

UNIVERSITY OF CAMBRIDGE INTERNATIONAL EXAMINATIONS
General Certificate of Education Advanced Level

THINKING SKILLS

9694/03

Paper 3 Problem Solving and Critical Thinking (Advanced)

For examination from 2007

Specimen Paper

1 hour 30 minutes

Additional Materials: Multiple Choice Answer Sheet
Soft clean eraser
Soft pencil (type B or HB is recommended)

READ THESE INSTRUCTIONS FIRST

Write in soft pencil.

Do not use staples, paper clips, highlighters, glue or correction fluid.

Write your Centre number, candidate number and name on the Answer Sheet in the space provided unless this has been done for you.

There are **25** questions on this paper. Answer **all** questions.

For each question there are five possible answers **A, B, C, D** and **E**.

Each question tells you whether to choose **one or two** answers.

Record your choice(s) in **soft pencil** on the separate Answer Sheet.

Read the instructions on the Answer Sheet very carefully.

Ignore responses 26-50 on the answer sheet.

INFORMATION FOR CANDIDATES

Each question is worth 2 marks. Marks will not be deducted for wrong answers.

This document consists of **28** printed pages.



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1 Read the question then record your **two** choices on the separate answer sheet.

In an argument there must be a conclusion, and one or more reasons given to support the conclusion.

From the above definition, which **two** of the following passages are arguments?

- A** The dangers from global warming are greater than any other dangers facing the planet. Reducing carbon emissions would reduce this danger. Replacing the use of energy from fossil fuels with nuclear power would reduce carbon emissions.
- B** Nuclear power is not a safe, pollution-free source of energy. Nuclear power stations discharge radioactive material into the oceans. This will inevitably damage marine life and is likely to adversely affect human health in the long term.
- C** Nuclear power produces radioactive waste that needs to be stored somewhere. This waste remains dangerous for thousands of years. Scientists claim that safe storage is possible, though it would be costly.
- D** Renewable sources of energy such as wind and wave power are being developed. If we do not increase our use of these sources we shall not be able to reduce carbon emissions. Research into the development of renewable energy sources is very expensive.
- E** Countries that have the technology for nuclear power can more easily produce nuclear weapons. The more countries there are with the capacity for producing nuclear weapons, the greater the threat of global conflict. International organisations must urge countries to tackle global warming without using nuclear power.

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2 Read the question then record your **two** choices on the separate answer sheet.

Sir - Most Londoners seem jubilant that their city was chosen for the Olympic Games in 2012. They may be less triumphant when the work starts and the costs start to sink in, but that is another matter. My point is not that London cannot afford it, but that London was the wrong choice in the first place. If the Olympic flame is to return to the UK at all it should have gone to a different city, such as Manchester or Glasgow, not to London, which has hosted the Games twice already. But why the UK anyway, or for that matter Spain or France or Russia whose capitals were also short-listed for 2012? All these countries have staged the Olympics one or more times whereas the entire continent of Africa, despite sending so many great athletes to compete in the Games over the years, has never hosted them once. London was not just the wrong city, it was in the wrong hemisphere.

A newspaper editor wanted a heading for the above letter and came up with the following statement:

“It is time Africa had its turn to host the Olympic Games”

Which **two** of the following fairly describe how the statement relates to the letter writer’s argument?

- A It is one of the reasons given for the conclusion.
- B It is implied in the letter but not stated.
- C It expresses the main conclusion.
- D It is contrary to the conclusion.
- E It is simply provided as an example.

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3 Read the question then record your **one** choice on the separate answer sheet.

Asteroid 2004 MN4 is predicted to come within 20,000 miles of Earth and may even collide with us. The lump of rock and metal, which is 380m across, would have an impact equivalent to fifty one-megaton hydrogen bombs exploding simultaneously. It could devastate an area the size of a large American state and cause tsunamis around the world. We must act now to prevent this collision. We could fire missiles at the asteroid to deflect its orbit, cover it with aluminium foil so that the sun would thrust it into a different orbit or develop space tugs. These could either tug the asteroid away from us, or bring it into orbit around Earth as a metal-rich second moon.

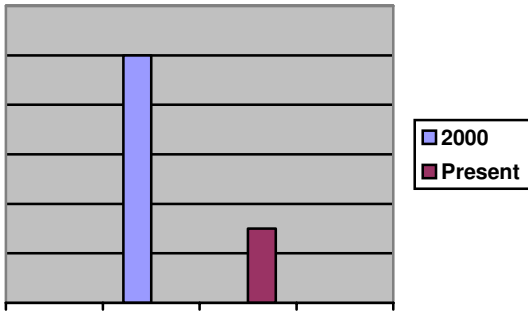
Upon hearing this, a woman tries to make an analogy by saying:

“That’s like saying we should stop flying because of a small risk that aeroplanes might crash.”

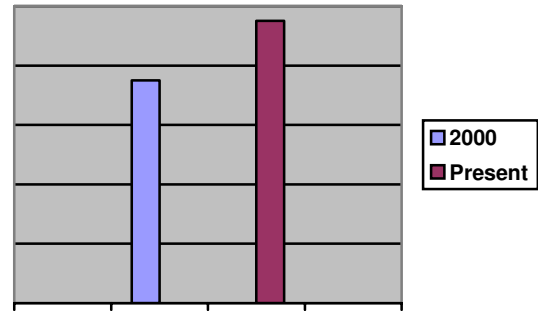
Which **one** of the following best expresses the failure of the analogy?

- A Stopping flying would be very much cheaper than diverting an asteroid.
- B Flying planes is a human activity, whereas asteroids are beyond human control.
- C Avoiding a slightly risky activity is not the same as acting to minimise risk.
- D An asteroid hitting Earth would have far more serious consequences than a plane crash.
- E Asteroids do not have pilots and therefore lack the risks associated with human error.

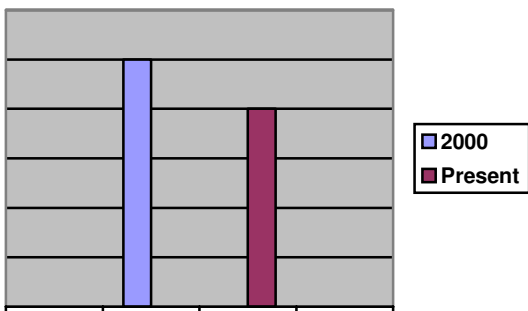
4 Read the question then record your **two** choices on the separate answer sheet.



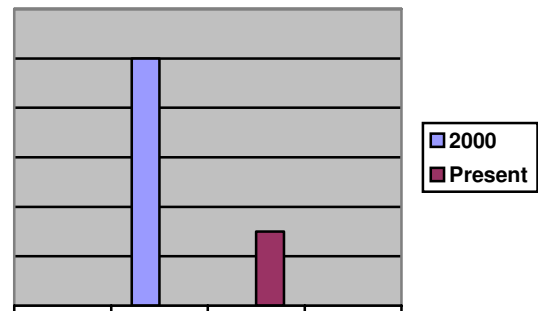
Physics *A Level* class size



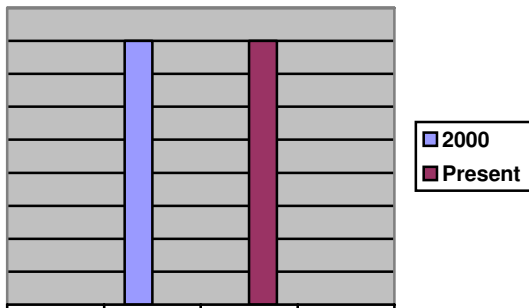
Money spent on teaching of Physics



Number of Physics teachers



Number of students taking Physics *A Level*



Percentage of students passing Physics *A Level*

Which **two** of the statements below are conclusions that follow from the above data?

- A The reduction in class group sizes has been due to spending more money on the provision of *A Level* Physics teaching.
- B The number of students passing Physics *A Level* has decreased.
- C Some teachers of Physics are now responsible for teaching more class groups over an academic year than in 2000.
- D Some teachers now have a better pass rate amongst the students that they teach than in 2000.
- E A further reduction in class group sizes would be likely to improve the pass rate.

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- 5 Read the question then on the separate answer sheet record **both** your choice for part (i) **and** your choice for part (ii).

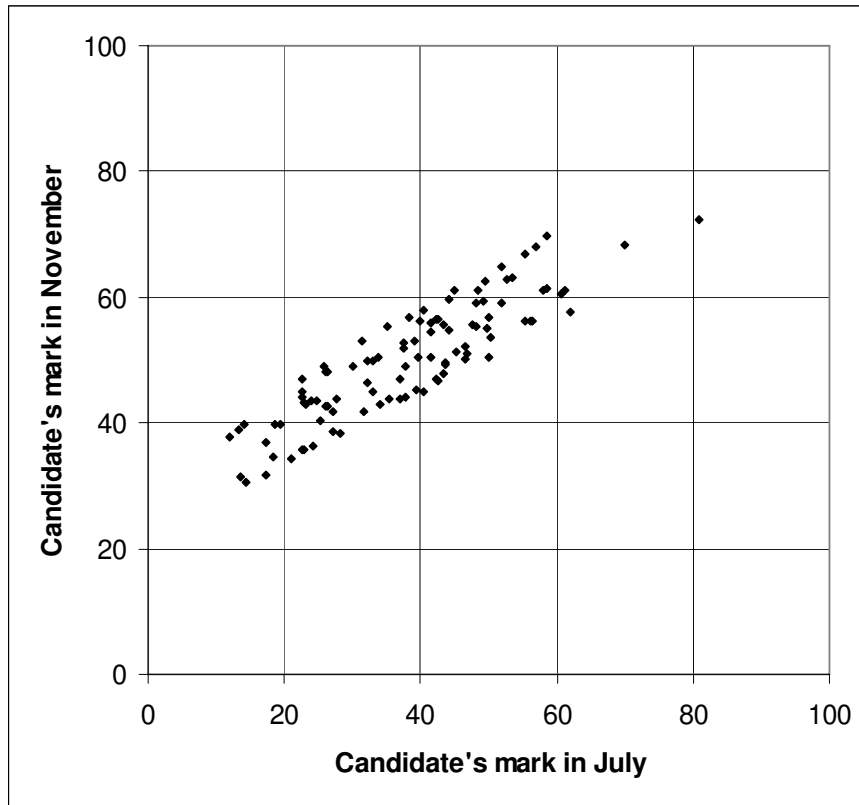
People who support the theory of intelligent design argue that complex organisms cannot have evolved by random combinations. This is because the chances of such complexity occurring naturally are so small. However, we do not need intentional design to explain the outcome of nature's processes. Nature does not have fixed intentions but makes billions of combinations of genes or characteristics. Any particular outcome is possible, however unlikely. Some individuals will have combinations of genes which make them more likely to survive. These will successfully raise young and pass on the beneficial characteristics.

- (i) Which **one** of the following best expresses the main conclusion of the above argument?
- A Natural evolution can lead to any combination of genes, however unlikely.
 - B The notion of a designer is not required to explain the development of complex organisms.
 - C Individuals with unlikely characteristics have a better chance of reproducing successfully.
 - D Complex organisms are so unlikely they must be the product of design not chance.
 - E The next generation will pass on useful characteristics to their own offspring.
- (ii) Which **one** of the following is a further conclusion which can be drawn from the reasoning in the passage?
- A A designed product must be better than one which occurs by chance.
 - B People have a natural tendency to explain evolution in terms of design.
 - C Life must necessarily have been created.
 - D A designed product cannot be better than one which occurs by chance.
 - E There might be desirable characteristics for a species which have not yet evolved.

6 Read the question then record your **two** choices on the separate answer sheet.

A group of students sat an examination in July. 100 of the students, who had not performed as well as they expected in July or who wished to improve their grades, retook the examination in November. The scatter graph below shows their performance on one paper of the examination in the two sessions.

Each point on the graph represents the mark (expressed as a percentage) of one student in the equivalent paper taken in July and November.



Which **two** of the following statements could reliably be inferred from the scatter graph?

- A Most students improved their percentage between July and November.
- B The November paper was easier than the July paper.
- C Students perform better in retakes than in the original examination.
- D The weaker students improved their percentages by more than the stronger students.
- E Some of the weaker students scored lower marks in November than in July.

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7 Read the question then record your **one** choice on the separate answer sheet.

The ingredients for a pizza, that is 10 inches in diameter, cost about twice as much as for a 7-inch pizza. A zero-inch pizza has no content and costs nothing.

Which **one** of the following has the same relationship between the item of interest (e.g. amount of pizza) and the measurement?

- A The distance travelled by one revolution of a 26-inch tyre is about twice that of a 13-inch one.
- B The power used by a 12-inch screen is only around half of that used by a 17-inch screen.
- C A 453g jar of jam costs about half as much as a 900g jar.
- D The Sun is around twice as bright as Venus since it is only 72% of the distance from the Sun to the Earth.
- E Two Canadian dollars is worth about one British Pound, so one dollar is worth around half a pound.

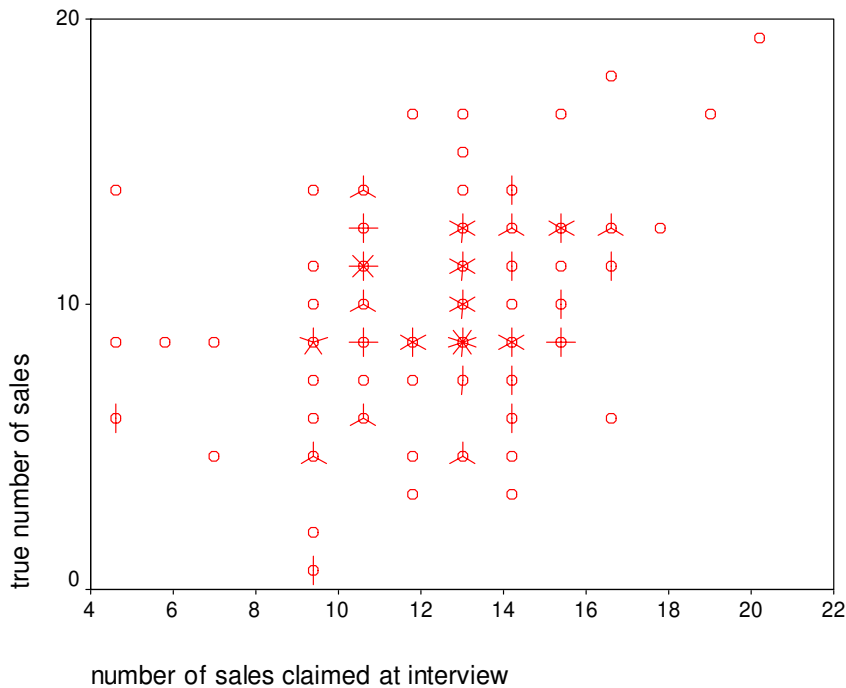
- 8 Read the question then on the separate answer sheet record **both** your choice for part (i) **and** your choice for part (ii).

The manager of a large chain of car sales showrooms interviews 139 potential sales staff. At the interview he asks the candidates how many car sales per month they make for their current employer. He appoints a total of TEN candidates using the simple strategy of selecting the top ten in terms of the number of sales they claim to have made.

The manager assumes that most candidates will tend to claim to make rather more sales than they actually do in order to impress him at the interview. The scatterplot below shows each of the 139 candidate's (a) true sales figure plotted against (b) the sales figure that they claimed at interview.

Each candidate is represented by a small circle on the scatterplot. However, where more than one candidate appears at a particular point on the scatterplot, then the number of candidates at that point is indicated by the corresponding number of 'spikes'.

For example, the following would represent six candidates:



- (i) How many of the appointed candidates had lower true sales scores than several of the rejected candidates?
- (ii) How many of the appointed candidates had higher true sales scores than all of the rejected candidates?

- A** 2
B 5
C 8
D 4
E 7

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9 Read the question then record your **two** choices on the separate answer sheet.

In the country of Numismia, the currency is the mart and coins exist in all denominations from 1 mart to 10 mart (i.e. 1 mart, 2 mart, 3 mart etc.) The next smallest is then 20 mart.

Ayesha has four coins in her purse, with three different denominations, adding up to 13 mart. Boris also has four coins in his pocket, with the same three denominations, but they add up to 17 mart.

Boris has two of one denomination of coin. There are two possibilities for what this could be. Select them **both**.

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

10 Read the question then record your **one** choice on the separate answer sheet.

Some floors of hotels are designated non-smoking. Only guests who request non-smoking rooms are given rooms on these floors. But these rooms still tend to be asked for more than smoking rooms.

Whenever possible, a room is left empty for a day after guests have gone.

The following show which rooms were occupied on various floors of a hotel in Ruritania on the first two days when it was opened.

5th Floor

				X	X			X		X	X	X	X	X	X	
	X		X	X	X	X	X	X	X	X	X					

4th Floor

		X	X		X	X		X								
X		X		X	X		X	X	X	X	X	X		X	X	

3rd Floor

	X		X	X			X	X	X					X	X	
X				X	X		X			X	X	X	X	X		X

2nd Floor

	X		X	X			X	X	X					X	X	
X	X	X			X	X				X	X		X	X		X

1st Floor

X	X		X	X			X	X	X		X			X		
X	X		X	X			X	X	X	X				X		

Which floor is the most likely to be one of the non-smoking ones?

- A 5th
- B 4th
- C 3rd
- D 2nd
- E 1st

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11 Read the question then record your **two** choices on the separate answer sheet.

Organic crops are grown without the use of manufactured pesticides and fertilisers. But this does not necessarily make organic food healthier, because all plants contain natural pesticides. In fact, 99.99% of the pesticides we consume are these natural pesticides. What is important for health is to eat several portions of fruit and vegetables each day, because these contain nutrients and vitamins that provide protection against a number of serious diseases. Therefore, our food crops should be grown mainly by conventional methods, using manufactured pesticides and fertilisers, because these methods have produced a massive increase in food production over the last 50 years. This has greatly reduced the price of food, and increased food availability worldwide, despite a doubling of the world's population. Organic agriculture is much less efficient than conventional methods, thus organically produced food costs more.

Which **two** of the following statements, if true, strengthen the above argument?

- A** The world's population is likely to continue to increase.
- B** Any pesticide is toxic if consumed in sufficient quantity.
- C** The use of artificial pesticides and fertilisers can be damaging to wildlife.
- D** Scientific research has shown that natural pesticides in plants can be harmful to the health of animals.
- E** The more vitamins we consume, the better we can resist the ill effects of any pesticide residues in food.

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12 Read the question then record your **two** choices on the separate answer sheet.

A questionnaire survey was conducted whereby a large number of people were asked a number of questions. Two of the questions were:

- Do you believe in the paranormal?
- Do you own a cat?

The data obtained from this survey led the authors to conclude that people who believe in the paranormal are significantly more likely than non-believers to own a cat.

Which **two** of the following five statements, if true, would explain the above correlation?

- A** More women than men keep a cat as a pet and more women than men believe in the paranormal.
- B** People who believe in the paranormal are more likely than non-believers to agree to requests to fill out questionnaires.
- C** The questionnaire contained so many questions that some significant associations were bound to be found just by chance.
- D** People who believe in the paranormal tend to answer survey questions unpredictably.
- E** Cat lovers tend to enjoy answering questions.

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- 13** Read the question then on the separate answer sheet record **both** your choice for part (i) **and** your choice for part (ii).

Human activities which ‘artificially’ select out the largest, strongest and most attractive members of a species, such as shooting elephants with the longest tusks, bias evolution in favour of members that are smaller and less attractive, including (for example) elephants with smaller tusks or no tusks at all. These evolutionary changes can be observed within a few generations, far more quickly than was realised until recently.

It follows that ‘artificially’ protecting the weaker and most disease-prone members of a species will tend relatively quickly to increase their proportion of the population. If so, what does it mean for the medium-to-long-term future of humans, as our health-care systems become more effective and far reaching? As a species we may well face a steadily increasing dependence on drugs and other forms of medical care in order to survive.

(i) Provided it is true, which one of the following statements most weakens the argument?

(ii) Provided it is true, which one of the following statements most strengthens the argument?

- A** The human population is far larger and more widely dispersed than the elephant population.
- B** Without the intervention of modern medicine, only the healthiest and strongest humans would survive to reproduce.
- C** Evolutionary changes occur to species even without any human activities to affect them artificially.
- D** It would be morally indefensible to withhold medical care from weaker and more disease-prone individuals.
- E** Protecting the weaker members of a species is not the same as killing off the strongest.

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- 14** Read the question then on the separate answer sheet record **both** your choice for part (i) **and** your choice for part (ii).

Research indicates that children who read fiction prolifically are more likely to be successful academically than those who do not. This success extends beyond the areas of literature, language and history, in which the link between stories and academic (school) work can clearly be seen. Children who read are also _____ . The reason for this is thought to be that stories help them to understand and structure the world around them. If this is true, parents with their children's happiness at heart should do all they can to encourage a love of stories.

- (i) Which one of the following phrases, inserted in the blank space, most logically completes the passage?
- A** more likely to be good at maths and science
 - B** unlikely to be good at maths and science
 - C** likely to prefer daydreaming to dealing with the real world
 - D** inclined to be socially awkward
 - E** more likely to watch less television
- (ii) Which one of the following is an unstated assumption which underlies the above argument?
- A** Academic success is essential to a child's happiness.
 - B** Reading can bring happiness regardless of its effect on academic success.
 - C** A love of reading has many benefits.
 - D** Reading can bring happiness only if it leads to academic success.
 - E** A child's happiness is influenced by their academic success.

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15 Read the question then record your **two** choices on the separate answer sheet.

Published statistics on deaths from smoking-related illness can be misleading. For example, in one country it was claimed that in 2001 one in four deaths were from smoking-related illness. This figure included all deaths from lung cancer, heart disease, strokes and bronchitis. All these diseases can be caused by smoking. It was not recorded whether all those who died from these diseases in 2001 had ever been smokers. Some of these diseases can have a variety of causes. Heart disease can also be caused by poor diet, lack of exercise or obesity. So it is possible that fewer than one in four of the deaths were from smoking-related illness.

Which **two** of the following definitions of 'smoking-related illness' express the meaning of the term as used in the conclusion of the above argument?

- A** A fatal illness that has a variety of causes.
- B** A disease from which all smokers suffer.
- C** An illness that could have been caused only by smoking.
- D** A disease that has a number of possible causes, including smoking.
- E** An illness that would not have occurred if the victim had not smoked.

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(ii) How much **more** did his revised itinerary cost him?

- A \$130
- B \$200
- C \$230
- D \$285
- E \$345

17 Read the question then record your **one** choice on the separate answer sheet.

I have four dice. The first is coloured Green and has the following numbers on its faces: 5,5,5,5,1,1.

The other dice and the numbers on their faces are:

Orange 4,4,4,4,4,4

Red 7,7,3,3,3,3

Blue 6,6,6,2,2,2

I have just rolled all four, and green beat orange and red beat blue.
In this case, what's the chance that orange beat red?

- A 0
- B $\frac{8}{27}$
- C $\frac{4}{9}$
- D $\frac{1}{2}$
- E $\frac{2}{3}$

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- 18** Read the question then on the separate answer sheet record **both** your choice for part (i) **and** your choice for part (ii).

There are currently 440 people on the waiting list for a hip replacement operation at a hospital. The hospital carries out this operation in 3 sessions per week, with 7 operations carried out in each session. There are, on average, 29 new cases per week. The number of people on the waiting list is re-calculated at the end of each week.

- (i) In how many weeks time should the hospital managers anticipate the waiting time for new cases requiring this operation to exceed 26 weeks?

- A 4 weeks
- B 6 weeks
- C 12 weeks
- D 14 weeks
- E 18 weeks

To prevent the waiting time for operation X rising, the hospital surgical timetable is re-scheduled so that operation X is now carried out in 2 sessions per week undertaking 15 operations per session and 2 additional shorter sessions every other week undertaking 6 operations per session. The initial waiting list is again 440 people and there are still 29 new cases per week.

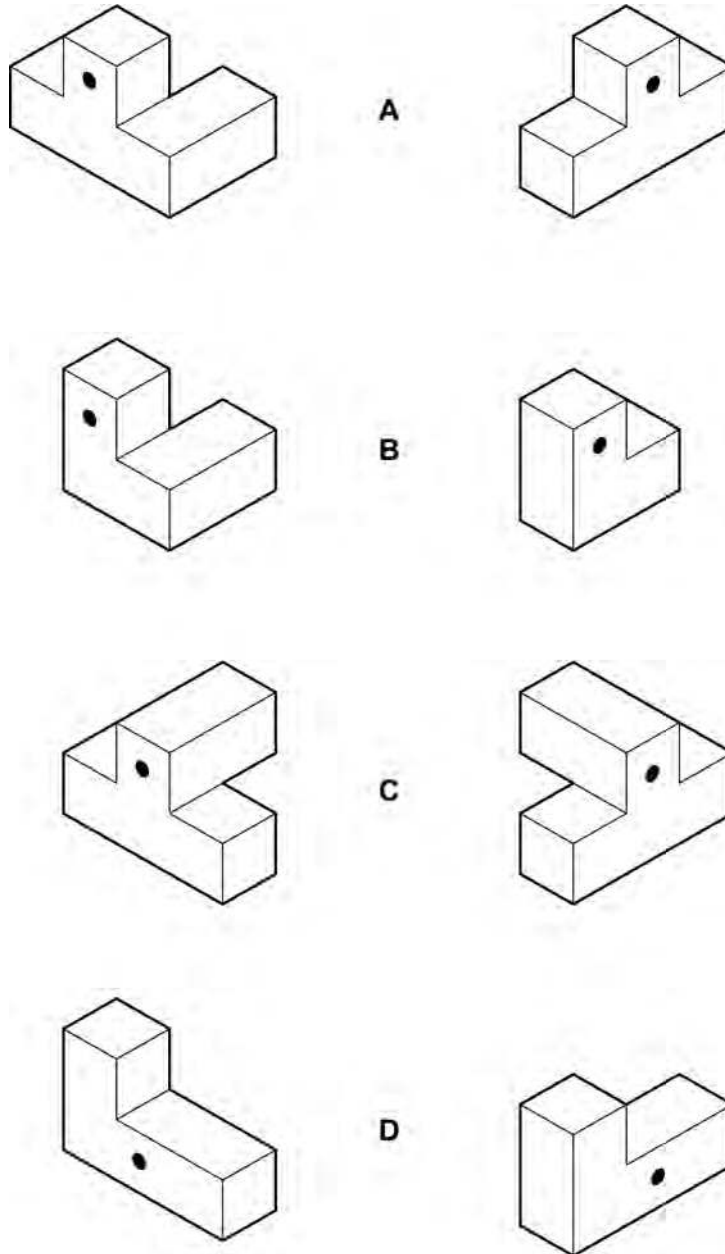
- (ii) How long will it take to reduce the waiting list to 300 people or fewer?

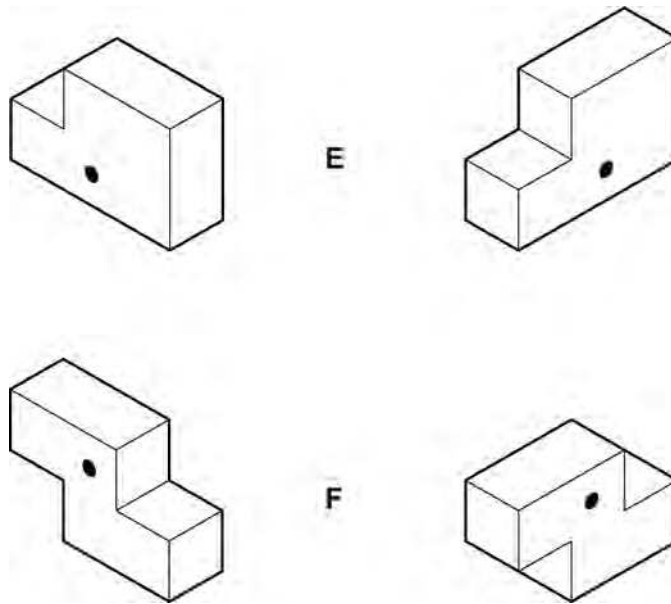
- A 10 weeks
- B 11 weeks
- C 20 weeks
- D 21 weeks
- E 22 weeks

19 Read the question then on the separate answer sheet record **both** your choice for part (i) **and** your choice for part (ii).

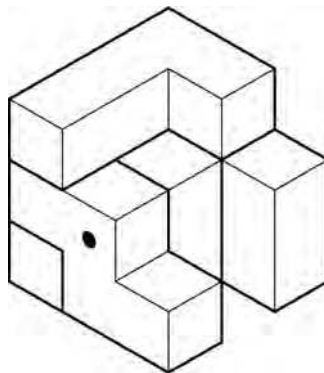
Omari has a three-dimensional puzzle. It consists of six pieces that fit together to make a cube. Each piece has a spot on it that marks the centre of one of the faces of the cube.

These pictures show each of the six pieces from two different angles:





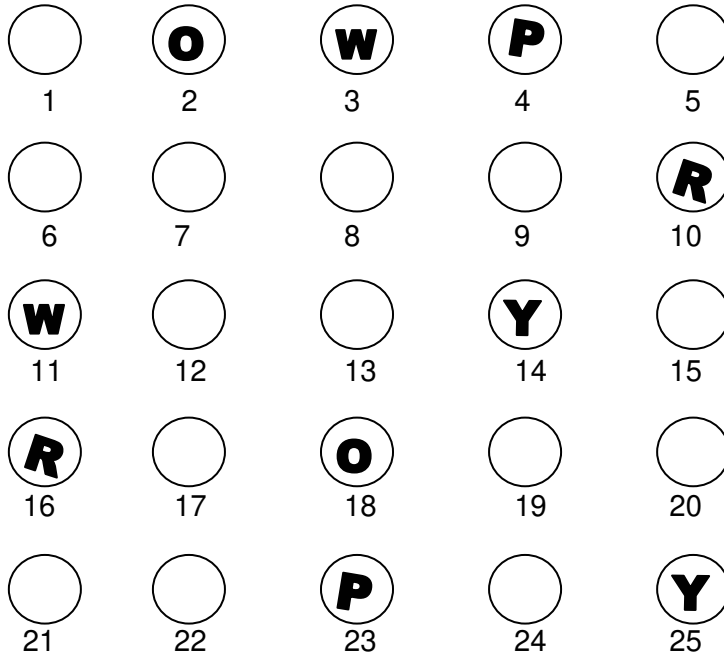
Here is the cube partially assembled (there are no hidden gaps):



- (i) Which piece (already in place) provides the spot on the bottom face?
- (ii) Which piece will provide the spot on the top face?
- A (see diagram)
 - B (see diagram)
 - C (see diagram)
 - D (see diagram)
 - E (see diagram)

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20 Read the question then on the separate answer sheet record **both** your choice for part (i) **and** your choice for part (ii).



Key: W = White
R = Red
P = Pink
Y = Yellow
O = Orange

Heather has bought 5 white, 5 red, 5 pink, 5 yellow and 5 orange rose bushes to plant in her garden. She has dug 25 holes, and so far she has planted two bushes of each colour, as shown above.

She is trying to arrange them so that she doesn't plant two bushes of each colour next to each other (including diagonally). At this point she realizes that there is only one way in which this can be done successfully without taking out any of the bushes she has already planted.

Heather can see that she must plant a red bush in hole 8.

(i) In which two holes must she plant the remaining red bushes?

- A 1 and 19
- B 6 and 20
- C 1 and 24
- D 6 and 19
- E 1 and 20

(ii) What colour bushes must Heather plant in holes 21 and 22?

- A orange in hole 21 and white in hole 22
- B pink in hole 21 and white in hole 22
- C white in hole 21 and yellow in hole 22
- D orange in hole 21 and yellow in hole 22
- E pink in hole 21 and yellow in hole 22

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21 Read the question then record your **two** choices on the separate answer sheet.

If a 747 jumbo jet crashed in Europe every three days killing all of its 420 passengers, travellers would demand action. But that's the rate at which people die on European roads. The World Health Organisation (WHO) predicts that the number of traffic deaths worldwide each year, 1.2 million in 2005, will increase by 65% by 2020 to make it the third biggest cause of death around the world. Extensive measures must be taken to make roads less lethal. One country which has led the way towards reversing the trend is Sweden, which last year saw a drastic drop in the number of traffic deaths, the lowest ever at 480 compared with 631 a decade ago.

Which **two** of the following statements are supported by the information given in the passage?

- A** The WHO cannot have taken Sweden's experience into account when making its forecast.
- B** It is clearly possible to take action which could reduce traffic fatalities.
- C** The WHO estimates that traffic deaths will rise by an average of over 50,000 per annum between 2005 and 2020.
- D** Europe currently accounts for more than 5 % of worldwide traffic fatalities.
- E** Sweden's toll of traffic deaths has decreased by 2.4% each year since 1995.

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- 22** Read the question then on the separate answer sheet record **both** your choice for part (i) **and** your choice for part (ii).

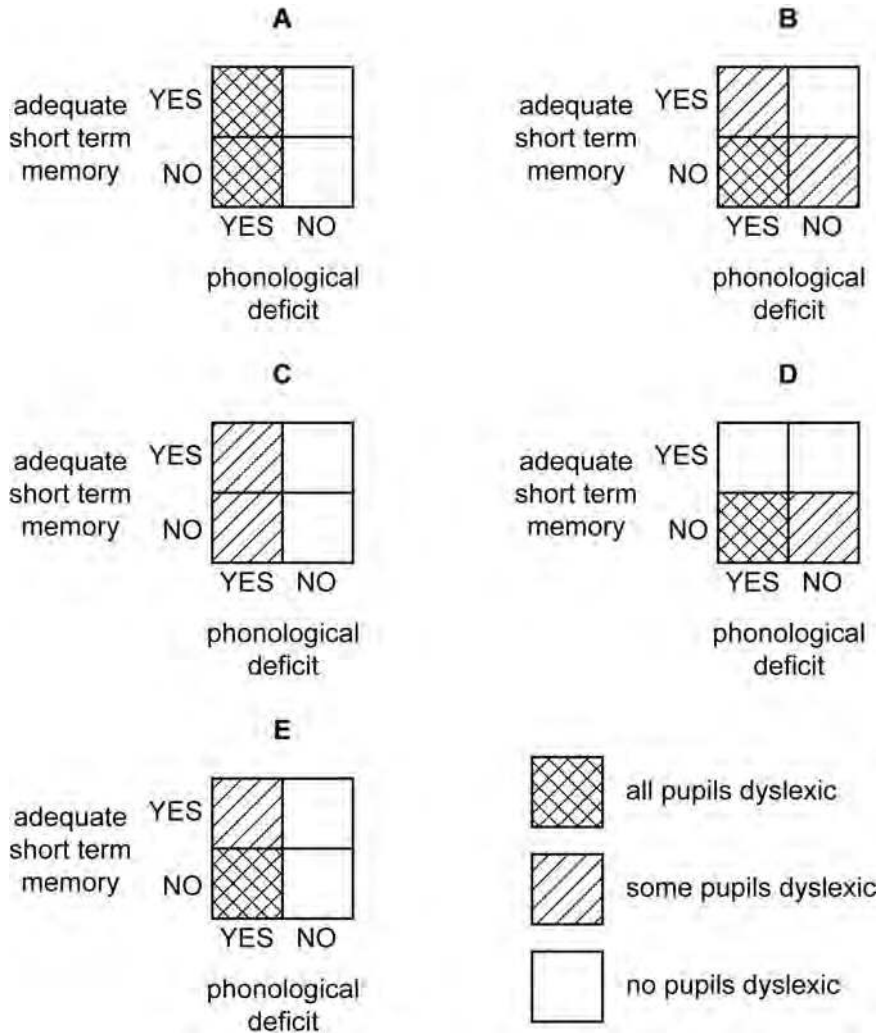
Many educational psychologists think that children who experience difficulties in learning to read have poor phonological awareness (ability to hear the different sounds within words). They claim that dyslexia is caused by a phonological deficit in those children affected, whilst accepting that other factors (e.g. poor short term memory) can make the condition worse.

Note: Dyslexia is defined as “a learning disorder marked by impairment of the ability to recognize and comprehend written words”.

- (i) Which one of the following statements will be true if the theory of these educational psychologists is correct?
- A** Children with a phonological deficit will become dyslexic.
 - B** A phonological deficit is the root cause of dyslexia.
 - C** Dyslexia is the result of poor phonological awareness only when combined with other problems.
 - D** Non-dyslexic children will have no phonological deficit.
 - E** Poor phonological awareness is often accompanied by poor short term memory.

- (ii) A Special Educational Needs Teacher tested 100 pupils in a secondary school for both phonological deficits and various degrees of dyslexia.

Which one of the following graphs indicates findings consistent with the theory of the educational psychologists outlined above?



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- 23** Read the question then on the separate answer sheet record **both** your choice for part (i) **and** your choice for part (ii).

At the end of the current week, Sunningdale Investments has a backlog of 800 applications to be processed for their recently advertised savings scheme. 50 new applications are being received per day.

They currently have 12 members of staff processing these applications. Each member of staff can process 10 applications a day. They intend to take on some temporary staff at the beginning of the next week. People from the existing processing staff will be used to train the new temporary staff and one existing member of staff can train up to 6 people in a day. All the new staff will be trained on Monday.

- (i) If they did not employ any temporary staff, after how many working days would the backlog be cleared?

- A 7
- B 8
- C 10
- D 11
- E 12

- (ii) How many temporary members of staff will have to be employed to clear the backlog in 6 working days including the Monday?

- A 4
- B 5
- C 6
- D 8
- E 12

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24 Read the question then record your **two** choices on the separate answer sheet.

It is commonly agreed that climate change is the most serious environmental issue facing the modern world. Proponents of nuclear and hydrogen power appeal to the fact that these forms of energy production do not involve the burning of fossil fuels, and hence do not increase the levels of carbon dioxide in the atmosphere. Sceptics point out that, as well as being expensive, both nuclear and hydrogen power do in fact involve the burning of some fossil fuels: nuclear power requires uranium to be mined, refined and concentrated, and atomic hydrogen would have to be produced in large power plants using fossil fuel. Yet these objections should be discounted. No solution to a complex global issue is ever going to be perfect. In the absence of better alternatives, we must convert as much power generation as possible to nuclear and hydrogen cell methods.

Which **two** of the following are assumptions underlying the above argument?

- A** Cleaner methods of energy production than either nuclear or hydrogen power will not be discovered in the future.
- B** Global climate change is not too complex a phenomenon to be accurately measured.
- C** The production of hydrogen cells and nuclear power emits less carbon dioxide than conventional means.
- D** The increase in carbon dioxide levels in the atmosphere is a major cause of climate change.
- E** Uranium can only be mined using conventional means of fossil-fuel generated power production.

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25 Read the question then record your **one** choice on the separate answer sheet.

There is evidence that birds of prey such as buzzards and black kites prefer to hunt their prey near roads rather than in the open countryside. Furthermore, they prefer to hunt near busy roads rather than quiet roads. Their preference can be explained in a number of ways. For one thing a busy road like a motorway provides a steady stream of fast-moving traffic which the birds adjust to more easily than to the sight and sound of an occasional vehicle on quiet roads. For another motorways have verges which provide open areas for hunting and shrubs at convenient perching height. It would seem that ever-expanding road-building programmes are, contrary to environmentalists' fears, good news for wildlife.

Statement: Birds of prey are just a narrow range of species with particular needs and preferences.

Which one of the following best describes how the statement relates to the passage?

- A** It is an assumption on which the argument depends.
- B** It strengthens the argument.
- C** It provides an explanation of the evidence.
- D** It exposes a flaw in the reasoning.
- E** It follows logically from the conclusion.