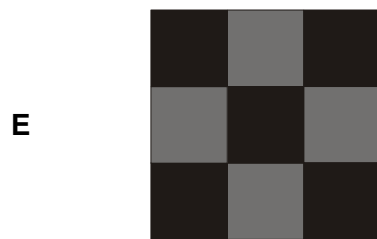
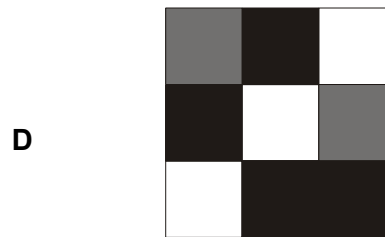
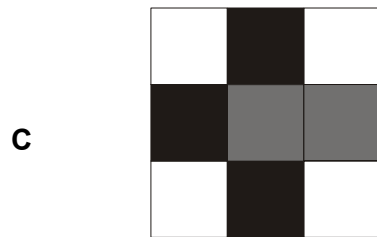
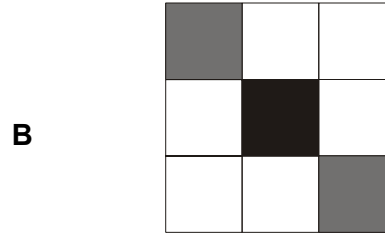
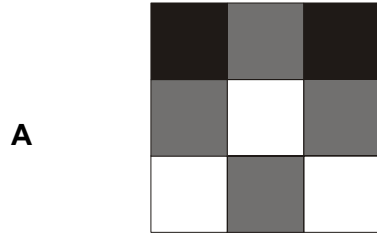
8 Which one of the following views is most clearly challenged by the first paragraph?

- A That toy preference in humans is the result of socialising.
- B That boys and girls play with different types of toys.
- C That cars and trucks are typically chosen by boys.
- D That animal behaviour is not social behaviour.

- 9 Which one of the following, if true, would present the strongest challenge to the inference that the vervet monkeys in the study showed preferences that varied in accordance with the sex of the monkeys?
- A The more aggressive sex monopolised the toys that were the most attractive to the monkeys.
 - B Male monkeys lost interest in the toys they chose more quickly than the females.
 - C Monkeys also show preferences for different kinds of food when they are given a choice.
 - D No other species besides monkeys has been observed to demonstrate preferences for different toys.
 - E Vervet monkeys exhibit signs of social behaviour, for example warning each other of danger.
- 10 To accept the claim made in paragraph two, which one of the following must be assumed?
- A Spending time with an object is a reliable indicator of interest.
 - B Vervet monkeys and humans are alike in their genetic makeup.
 - C Cooking and childcare are distinctively feminine roles.
 - D The only explanation for preferring one toy to another is sexual stereotyping.
 - E Previous studies of animal behaviour have shown that monkeys show no preference for different toys.
- 11 From the photographic evidence accompanying the article, which of the following can be reliably inferred?
- 1 Vervet monkeys respond to toys in the same way as humans.
 - 2 Some monkeys show the preferences alleged by Alexander and Hines.
- A 1 but not 2
 - B 2 but not 1
 - C both 1 and 2
 - D neither 1 nor 2
-

- 12 I am planning to tile my floor. Each tile is square and has a design which is a 3×3 grid of squares. I want to use a combination of 4 different types of tile and when I have finished, I want to have used the same number of each tile. I also want the proportion of squares of each color to be equal.

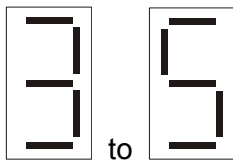
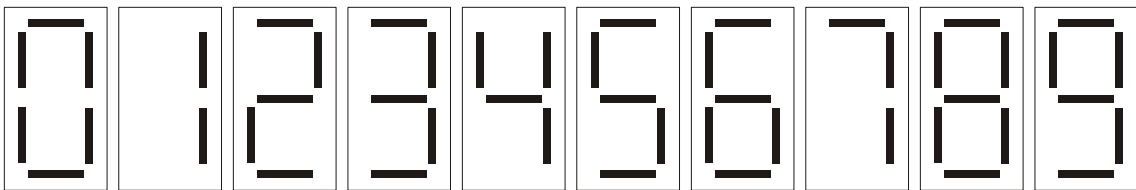
Which one of the following 5 tiles should I **not** choose?



- 13 As examination results come out again there will undoubtedly be concerns about the state of the education system. If the results are good then we will hear that the examinations are becoming too easy. On the other hand, if the results are poor, then we will hear about the poor state of funding for the education sector. Since there will be negative stories in the press either way, we should ignore these stories and not worry about them.

Which one of the following is the best statement of the flaw in the above argument?

- A The options are restricted to the results being either good or bad.
- B It makes an unwarranted attack on the press.
- C It makes a prediction about the future which is not supported by any evidence.
- D It fails to establish that examinations are becoming easier.
- E The fact that a negative story is inevitable does not mean that it should be ignored.
- 14 These are the most common versions of the digits that appear on digital displays, and are to be assumed in this question.



To change a display from  to , two of the seven elements have to change:

- top left changes from off to on.
- top right changes from on to off.

What is the maximum number of elements that change from one number to another?

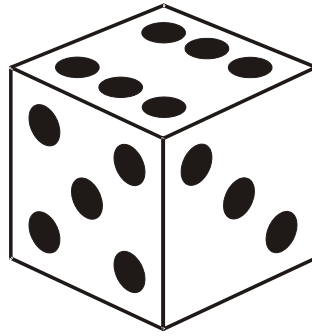
- A 3
- B 4
- C 5
- D 6
- E 7

- 15 Although child road deaths and serious injuries have fallen by 52% in the past ten years, parents should not assume that lessons in road safety are no longer vital for school pupils. A Government study reports that in 2006 almost 1,300 boy pedestrians and 700 girl pedestrians were killed or seriously injured in road traffic accidents, and that 500 child cyclists were killed or seriously injured, more than 400 of whom were male.

Assuming that 2006 is a representative year for road accidents involving child pedestrians and cyclists, which one of the following is a conclusion that can be drawn from the passage above?

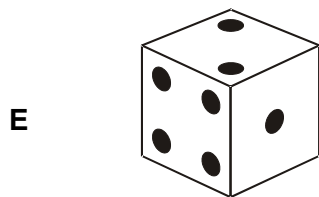
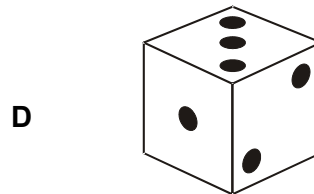
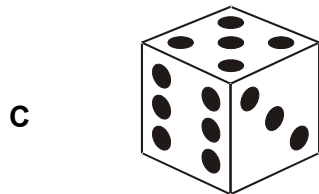
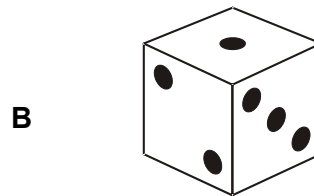
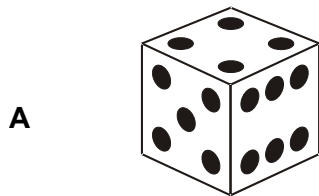
- A There are more boys than girls who own and ride bicycles.
- B Girls spend less time than boys as pedestrians unsupervised by adults.
- C Boys are much more likely than girls to take risks when cycling.
- D Boys are more than twice as likely as girls to be killed or seriously injured as pedestrians or cyclists.
- E Lessons in road safety specially designed for male pupils would reduce child road deaths.

- 16 The image below shows a view of a conventional six sided die with opposite sides adding to 7 (so the 1 is opposite the 6 etc).



From the position shown the die is rotated 90° in one direction and then 90° in a different direction.

Which one of the following could be a view of the die from the same position after the two rotations?



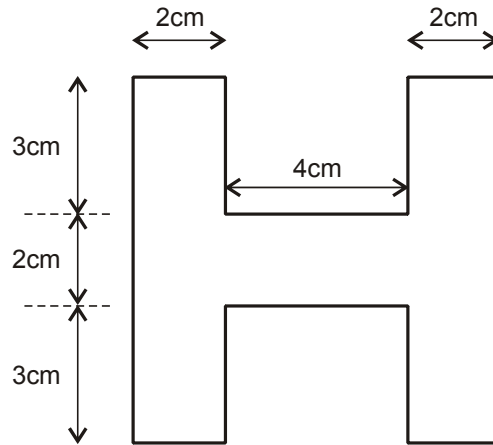
- 17 When defending the British Museum's stance on holding on to important historical artefacts that were taken from other countries, the tale of the Standard of Ur offers a huge case in support of the policy. Had Britain returned it to Iraq, it would have been lost along with so much of the country's history when the national museum was looted. Consequently, it would have been lost to all of us. By keeping these treasures at the British Museum, their safety is ensured for the whole world.

Which one of the following is the best statement of the flaw in the argument?

- A An artefact taken from another country has technically already been looted.
- B An artefact taken from another country will always belong to that country.
- C Because one museum overseas is looted it does not mean that others will be.
- D If the British Museum returned all the artefacts to their homes, more people from other countries would get the chance to see them.
- E Because the Standard of Ur is safe it doesn't mean all other artefacts are safe.

- 18 The Rimmer Club is named after the character from the cult TV series "Red Dwarf" who has a large letter H on his forehead.

Tonight is the Rimmer Club's annual dinner. Rory has been given the task of making place cards. He has decided to make the cards in the form of a letter H, with dimensions as shown below:

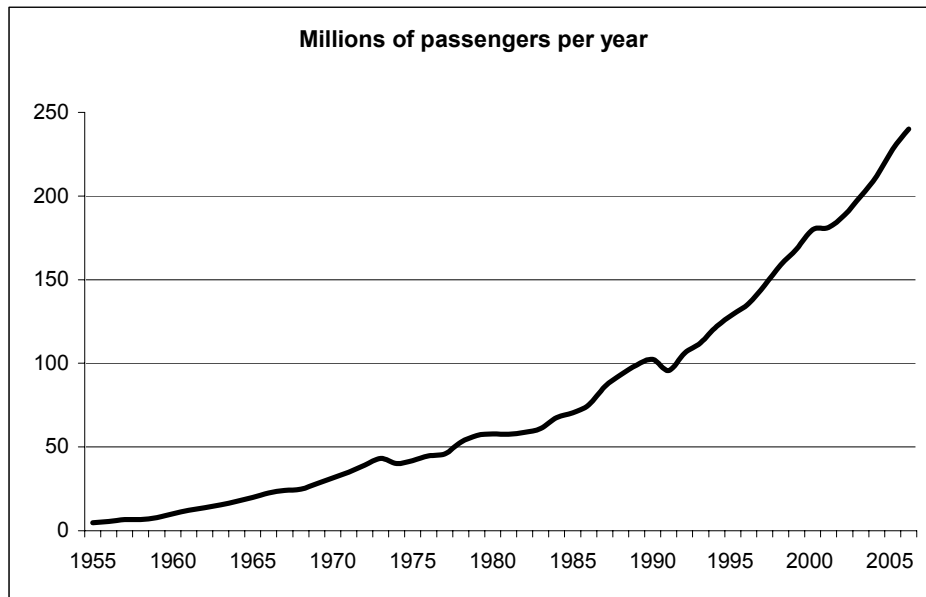


He has a number of rectangular sheets of white card, measuring 33cm by 24cm from which to make the cards.

What is the maximum possible number of cards that Rory can make from one sheet of card?

- A 12
- B 13
- C 14
- D 15
- E 16

Questions 19 - 22 refer to the following information:



In 2005, the total number of passengers at UK airports rose to 228 million, compared to 5 million in 1955.

The numbers of passengers fell in the recession year of 1974, and in 1991, the year of the Gulf War, before continuing upward. There was also a marked flattening of the upward trend in 2001, the result of the Foot and Mouth outbreak and the September 11 attacks in New York. But these blips were temporary.

The number of passenger kilometres flown by UK airlines increased significantly over the past twenty years, from 80 billion kilometres in 1985 to 287 billion in 2005. Around 97% of the 2005 total was accounted for by international travel.

Nine in ten air passengers at UK airports in 2005 were travelling internationally. The country with which the UK exchanges the most air traffic is Spain. There were 34 million passenger movements between the two countries in 2005.

Heathrow was the busiest airport in the UK, with 68 million passengers in 2005. Gatwick was the second busiest (33 million passengers).

Demand for air travel is projected to continue growing well into the 21st century. Mid-range estimates from the Department for Transport suggest that the number of passengers at UK airports will grow to 500 million in 2030.

Notes:

Passengers on internal flights (domestic) are counted both at airport of departure and arrival.

- 19 Domestic passengers are counted both at airport of departure and airport of arrival. In 2005, it was discovered that domestic passengers were counted once per flight instead of both on departure and arrival. The figures for 2005 and the figures were adjusted accordingly.

What would be the corrected figure for the total number of passengers at UK airports in 2005, to the nearest million?

- 20 Assuming that the proportion of passengers travelling to Spain was the same in 1980 as it was in 2005, which of the following is the best estimate of passenger movements between UK airports and Spain in 1980?

- A 3 million
- B 6 million
- C 9 million
- D 12 million
- E 15 million

- 21 Which of the following can reliably be inferred from the graph and other available data?

- 1 Between 1980 and 2005 the average increase per annum in the number of passengers more than trebled compared with the previous 25 years.
- 2 Heathrow and Gatwick between them account for more than 4 out of every 10 passengers passing through UK terminals.
- 3 To achieve the Department of Transport prediction for 2030, the average increase in the number of passengers going through UK terminals will have to exceed 10 million per annum.

- A 1 only
- B 2 only
- C 3 only
- D 1 and 3 only
- E 2 and 3 only
- F 1, 2 and 3
- G none of the above

- 22 After the first Gulf War in the early 1990s and the flattening effects of Foot and Mouth and the September 11 attacks in 2001, passenger numbers at least recovered their previous trend. Therefore the recession of 2009, although it has brought a sharp fall in passenger numbers, does not necessarily prevent the Department of Transport's prediction - that 500 million passengers will use UK terminals by 2030 - from being realised.

Which one of the following is a fair assessment of the use of data in the above argument?

- A The data have been incorrectly interpreted and do not justify the conclusion.
 - B Although the data have been correctly interpreted, they do not justify the conclusion.
 - C If the interpretation of the data had been correct it would justify the conclusion, but it has been incorrectly interpreted.
 - D The data have been correctly interpreted and do support the conclusion.
-

- 23 One fund-raising activity of a particular sports club is a weekly draw. Participants choose two different numbers between 1 and 15 inclusive. When the draw is made, two numbers between 1 and 15 inclusive are selected at random. The prize money is shared by anyone who has chosen these two numbers. If there are no winners, the prize fund rolls over to the following week.

When last week's winning numbers were announced as 3 and 10, someone pointed out that it was the fifth successive week that the two numbers consisted of a total of three digits, all different.

What is the probability that when two different numbers between 1 and 15 inclusive are selected at random they will consist of three digits all different?

- A $\frac{4}{21}$
B $\frac{8}{21}$
C $\frac{6}{35}$
D $\frac{9}{35}$
E $\frac{12}{35}$
F $\frac{18}{35}$

- 24 Scientists have argued over whether the extinction of the dinosaurs was caused by a space impact or by super-volcanic activity which lasted for 1.5 million years. The space impact would have caused sudden large-scale fires and earthquakes. Volcanic activity would have caused a cooling of the atmosphere and acid rain which would be seen in changes to marine and land ecosystems over the 500,000 years before the extinction. As no such changes were identified during this period, the space impact is the only plausible explanation.

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

- A Volcanic activity would not have also caused large-scale fires and earthquakes.
- B A cooling of the atmosphere and acid rain could have caused the extinction of the dinosaurs.
- C There are no other possible explanations for the extinction of the dinosaurs.
- D The large-scale fires and earthquakes caused by a space impact would have caused the extinction of the dinosaurs.
- E Extinction is always accompanied by significant changes in marine and land ecosystems.

- 25 I am playing a card game with three friends. Each of us has two cards which are placed on the table. The score for a hand is calculated by adding up the value of the two cards, then doubling the total if the cards are the same suit (denoted by the symbols ♥, ♦, ♣ or ♠). The highest score wins. My two cards are the 2♠ and 7♥. The other hands are:

- 4♦ and 7♦
- 5♣ and 8♠
- 2♥ and 9♣

I am the last person to play. I can exchange one of my cards with a card from another hand and I want to finish in the **highest position** possible.

What will be my score after I exchange cards?

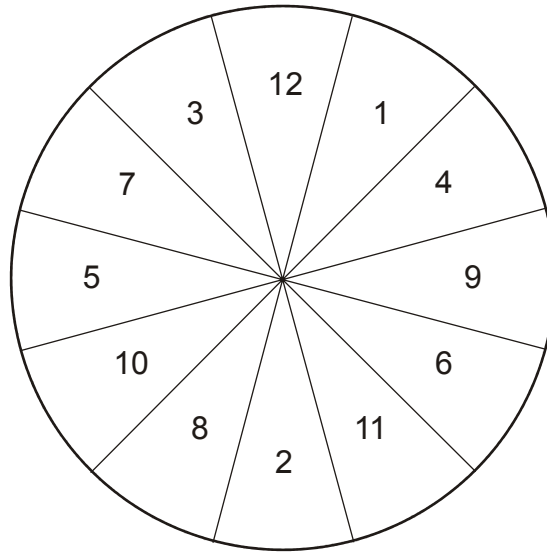
- A 14
- B 16
- C 18
- D 20
- E 22

- 26 The behaviour of the general public has contributed to the reluctance of doctors to do out-of-hours work. When doctors only ever had to deal with genuine medical emergencies out-of-hours then the workload was manageable. Unfortunately, the Government has helped stoke public expectations so that now people think they should be entitled to full medical care 24 hours a day, no matter how trivial the problem is. However, minor problems should be dealt with at day surgeries.

Which one of the following best expresses the main conclusion of the above argument?

- A The problem of providing out of hours medical care is partly of the public's making.
- B The Government should encourage doctors to offer separate out-of-hours surgeries for urgent and non-urgent problems.
- C The public cannot distinguish between an urgent and a non-urgent medical problem.
- D Doctors running out-of-hours surgeries see more patients with non-urgent than urgent medical problems.
- E Doctors should turn away patients who come to out of hours surgeries with non-urgent medical problems.

27



A target at a fair has twelve sections, marked as shown above. Participants throw four darts at the target. They win a prize if all four darts land in different sections of the target and the total score is at least 30.

Phil has thrown two of his four darts, scoring 12 and 8. He is confident that whenever he throws he will hit the target and, whatever section he aims at, the dart will never land further away than one of the two neighbouring sections. With this in mind, he realises that if he aims his third dart at 5 or 6 he can be confident of winning a prize.

Which other section could Phil aim his third dart at and still be confident of winning a prize?

- A 4
- B 7
- C 9
- D 10
- E 11

- 28 During the trial of a 10 year old accused of frequent violent crimes, privacy laws meant he could only be referred to in the media as 'Child B'. One newspaper, however, continually referred to the boy as the 'Devil Child'. Despite many media sources reporting the difficult violent upbringing the boy himself had had, calling for understanding and leniency, many letters sent to newspapers and comments posted on internet forums showed strong public anger and calls for the harshest possible sentence. Almost all of those calling for tough measures used the term 'Devil Child'. This shows that the name alone had influenced public opinion and prevented members of the public having sympathy for the child.

Which one of the following statements, if true, would strengthen the argument above?

- 1 The newspaper that used the term 'Devil Child' reported the case and the child's upbringing accurately.
 - 2 The editors of the newspaper that used the term 'Devil Child' also called for the harshest possible punishment.
 - 3 The newspaper that used the term 'Devil Child' had also continually referred to his victims as 'innocent' and 'defenceless'.
- A 1 only
- B 2 only
- C 3 only
- D 1 and 2
- E 1 and 3
- F 2 and 3

- 29 Paul, who works in the fruit and vegetable section of a supermarket was given the job of making up packs of three apples from the contents of a large box of loose apples. Each pack had to weigh 600g, with an allowance of no more than 3g heavier or lighter.

When there were just seven apples left in the box he feared that he might not be able to make up any more packs, but after weighing them he found that he was able to make up two more.

The seven apples weighed 173g, 182g, 188g, 197g, 207g, 219g and 224g.

What was the weight of the apple that was left over?

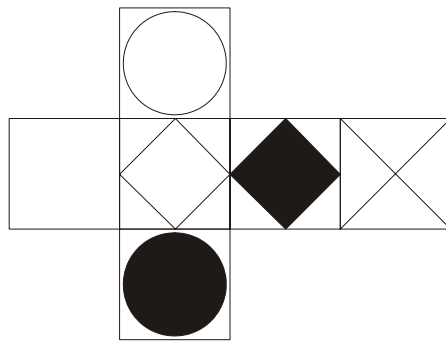
- A 173g
- B 182g
- C 188g
- D 197g
- E 207g
- F 219g
- G 224g

- 30 Reducing class sizes in UK primary schools to 20 pupils would be very expensive and would produce little improvement in children's education. This is confirmed by evidence from the USA. In the 1990s class sizes were reduced in California because the state had been ranked 49th out of 50 states in the reading ability of 9 to 10 year olds. Ten years and \$50 billion later, California had risen only to 48th out of 50. If class sizes are reduced, more teachers are needed. Thus, in the UK, candidates with lower qualifications would have to be recruited, since there are already only 1.2 applicants for each teaching post. What is important is not whether there are 20 or 30 children in a classroom, but whether there is one good teacher. Countries whose children do well at school are those that recruit their teachers from the brightest graduates.

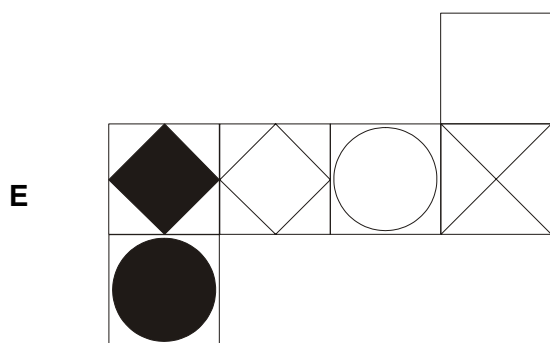
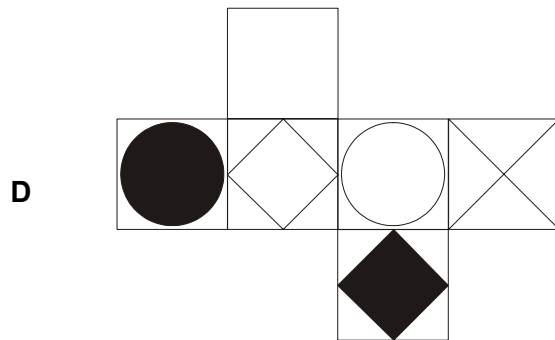
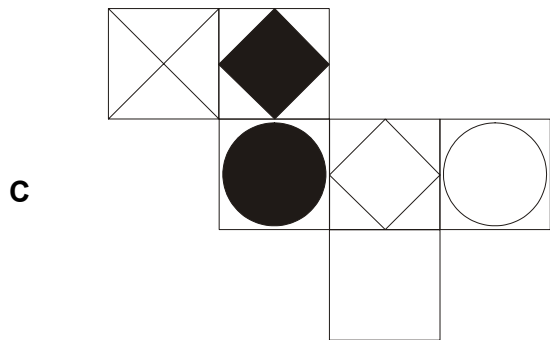
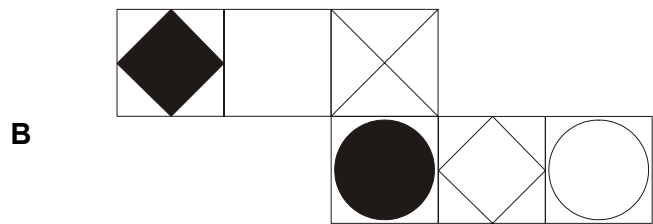
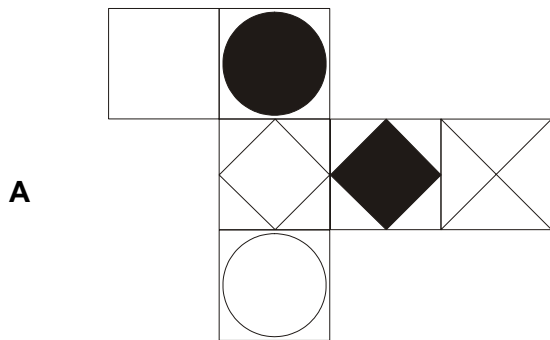
Which one of the following is **not** an assumption underlying the above argument?

- A Candidates with lower qualifications are unlikely to be good teachers.
- B Expensive schemes aimed at improving education cannot be justified.
- C Other states in the USA had not significantly improved children's reading ability.
- D Being taught by the brightest graduates improves pupils' performance.

31 The net shown can be folded up to make a cube.



Which one of the following nets could be folded to make an identical cube?



Questions 32 - 35 refer to the following information:

Vitelo Pareto observed that in Italy in 1906 that 80% of the wealth was owned by 20% of the people. The 'Pareto Principle' has since been applied to a wide range of other areas. For example in the USA it has been found that 20% of the population use 80% of the health care resources. Although most developed countries have a somewhat more even distribution of wealth in modern times, on a global scale it has been estimated that currently 20% of the world's population have 82.7% of the world's income.

Various parameters are used to give a measure of inequality of income within a society. One of the simplest of these is the ratio of the average income of the best paid 20% of the population to that of the lowest paid 20%. Among countries this ratio varies from 4.5 for Japan to 168 for Bolivia. It is clearly very high for some developing countries because a significant part of the population has no measurable income at all.

In the fictional country of Capitalia, the income distribution is as follows:

Average annual income	
The bottom 10% earn	\$16,203
The next 10% earn	\$17,338
The next 10% earn	\$18,710
The next 10% earn	\$20,415
The next 10% earn	\$22,604
The next 10% earn	\$25,552
The next 10% earn	\$29,806
The next 10% earn	\$36,687
The next 10% earn	\$50,656
The top 10% earn	\$162,029
Overall	\$40,000

32 In Capitalia what, approximately, is the ratio of earnings of the richest 20% to the poorest 20%?

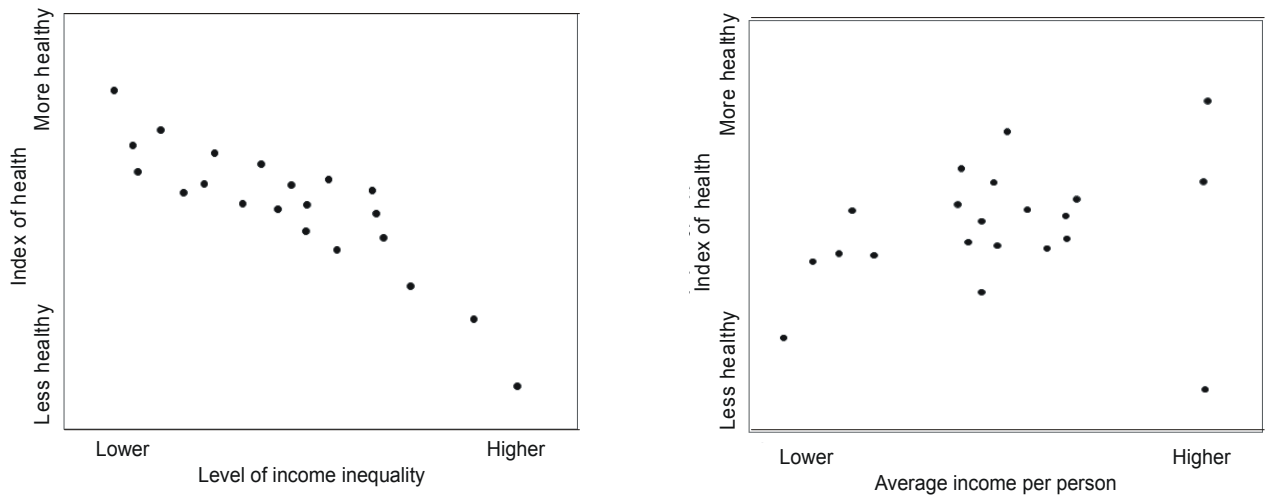
- A** 5:2
- B** 4:1
- C** 6:1
- D** 10:1
- E** 12:1

33 In Capitalia, what percentage of income is earned by the richest 10%?

- A** 10%
- B** 20%
- C** 40%
- D** 60%
- E** 80%

- 34 Suppose a wealth tax of 20% of income was imposed on the top 20% of earners and the revenue spread out evenly among the rest (a so called 'Robin Hood' tax). To the nearest \$100, how much would the average earnings of the bottom 10% be?
- A \$17,800
 B \$18,000
 C \$21,500
 D \$32,400
 E \$48,600

- 35 The graphs below show an index of health as a function of both inequality and wealth for a range of countries (the same group of developed countries is shown in both graphs).



Which of the following may be concluded from these graphs?

- 1 Within any given country, the richer people are no healthier than the poor.
 - 2 Countries with less variability of income generally have healthier people.
- A 1 only
 B 2 only
 C both 1 and 2
 D neither 1 nor 2

END OF TEST

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