BioMedical Admissions Test   4500/01

Wednesday   31 October 2007   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.

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. Questions ask you to show your choice between options by shading a circle. 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 22 printed pages and 2 blank pages.

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1   Under ideal conditions, a tree, newly planted from seed, grows 1 m in its first year. In each subsequent year it grows 10 % of the difference between its height at the beginning of the year and its theoretical maximum height.

If a given tree's theoretical maximum height is 30 m, how big will it be (under ideal conditions), to the nearest 10 cm after 3 years growth?

A   5.9 m

B   6.5 m

C   7.0 m

D   8.9 m

E   9.0 m

2   'WMD' (weapons of mass destruction) is a recently invented term and one that is not well defined. It includes everything from nuclear warheads to chemical and biological weapons, and is supposed to fill us with special dread. But any idea that 'WMD' are _____ is easily disproved. In 1945 fewer than 200,000 people were killed, albeit in a frightful way, by the atomic bombs dropped on Hiroshima and Nagasaki; but this was at the end of a war in which well over a million Germans and Japanese had already been incinerated or asphyxiated by 'conventional' bombing. It would have been little consolation to those dying in the air raids on Hamburg and Tokyo to know that there had been nothing 'mass-destructive' about their deaths.

A phrase has been omitted from the above passage. Which one of the following phrases most logically completes the argument?

A   morally unacceptable

B   a serious threat

C   uniquely dangerous

D   necessarily devastating

3 The table below shows the annual sales (in £) of the five sales representatives of a carpet company for two years. This shows a substantial rise in sales in the second of the two years.
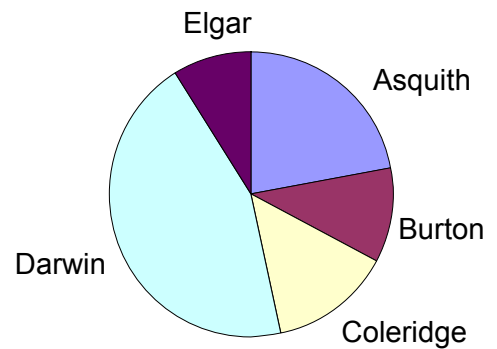
Representative	2005	2006
Asquith	240000	300000
Burton	380000	420000
Coleridge	350000	400000
Darwin	150000	250000
Elgar	580000	630000
Total	**1700000**	**2000000**

Which of the following pie charts represents the percentage contribution of each of the representatives to the **increase** in sales?

A
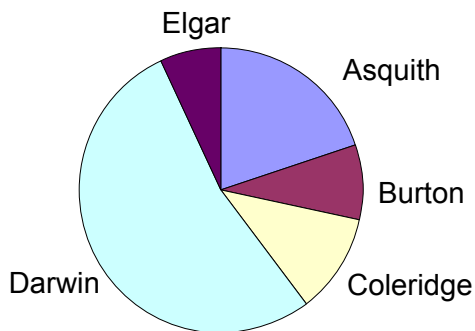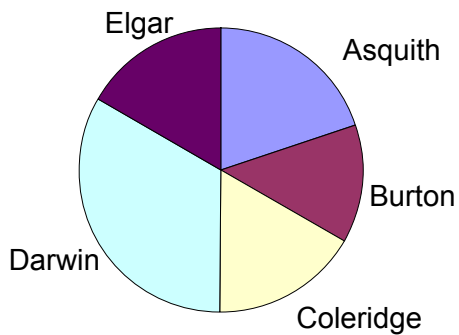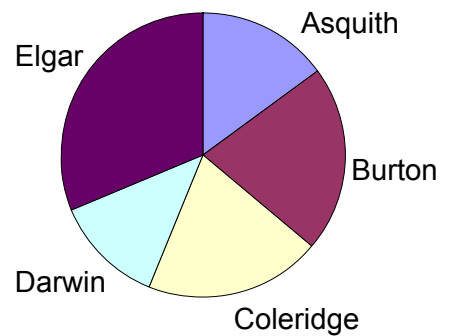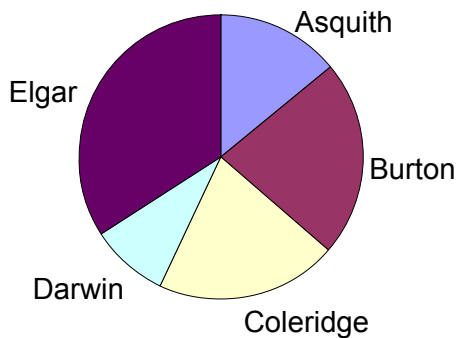

B

C

D

E

4 In the UK the accident rate for male drivers aged under 25 is much higher than for any other group. More than 1000 young male drivers, many of whom had passed their driving test at the first attempt, were killed or seriously injured last year. To reduce this loss of young life, the driving test should require a much higher level of mastery of driving skills than it does at present. In this way, failure at the first attempt would become the acknowledged norm, and drivers would not be allowed on the roads unsupervised until they had more driving experience.

Which of the following, if true, would weaken the above argument?

1 Many of the young male drivers involved in serious accidents are highly skilled in driving techniques.

2 Serious accidents are more likely to occur when young drivers are accompanied by a number of young passengers.

3 Accident rates are lower in countries where young drivers are required to have 100 hours of driving experience before taking the test.

A 1 only

B 2 only

C 3 only

D 1 and 2

E 1 and 3

F 2 and 3

5 The table below shows average occupation rates for beds in English NHS hospitals in 2004-5.

Title:	Average daily number of available and occupied beds by sector, England, 2004-5	
Source:	Department of Health form KH03	
Status:	Revised 7 December 2005 following refresh of dataset in line with DH revisions policy	

sector	available beds	occupied beds
all ward types	181,784	154,848
general & acute (acute plus geriatric)	136,123	117,145
acute	109,505	92,853
geriatric	26,619	24,291
mental illness	31,667	27,832
learning disabilities	4,899	4,134
maternity	9,095	5,737

Which sector has the highest percentage occupancy?

A   acute

B   geriatric

C   mental illness

D   learning disabilities

E   maternity

6 The best way to reverse the trend towards increasing violence amongst the young is to encourage more young men to take up boxing. Boxing is not primarily about aggression; it is about discipline and self-restraint. It also provides an activity to keep young men occupied during their leisure time. In every instance in which a boxing club has been set up in a high-crime area there has been a reduction in violent crime and drug use.

Which one of the following identifies a weakness in the above argument?

A   It assumes that boxers are never aggressive.

B   It ignores the possible effects on the crime rate of other leisure activities.

C   It assumes that most young men lack discipline and self-restraint.

D   It ignores the possibility that young men take up boxing because they enjoy violence.

7 In an experiment, 6 bulbs were planted in a row. 3 produced red flowers and 3 produced yellow flowers.

If the bulbs were planted in a random order, what is the probability that the colours will alternate along the whole row?

A $^1/_{60}$

B $^1/_{48}$

C $^1/_{32}$

D $^1/_{20}$

E $^1/_{10}$

8 Many people think that if they – or 'the experts' – cannot explain something, it must therefore be truly paranormal. An amateur archaeologist declares that because he cannot figure out how the pyramids were built, they must have been constructed by aliens. Feats such as the bending of spoons, or telepathy, are often thought paranormal or mystical. But if they were explained people would respond, "Yes, of course" or "That's obvious once you see it." Fire-walking is a case in point. People speculate about the supernatural powers of fire-walkers over pain and heat, yet the simple explanation is that the conductivity of heat from the light and fluffy coals to the walker's feet is very poor. As long as you don't stand still, you will not get burned.

Which one of the following is an inference which is supported by the above passage?

A There are no truly paranormal occurrences.

B Everything that occurs has an explanation.

C The lack of a simple explanation does not make an occurrence paranormal.

D Feats such as spoon bending and telepathy do not really occur.

Questions 9 to 12 refer to the following information:

The tables below enable nutritional requirements to be calculated for cats who are receiving treatment in veterinary surgeries.

Step 1. Calculate basic energy requirement (ber)

Body weight (bw)	Basic energy requirement (ber)
<2 kg	$=70*bw^{0.75}$
>=2 kg	$=30*bw+70$

Step 2. Calculate maintenance energy requirement (mer)

(mer = ber*factor: kcal/day)

Status	Factor
cage rest	1.1
post trauma	1.3
cancer	1.4
sepsis	1.6
burns	1.8

Step 3. Calculate protein requirement

Status	Requirement
maintenance	7 g/100 kcal
hepatic or renal failure	4 g/100 kcal

Step 4. Choose feed formula

Product	Energy content (kcal/ml)	Protein (g/ml)
FCH	1.3	1.4
FCV	1.4	0.12
FIF	2.1	0.16
CCF	1	0.09
CCFR	1	0.06
ES	1	0.04
OHN	1.1	0.05
EMF	2.1	0.08

9 How much protein (to the nearest 0.1 g) does a 2 kg cat with sepsis but without hepatic or renal failure require?

A   8.6 g

B   11.2 g

C   13.2 g

D   14.0 g

E   14.6 g

10 A 1 kg kitten has been injured in a road accident and is being treated post trauma. If it is being fed with the correct amount of product CCFR to give it the correct energy intake, how much protein is it receiving relative to the recommended level?
(Answer to the nearest 0.1 g)

    A   0.4 g too little

    B   0.7 g too little

    C   0.9 g too little

    D   1.3 g too little

    E   2.8 g too little

11 Which is the most appropriate feed formula (i.e. giving the closest amounts of both energy and protein) for a cat suffering renal failure?

    A   FCH

    B   CCFR

    C   ES

    D   OHN

    E   EMF

12 A feed containing 100 kcal has been mixed up to give the right amount of energy and protein for a cat in care. However, formula CCF was used by mistake instead of CCFR. It is decided that, rather than throwing it away, the CCF feed will be mixed with ES to give the same ratio of protein to energy as CCFR.

How much ES must be added to the 100 ml CCF mix?

    A   60 ml

    B   100 ml

    C   150 ml

   **D**   167 ml

    E   250 ml

13 The table below shows the results of a survey into alcohol use in England in a single week in 2002. Those interviewed were asked to say how many days they had drunk alcohol in the previous week.

Number of drinking days	Percentages				
	all ages	16-24	25-44	45-64	65 or over
0	34	36	30	31	45
1	18	21	19	16	16
2	14	16	16	14	9
3	10	10	12	10	6
4	6	7	7	7	3
5	4	4	5	5	3
6	3	2	3	4	2
7	11	3	8	14	16

Percentage who had drunk last week	66	64	70	69	55

The bar chart below shows this data summarised as the percentage who had drunk on a certain number of days or more.

Percentage who had drunk on *x* days or more
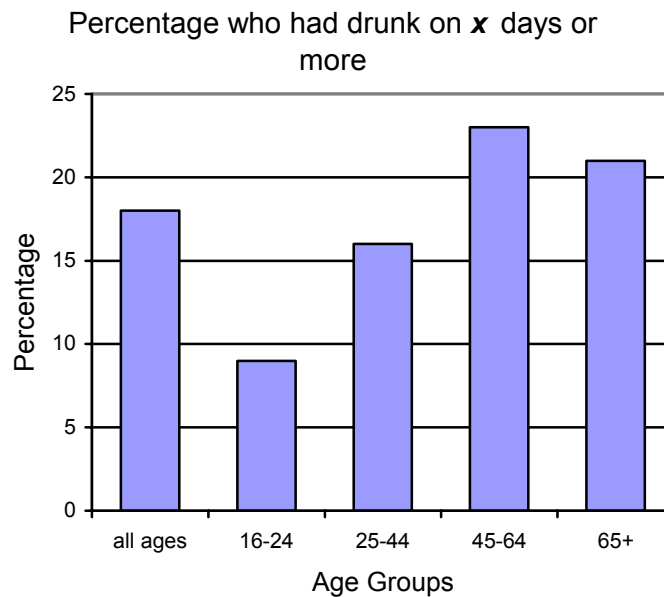
What is *x*?

A 3

B 4

C 5

D 6

14 A survey of the behaviour of dogs in Vancouver over several months in 2001 revealed a surprising finding. On 27 February, the day before a major earthquake with an epicentre 240 kilometres south of the city, almost 50 % of the dogs were observed to be much more active and anxious than usual. The probability of this happening by chance was 1 in 1000, so it is likely that it was connected in some way with the earthquake. Suggested explanations have been that dogs were responding to electromagnetic changes or to the release of subterranean gases associated with earthquakes. But given what we know about dogs' hearing abilities, the most likely explanation is that dogs can hear sounds from rocks scraping or breaking underground before an impending earthquake.

Which one of the following, if true, gives support to the explanation offered in the above passage?

A Many dogs that had a hearing impairment did not show an increase in anxiety on 27 February 2001.

B Seismic waves at very high frequencies are usually detectable only up to 100 metres from their source.

C The observation and recording of the dogs' behaviour was done by the dogs' owners.

D Monitoring of earthquake zones using acoustic detection systems has failed to find acoustic signals before an earthquake.

15 In an election for a school council there were three candidates. Ann received exactly one third of the votes cast, Paul received 116 votes and Elaine received half as many as Paul.

Who won, and by what margin?

A Ann by 116 votes

B Ann by 87 votes

C Paul by 29 votes

D Paul by 58 votes

E Paul by 116 votes

16 Data from a Swedish census shows that at age 64 those who have a PhD are less likely to die within the next year than are those who have only a BA or a BSc. The census showed further evidence of the relationship between level of educational attainment and longevity, since those aged 64 with an MA (higher than a BA and lower than a PhD) were less likely to die within the next year than those with a BA and more likely to die within the next year than those with a PhD. So it's clear that someone who is awarded a PhD in Sweden will live longer than they would have done if they had not studied for a higher degree.

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

A It assumes that what is true for a group is true for each individual.

B It assumes that people who are awarded PhDs will have a healthier lifestyle.

C It assumes that what applies in Sweden will apply in other countries.

D It assumes that in Sweden only the healthiest people are awarded PhDs.

17 It would not be surprising to discover that today's smokers find it harder to give up than did their predecessors, since smokers are now inhaling more nicotine. Data supplied by tobacco companies reveals that the amount of nicotine inhaled by a typical smoker increased by 11 % per cigarette between 1998 and 2005. This is because the nicotine content of cigarettes has increased, no doubt because tobacco companies want their product to be more addictive.

Which of the following, if true, weakens the above argument?

1 Today's cigarettes burn at the same rate as those of ten years ago, allowing the same number of puffs per cigarette.

2 The higher the nicotine content of a cigarette, the fewer the cigarettes smoked by a typical smoker.

3 Drugs which could partially block nicotine in the nervous system are currently being tested.

A 1 only

B 2 only

C 3 only

D 1 and 2

E 1 and 3

F 2 and 3

18   Bob has £140 to spend on paving slabs for his patio garden. Paving slabs are 70 x 70 cm square and cost £2.80 each. He finds that, using whole slabs, he is only able to buy enough to lay an area which is twice as long as it is wide but will not cover the whole patio. He decides to leave the remainder as a rectangular flower bed down one side.

If his patio garden is 5 m wide, how wide is the flower bed?

A   1.4 m

B   1.5 m

C   2.0 m

D   3.5 m

E   7.0 m

19   Two drivers take part in a race. The faster driver's average lap time is 1 minute 6 seconds, and the slower driver's 1 minute 10 seconds.

Assuming they drive at a constant speed and started together, how long would it take for the faster to lap the slower driver?

A   18 minutes 9 seconds

B   19 minutes 15 seconds

C   20 minutes 25 seconds

D   38 minutes 30 seconds

E   40 minutes 50 seconds

Questions 20 to 23 refer to the following information:

The information below is taken from two independent studies on the detection of prostate cancer. Prostate Specific Antigen (PSA) is a measurement taken from a blood sample and Digital Rectal Examination (DRE) is a physical examination. In the absence of further information, you should assume that there is no connection between the probability of a person having a false positive on one test, and their chance of a false positive on the other.

STUDY 1: PSA

The PSA test allows early detection of a potentially curable prostate cancer. A normal PSA does not categorically exclude the presence of prostate cancer (false negative) neither does an abnormally high PSA always indicate the presence of cancer (false positive).

The level of PSA which is used to determine what is normal and what is abnormal is set at a value which tries to keep false positives low whilst not allowing too many false negatives. A typical value of the normal reference point is 4 ng/ml.

- 10 % of men aged 50-70 tested will have an abnormal PSA level.
- Of those with abnormal PSA levels, 26 % will subsequently be found to have cancer and the remaining 74 % will be shown to be false positives.
- Of those with normal PSA levels, 0.8 % will later be found to have prostate cancer (false negatives).

STUDY 2: DRE

There were 14 studies with results on 21,821 men. The overall prevalence of cancer confirmed by biopsy or surgery was 3.7 % (range 1.2 % to 7.3 %).

The results of the studies are presented in a different way below. Studies were normalised to 1000 men, and the number calculated for:

- True positive: screened positive by DRE and with cancer shown by biopsy or surgery. In every 1000 men screened the average number screened positive and with cancer was 21 men (range 6 to 54).
- False positive: screened positive by DRE and with no cancer shown by biopsy or surgery. In every 1000 men screened the average number screened positive but without cancer was 85 men (range 6 to 301).
- False negative: screened negative by DRE and with cancer shown by biopsy or surgery. In every 1000 men screened the average number screened negative but who actually had cancer was 16 men (range 4 to 32).

20 If DRE was used alone to diagnose prostate cancer, what would be the percentage of men screened positive?

    A   2.1 %

    B   3.7 %

    C   6.4 %

    D   10.6 %

    E   12.2 %

21 If the samples of men involved in the study were representative of the general population, what would be the overall rate of confirmed prostate cancer in 50-70 year old men according to the data given in study 1?

    A   0.8 %

    B   2.6 %

    C   3.3 %

    D   26 %

    E   33 %

22 A journalist, on the basis of the above scientific summaries, concludes that the PSA test is more reliable than the DRE test. If his conclusion is correct, the word 'reliable' can be defined in the following ways:

    P: In the sense that PSA gives fewer false positives.
    Q: In the sense that PSA gives fewer false negatives.

Which of the above is/are correct?

    A   P and Q

    B   P only

    C   Q only

    D   Neither P nor Q

PLEASE TURN OVER

23 Since neither test is 100 % decisive or accurate, the normal clinical procedure is to follow an abnormally high PSA test with a DRE. If 1000 men are screened, using this two stage process, on average how many will have false positive readings on **both** tests? (Answer to the nearest whole number)

    A   2

    B   6

    C   16

    D   59

    E   159

24 The word 'globalisation' has mistakenly become associated in people's minds with the internet. But globalisation must involve a worldwide network of trade in goods and services, which is possible without the communication provided by the internet. Of course, the internet allows people to exchange ideas and information at a distance, but it is not capable of moving tradable goods and people around the world. For that to happen there must be easily affordable transport. So what really drives globalisation is the availability of cheap air travel and cheap shipping.

It follows from what is stated in the above argument that the internet is:

A a necessary, but not a sufficient condition for globalisation.

B a sufficient, but not a necessary condition for globalisation.

C both a necessary and a sufficient condition for globalisation.

D neither a necessary nor a sufficient condition for globalisation.

25 In his 2007 State of the Union address, President George W. Bush, called for the country to increase its ethanol production to 35 billion gallons per year by 2017 – or nearly five times the 7.5 billion gallon target for 2012 that Congress established in 2005. Raising biofuels consumption would cut U.S. dependence on foreign oil and help curb carbon dioxide emissions, because the plants from which the fuels are derived absorb atmospheric CO_2 during photosynthesis. Ethanol is now produced domestically from corn grown on 54,000 square kilometres of farmland, or an area a little larger than West Virginia. Reaching the president's goal would require another 334,000 square kilometres, or the combined size of Kansas and Iowa.

Assuming production rates per square kilometre of farmland do not change between 2007 and 2017, approximately how much ethanol is being produced now?

A 1.5 billion gallons

B 4.9 billion gallons

C 5.7 billion gallons

D 6.7 billion gallons

E 7.5 billion gallons

26 A budget airline operates a 'sit anywhere' policy on its short-haul flights.

Flight NJ201 to Madrid is booked to capacity. In row 8, as in all the rows, there are six seats, three each side of the aisle:

| window | 8A | | 8B | | 8C | aisle | 8F | | 8E | | 8D | window |

Four passengers are already sitting in row 8: Maurice and Noola are in adjacent seats, but Noola refuses to sit by a window. Olive has chosen a window seat and Pete an aisle seat. This leaves two seats, and by the time Quentin and Ron arrive they are the only unoccupied seats on the plane.

From this information, and if all the resulting seating arrangements are equally probable, what are the chances of Quentin and Ron finding two vacant seats next to each other?

A $1/6$

B $1/4$

C $1/2$

D $2/3$

E $3/4$

27 A farmer has free range chickens. They are all over his farm and he has no easy way of counting them. However, he has devised a clever system. One day he rounded up 50 chickens, put metal rings around their legs and let them go. The next day he rounded up 50 chickens and found that 6 of them had rings on their legs.

Assuming there was no change in the number of chickens between the two days, what was his estimate of the number of chickens on the farm? (Give your answer to the nearest whole chicken.)

A   300

B   367

C   417

D   1500

E   2200

28 Young children who sleep with a light on may have a substantially higher risk of developing nearsightedness as a result, says a new study in the journal *Nature*.

The collaborative study of 479 children by researchers at the University of Pennsylvania Medical Center and The Children's Hospital of Philadelphia found 55 percent of children who slept with a room light on before age 2 had myopia, or nearsightedness, between ages 2 and 16.

Of the children who slept with a night-light before age 2, 34 percent were myopic, while just 10 percent of children who slept in darkness were nearsighted.

Which one of the following, if true, gives a reason why the above argument might be flawed?

A   A later study showed that myopic parents are more likely to leave children's lights on than those without myopia.

B   The study did not follow the subjects into adulthood.

C   American children are more prone to developing myopia than those from other parts of the world.

D   Few children in the third world, where there are few electric lights, wear glasses.

29 A conflict diamond is a diamond mined in a war zone and sold in order to finance the military rebellion of groups opposing legitimate and internationally recognised governments. While rough diamonds can be traced with some degree of accuracy to their source, once in their commercial, polished state, they can no longer be identified. Until regulations are brought into place that enable you to judge with confidence the true origins of a diamond, the purchasing of diamonds is morally unjustifiable. Diamonds are an unnecessary luxury, and at present the human cost for the war-torn countries that they may have come from is simply too high.

Which of the following, if true, would most weaken the above argument?

A   It may never be possible to know with certainty the origins of the diamond you wish to produce.

B   Military intervention has regularly proved more decisive when dealing with rebel insurgents than economic sanctions.

C   Sales of diamonds are an important source of revenue for the 'recognised governments' of war-torn countries.

D   Some people believe precious stones to have a deeper significance than that of wealth or luxury.

30   Which **two** of the paper shapes shown below can be folded to form a cube with 6 complete faces?
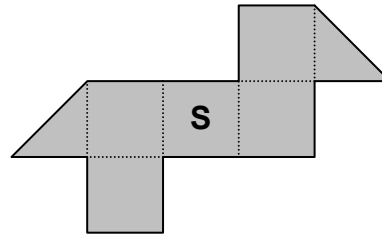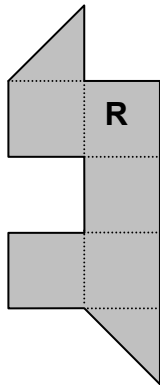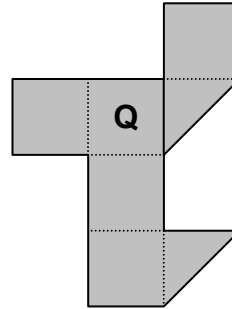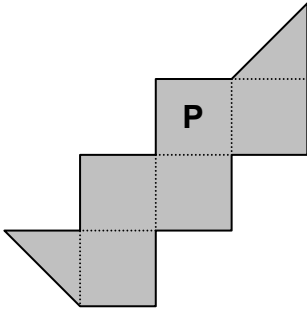
A   P and Q

B   P and R

C   P and S

D   Q and R

E   Q and S

F   R and S

31 Athletes who use a heart rate monitor as a training aid need to identify their maximum heart rate in order to determine their effective training zones.

It should be remembered that any formula used to determine maximum heart rate (MHR) is only a best guess (based on research) and not a guarantee of the MHR value.

To determine your maximum heart rate (bpm – beats per minute) you could use the following, which combines the Miller formula with research from Londeree and Moeschberger.

1 Use the Miller formula of MHR=217-(0.85 x age) to calculate MHR

2
Subtract 3 beats for elite athletes under 30
Add 2 beats for 50 year old elite athletes
Add 4 beats for 55+ year old elite athletes

3
Use the resulting MHR value for running training
Subtract 3 beats for rowing training
Subtract 5 beats for bicycle training
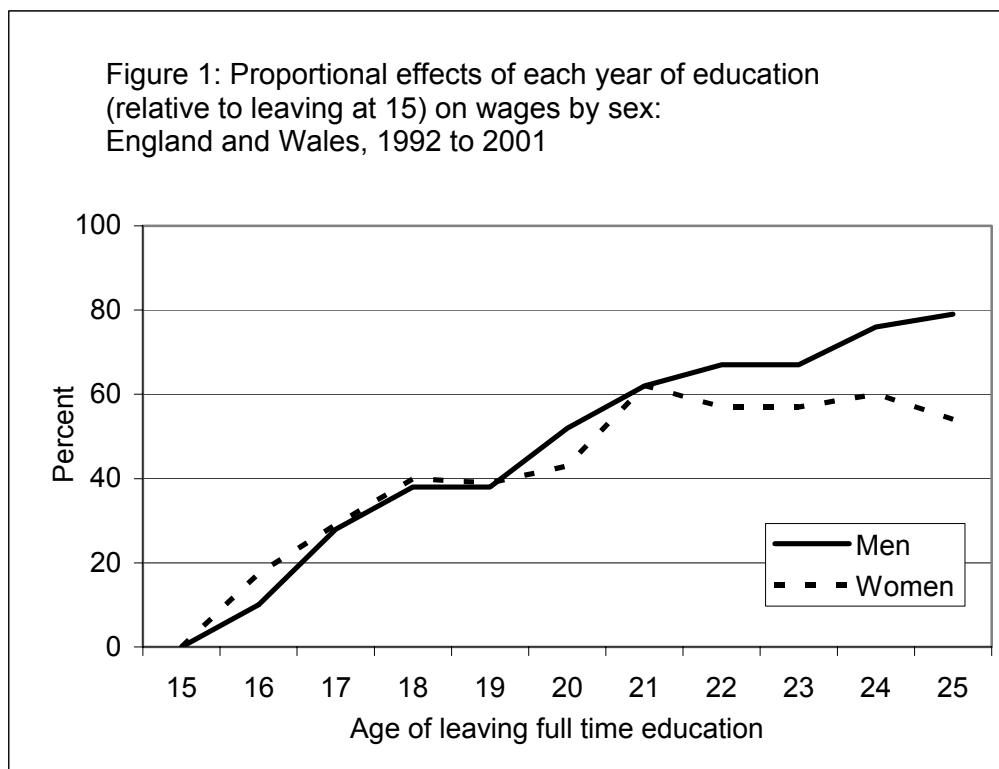subtract 14 beats for swimming training

What is the estimated maximum heart rate for a 60 year old elite swimmer in training?

A   152 bpm

B   156 bpm

C   166 bpm

D   170 bpm

E   176 bpm

PLEASE TURN OVER

Questions 32 to 35 refer to the following information:

The graph below shows some of the results from a government survey into the effects that additional years of education have on wages. The results given are raw averages of the entire sample (around 20,000 people of all ages). Values are proportional to the difference in average wage when compared to the average wage of people who left education at 15 for each sex. For example women who left education at 18, regardless of their age at the time of the survey, earn on average 40% more than those who left education at 15.

Figure 1: Proportional effects of each year of education (relative to leaving at 15) on wages by sex: England and Wales, 1992 to 2001

32 Which one of the following conclusions may safely be drawn from the above graph?

A Up to the age of 19, women's average wages are higher than those of men.

B Women staying in education past the age of 20 earn, on average, less than their male equivalents.

C Extra education is always beneficial in increasing wages.

D Education beyond the age of 21 or 22 on average does not enhance women's wages.

E A degree (taken between the ages of 18 and 21) adds, on average, 50 % or more to wages relative to people leaving education at 18.

33 If the authors of the report concluded that each year of education past 15 improves wages by 8-10 % on average, which one of the following would be an assumption they were making in drawing this conclusion?

A That a few graduates with extremely high wages are not biasing the data.

B That people's wages do not increase, on average, as they get older.

C That higher wages are due mainly to the extra education.

D That those people with higher wages would have had them even if they had not stayed in education longer.

E That no 15 year olds earn any wages.

34 It was found that the financial returns for a degree were somewhat less for trade union members.

Which one of the following would give a reason for this?

A There has been a substantial fall in trade union membership over recent years.

B Graduates in low paying jobs in the public sector are more likely to be trade union members.

C Trade unions tend mainly to represent those in manual jobs who usually do not have degrees.

D The average age of trade union members in the survey is higher than that of non-members.

E Some people who used to be trade union members have recently resigned because they feel the subscriptions are not worth paying.

35 On average, older people left education earlier but earned more. What effect has this had on the shape of the above graph (relative to the way the graph would look if this was not so)?

A It has had no effect.

B It has caused it to turn downward at the upper end.

C The entire graph has shifted up.

D The average gradient is lower than it would have been otherwise.

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