



Psychological and Behavioural Sciences Admissions
Assessment 2016

Specimen Paper Section 1: explained answers

THINKING SKILLS

1

The answer is option **D**.

The passage starts with a recommendation that if people go to a foreign country they should try to learn some of the language. This is followed by reasons for acting on this recommendation. The first of these, signalled by the word 'because' in the first sentence, is that learning a little of a foreign language helps you to find out more about the country and its customs. The second is that you can function more easily when asking for directions or ordering at a restaurant. The third is that it is less embarrassing to be able to ask for these things in the country's language than to have to communicate by pointing and waving your arms. These reasons give support to the recommendation, which is the main conclusion of the argument, and is expressed in option **D**.

Option **A** is not the conclusion but is one of the reasons, identified above as the second reason.

Option **B** is the first reason given for the conclusion.

The passage concedes in the first sentence that it is difficult to pick up a good command of a foreign language in a short time, but option **C** is not a conclusion, because no reasoning is offered in support of it. Its function in the passage is as a possible objection to the recommendation to learn a little of a foreign language, an objection which is then countered by the three reasons given.

Option **E** is not the conclusion because it is not explicitly expressed in the passage, but combines elements of the second and third reasons. It does not accurately express the third reason, which claims that it is less embarrassing to speak the language than to use sign language, not that it is easier.

2

The answer is option **C**.

The maximum number of days in a calendar month is 31.

Each day of the week occurs four times during the first 28 days of every month. Two of these days will be working Saturdays. If the 29th, 30th and 31st of a 31-day month are all weekdays, or if the 31st is a working Saturday, the number of working days during the month will be $(4 \times 5) + 2 + 3 = 25$.

In a month when the neighbours work the maximum 25 days, one of them will drive 12 times and the other one will drive 13 times.

3

The answer is option **D**.

The main conclusion of the argument is the final sentence of the passage. The first part of the passage contains an intermediate conclusion that those who are promoted to senior positions may not be the most able. This is supported by the fact that the percentage of women in senior positions in business and the professions is considerably lower than the percentage of women in the work force. From the claim that those promoted to senior positions may not be the most able, the passage draws another intermediate conclusion that this situation is not only unfair to women but is also bad for the economy.

The main conclusion, that employers must be urged to offer flexibility in working hours and move away from the culture of long working hours, is supported by this second intermediate conclusion, together with two further reasons. These are that women may be discouraged from seeking promotion because employers require senior employees to work long and inflexible hours, and that women may be perceived as being unwilling to subordinate the demands of family to the demands of the job.

If women's ability to perform well in senior positions were not comparable to that of men, it could not be concluded that those promoted to senior positions may not be the most able, nor that the situation is unfair to women and bad for the economy. Thus the argument must assume that women are just as likely as men to have the relevant abilities, as stated in option **D**.

Option **A** is not assumed by the argument, which explains the reluctance of women to apply for senior positions as being due to the culture of long and inflexible hours, not to women's lack of interest in seeking promotion.

The argument is based on the fairness to women of promoting more of them to senior positions, and does not consider how men would react to this, so option **B** is not assumed.

The argument does not need to assume that women would perform better than men in senior positions, only that some women could perform better than some men. So option **C** is not a necessary assumption.

Option **E** is not assumed, since the claim that greater flexibility in working hours could lead to the promotion of more women does not imply that promoting more women would lead to greater flexibility in working hours.

4

The answer is option **D**.

The journey to work is 1800 m, which would take $1800 \div 5 = 360$ seconds = 6 minutes if there was no delay at either of the sets of lights.

It takes $900 \div 5 = 180$ seconds = 3 minutes to cycle from the first set of lights to the second. Because both sets change simultaneously, the maximum wait of 2 minutes at one of them will mean a wait of 1 minute at the other.

The longest journey time is therefore $6 + 2 + 1 = 9$ minutes.

5

The answer is option **A**.

The argument concludes that governments should take action to prevent a continued rise in house prices above the level of inflation. The reasons given for this are:

- Because of high prices, owning their own home has become unaffordable for many people.
- Those who can own their home are burdened by a huge level of debt.
- The recent financial crisis can be attributed in part to those who were unable to meet the repayments on their debts.

Option **A** suggests that house prices are rising faster than average salaries. If **A** is true, many more people may be unable to afford to buy a house, and some who succeed in getting a loan to buy a house may find that their salary is not sufficient for them to be able to meet repayments. Thus **A** reinforces the idea that a rise in house prices has an adverse effect on the economy, and thus strengthens the argument for government action to prevent further rises in house prices.

Option **B** does not strengthen the argument, because if house prices have already fallen there may be no need for the government to intervene to prevent price rises.

If option **C** is true and getting a loan is not possible without making a substantial deposit, people will be less likely to be able to take on loans that they cannot afford to repay, thus weakening the second reason for the conclusion. So **C** does not strengthen the argument.

Option **D**, if true, implies that government action would be unable to reduce house prices. This neither strengthens nor weakens the argument, because the argument is recommending action to prevent a continued rise in house prices, which may be possible even if it is not possible for the government to lower house prices.

If option **E** is true government action to control house price rises may have negative consequences for those who want to sell their house at a higher price than they bought it. So **E** does not strengthen the case for government action, because such action may lead to an increase in the numbers of those who cannot repay their debts.

6

The answer is option **B**.

There are eight possible side views of this paperweight: four with TLF uppermost (as shown in the question) and four with the reflection of TLF uppermost. You should visualise these views and eliminate the four options that **are** side views.

From the side, a vertical line will be seen at each boundary between a projection and a recess.

A and **E** are both views of the bases of the letters T, L and F. **A** is the view when TLF is uppermost and **E** is the view when the reflection of TLF is uppermost.

C is the view of the tops of the letters T, L and F, with TLF uppermost.

D is the view of the edge of the letter F, with the reflection of TLF uppermost.

(Note that a view of the edge of the letter T would have a single vertical line one fifth of the way from one end.)

7

The answer is option **E**.

The conclusion of the argument is the prediction made in the final sentence: that as the roads grind to a halt, canals will soon once again become the backbone of goods transportation. The reasons given are as follows:

- During the Industrial Revolution, canals functioned as a cost-effective and efficient way of moving goods around the country.
- Gradually canal carriage was replaced by other modes of transportation that were faster and cheaper.
- Now most businesses choose to use road haulage as a means of transportation.
- With the rise in fuel costs and introduction of 'low emission' zones, road haulage is becoming less practical and economical.

From the fact that road haulage is becoming less practical and economical, it cannot be concluded that there will be a return to a system of transportation of goods that worked cost-effectively and efficiently during the Industrial Revolution. A more general way of expressing this is that from the fact that system X is problematic, it cannot be concluded that it will be replaced by system Y.

If it becomes desirable to use a different method of transportation, there may be other possible methods (e.g. railways) that would be as fast as and more economical than road haulage. Option **E** is the correct answer, because it points out that canals and roads may not be the only options.

Options **A**, **B** and **D** challenge the argument by pointing out some of the disadvantages of canal transport, but they do not explain why the conclusion that canal transport will be readopted does not follow from the fact that road haulage is becoming less practical and economical.

Option **C** challenges an assumption of the argument, i.e. that road haulage will inevitably become less economical, but does not identify the flaw in assuming that because X is less economical, it will be replaced by Y.

8

The answer is option **A**.

The energy values in the table are for 100 g of each food. The energy provided by each of the first four ingredients is, therefore:

mealworms	–	$1.5 \times 150 = 225$ calories
apples	–	$1.5 \times 350 = 525$ calories
raisins	–	$2.5 \times 300 = 750$ calories
suet	–	$1.25 \times 800 = 1000$ calories

The total energy provided by these ingredients is $225 + 525 + 750 + 1000 = 2500$ calories.

This means that the sunflower seeds must provide 2500 calories in order to make up the required total of 5000 calories.

Sunflower seeds provide 500 calories per 100 g, so $(2500 \div 500) \times 100 = 500$ g of sunflower seeds must be used.

9

The answer is option **C**.

The passage justifies the high earnings of top singers on the grounds that these singers are the best at what they do, and, as further support, offers the principle that those who are better than others at what they do should be rewarded.

This principle applies to the example given in option **C** of a bonus having been awarded to a member of staff who had made the most efficient use of time in a business in which efficiency was the most important aspect of the work.

Option **A** does not illustrate the principle, because higher pay for doctors is recommended on the grounds of the length of training, not being better at the job.

Option **B** gives an example of those who perform poorly being rejected, not those who perform well being rewarded, so **B** does not illustrate the principle.

The example in option **D** is of someone rewarded for working longer hours than others, not necessarily someone who performs better than others, so **D** does not illustrate the principle.

Option **E** does not illustrate the principle because the film that made the most money at the box office in its opening week may not be judged to be the best film in terms of, for example, artistic criteria.

10

The answer is option **B**.

The distance between Sue and Freya increases while Freya runs to collect the stick and decreases as she brings it back to Sue. Only options **B** and **D** show this situation.

If Sue were to stand still, it would take the same amount of time for Freya to run 20 m in both directions (assuming the same average speed both ways), but because Sue is walking towards her, the distance between them decreases from 20 m to 0 in a shorter time than it increases from 0 to 20 m.

11

The answer is option **A**.

The last sentence of the passage contains the conclusion that parents should recognise that they have answers closer to home: common sense and a remote control. The reasons are as follows:

- Children are impressionable.
- Force feeding children with junk TV is just as bad as allowing them to eat nothing but junk food.
- Parents allow children to watch all sorts of rubbish on TV.
- Parents blame outside influences over which they have no control when discussing playground violence, petty crime and early sexual awareness.

The conclusion identified above implies that parents should use their common sense and switch off the television when their children want to watch unsuitable programmes. This is expressed in option **A**.

The argument assumes that some parents are not sufficiently concerned by what their children watch on TV. However, option **B** is not a conclusion but is a reason for urging parents to exercise control over what their children watch.

Option **C** is not part of the argument, which says that parents are concerned about certain aspects of behaviour, but mistakenly blame outside influences for such behaviour.

Option **D** is not part of the argument, since it contradicts the main theme of the argument that parents could influence children's behaviour by controlling what they watch on TV.

The argument assumes that some parents do not recognise that what their children watch on TV is causing bad behaviour. However, option **E** is not a conclusion but, like option **B**, is a reason for urging parents to exercise control over what their children watch.

12

The answer is option **E**.

Because Alistair changes the code each time, you must not allow yourself to be distracted by the symbols making up his name. You simply need to identify which one of the options has repeated letters in the positions of the repeated symbols in the reply.

Only **SOMETIME** has the 7th letter the same as the 3rd letter and the 8th letter the same as the 4th letter.

13

The answer is option **E**.

The argument concludes that drinking caffeinated coffee is not the way to remain alert. Evidence for this claim comes from an experiment in which participants abstained from drinking coffee for 16 hours, then drank either coffee or a fake coffee substitute and were tested for alertness. There was found to be little difference in alertness between those who drank coffee and those who drank the substitute. According to the argument, this suggests that frequent coffee drinkers develop a tolerance to the stimulatory effects of caffeine.

In order to draw any conclusion about the effects of caffeine consumption on alertness, it must be assumed that when participants were tested for alertness during the experiment, their reactions were not affected by coffee consumed 16 hours earlier, and thus that any stimulatory effects of coffee consumption will have worn off after 16 hours. This is expressed in option **E**.

The argument does not need to assume that there are no important benefits from consuming drinks containing caffeine, because it is concerned with only one drink – coffee – and only one possible effect – producing alertness. So option **A** is not assumed.

Option **B** is not a necessary assumption. Although the argument concludes that drinking coffee will not help people to remain alert, it does not need to assume that this is the only reason why people drink coffee.

The argument mentions anxiety as a possible effect of coffee-drinking, but does not focus on this effect, and does not assume that anxiety can be avoided by avoiding coffee. So option **C** is not assumed.

The reason why option **D** is not the correct answer is that although the argument concludes that drinking caffeinated coffee is not the way to remain alert, it neither suggests nor implies that there are other drinks that would be more effective.

14

The answer is option **D**.

The two journeys took a total of $24/32$ hours, which is 45 minutes. This means that on his second journey he travelled $24 - 15 = 9$ km in $45 - 30 = 15$ minutes ($\frac{1}{4}$ hour).

Speed = distance \div time, so his average speed on the second journey was $9 \text{ km} \div \frac{1}{4} \text{ hour} = 36 \text{ km/h}$.

15

The answer is option **C**.

The passage concludes that the future of the function of libraries will be more assured if all libraries follow the lead of a library in Bournemouth. The reasons given for this conclusion are:

- A report suggests that the decline in public library use is not due to a lack of public interest in reading books.
- The decline is due instead to the authoritarian style and image of libraries with their rules about silence and fines for late return of books.
- Those few libraries that have moved away from this image, such as the one in Bournemouth, which provide cafes and 'chill-out' zones, have seen a 40 per cent increase in library use.

If bookshops have increased their sales during the period in which library use has declined, then the claim that the decline is not due to a lack of interest in reading books is strengthened. Thus option **C** strengthens the argument by ruling out an alternative explanation to the one offered by the passage that it is the image of public libraries that has caused the decline.

Option **A** cannot strengthen the argument because it does not include information about the image of public libraries in other European countries.

Nothing is said in option **B** about whether school children have increased or decreased their use of public libraries, so **B** has no impact on the argument.

The fact that one aspect of library use has increased during a period when overall use has declined has no implications for the claim that the decline is due to the authoritarian nature of libraries. So option **D** does not strengthen the argument.

Option **E** suggests that the increase in use of new-style libraries may be due to the fact that they offer more services than traditional libraries, but this does not strengthen the claim that the decline in library use is due to the authoritarian style and image of traditional libraries. So **E** does not strengthen the argument.

16

The answer is option **C**.

This question requires you to extract and process the relevant data from both the table and the narrative.

You will need to compare the cost of silver membership for one year, which includes a free locker, with the cost of bronze membership for one year plus locker hire.

The cost of silver membership for one year is the renewal price of £28.

The cost of bronze membership for one year plus locker hire for 12 visits (one per month) is the renewal price of $£8 + (12 \times £2) = £32$.

The cheaper option is silver membership for £28, which is £12 less than the £40 paid for gold membership 6 months ago as a new member.

17

The answer is option **D**.

The argument concludes that we should accept the truth of the theory that the Moon was formed from debris breaking off from the Earth in a planetary collision 4.5 billion years ago. The evidence given for this is that Moon rocks have been found to be made of the same material as is found on Earth, which would have to be the case in order for the theory to be true. The fact that there is little iron in Moon rocks is claimed not to disprove the theory since, according to the theory, the material that formed the Moon would have come from the Earth's crust, not its iron-rich core.

The flaw in the argument is that although the evidence confirms the truth of something which must be true for the theory to be true, it does not guarantee that the theory is true. Perhaps the material of which the Moon is made came from some source other than the Earth. This is expressed in option **D** as the general point that a theory cannot be proved true by evidence that confirms its predictions.

Option **A** does not identify a flaw because the argument does not base its conclusion on the popularity of the theory about the origin of the Moon.

Option **B** does not identify a flaw because the evidence given in the argument is consistent with the theory.

The explanation offered in the passage about the paucity of iron in Moon rocks is shown to be consistent with the theory, in that the theory states that the material of the Moon would not have come from the iron-rich core of the Earth. So option **C** does not identify a flaw.

Option **E** does not identify a flaw, because in this case the theory is consistent with the facts, including the fact about iron levels, so no modification of the theory is necessary, nor is modification of the theory suggested by the argument.

18

The answer is option **A**.

To answer this question you first need to establish that the number of 11-year olds who go swimming (104) is slightly greater than $\frac{2}{3}$ of the number of 16-year olds who go swimming.

It is not necessary to carry out exact calculations for any of the sports; you only need to observe the following:

Football	–	120/181 is very close to $\frac{2}{3}$.
Cricket	–	120/133 is considerably greater than $\frac{2}{3}$.
Hockey	–	55/66 is considerably greater than $\frac{2}{3}$.
Tennis	–	123/149 is considerably greater than $\frac{2}{3}$.
Squash	–	51/97 is slightly greater than $\frac{1}{2}$.

19

The answer is option **A**.

The argument concludes that the Government must act because its policy decisions have helped to cause the situation in which pensioners are likely to face poverty. The conclusion is supported also by the principle that one should take responsibility for one's mistakes.

Option **A** is the correct answer because it relies on the same principle: my action caused the breaking of the plates, so I should replace the broken ones.

The situation described in option **B** does not involve compensation for a mistake that has caused damage, but taking precautions to avoid damage.

In option **C** it is recommended that the Government should take action to help those suffering as a result of a natural disaster, but there is no suggestion that Government action has helped to cause the problem.

Option **D** suggests that the Government has a general responsibility for the welfare of its citizens, but lacks the reference to compensation for mistakes by Government that is found in the passage.

Option **E** does involve the idea that we should take responsibility for our actions, in that we have only ourselves to blame if we have not insured against damage, but it does not have the element found in the passage of putting right our mistakes that have caused damage to others.

20

The answer is option **B**.

The moving average of 13.82 beside 1913 means that $x + 13.3 + 14.9 + 13.7 + 14.2 = 13.82 \times 5$, so $x + 56.1 = 69.1$ and $x = 13.0$.

y is therefore $(13.4 + 14.4 + 13.4 + 13.7 + 13.0) \div 5 = 67.9 \div 5 = 13.58$.

21

The answer is option **B**.

The argument draws the main conclusion that we should follow the example of other countries in using willow for generating electricity. This is expressed in option **B**. The reasons given are as follows:

- We need to find solutions to the problem of high levels of carbon dioxide emissions.
- Burning wood has the environmental advantage that in doing so one releases into the atmosphere only as much carbon dioxide as the trees themselves absorbed.
- Plantations of willows will not only support the insects on which songbirds feed, but also, being trees that thrive in wet areas, they will help to conserve our threatened wetlands.

The second and third of these reasons support an intermediate conclusion that there are many environmental advantages in using willow. There is one further reason:

Other countries, such as Sweden, have already recognised the advantages of using willow for fuel.

Option **A** is the first reason for the conclusion.

Option **C** is the second reason for the conclusion.

Option **D** summarises the benefits (mentioned in the third reason) of planting willow trees for use in generating electricity.

Option **E** is an intermediate conclusion drawn from the second and third reasons.

22

The answer is option **B**.

A group of 10 students would only require 2 instructors, who would be paid £12 each for 2 hours, but the extra £12 for a third instructor is much less than the extra income from a group of 18 students.

A group of 18 students would pay a total of $18 \times (\text{£}7 + \text{£}5) = \text{£}216$ for 2 hours, so the maximum profit the centre can make from a group after paying the instructors for a two-hour session is $\text{£}216 - \text{£}36 = \text{£}180$.

MATHEMATICS AND BIOLOGY**23**

The answer is option **A**.

We can write:

area of shape = area of square – area of semi-circle.

If we let the length of one side of the square be $2x$, so that the radius of the semi-circle is x , then this becomes:

$$100 = 4x^2 - \frac{1}{2}\pi x^2 = x^2\left(4 - \frac{\pi}{2}\right)$$

Rearranging:

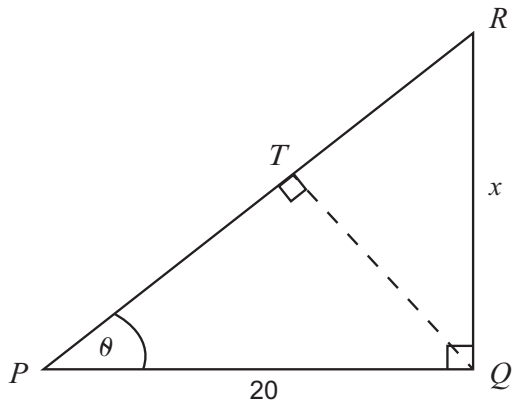
$$x = \sqrt{\frac{200}{8 - \pi}} = 10\sqrt{\frac{2}{8 - \pi}}$$

So the length of one side of the square is $2x = 20\sqrt{\frac{2}{8 - \pi}}$

24

The answer is option **E**.

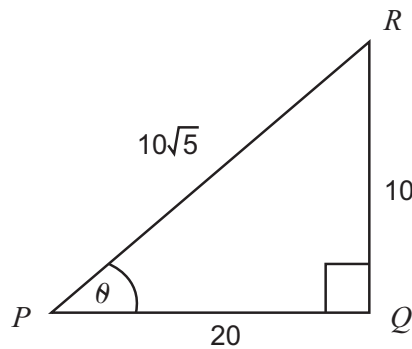
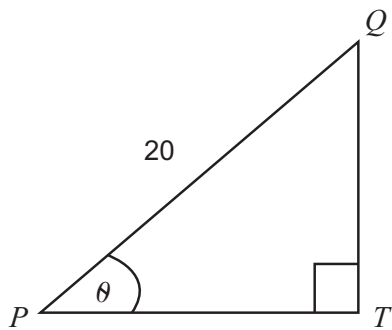
Let $RQ = x$



We know $RQ:PQ$ is 1:2 so we can deduce $x = 10$

By Pythagoras' Theorem, we have $PR = 10\sqrt{5}$

We notice triangles PQT and PRQ are similar:

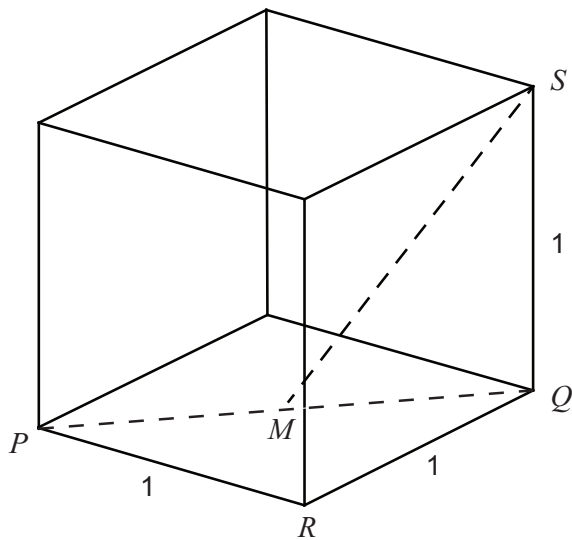


So we can write: $\frac{QT}{10} = \frac{20}{10\sqrt{5}}$

Giving: $QT = \frac{20}{\sqrt{5}} = 4\sqrt{5}$

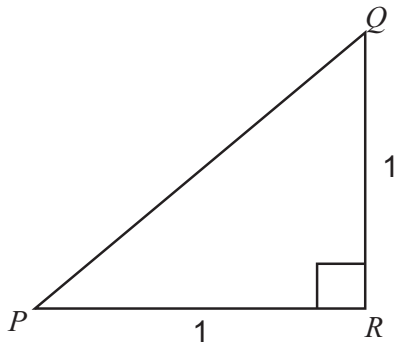
25

The answer is option **A**.



[diagram not to scale]

In triangle PQR , the angle at R is a right angle so we can use Pythagoras' Theorem to find PQ :

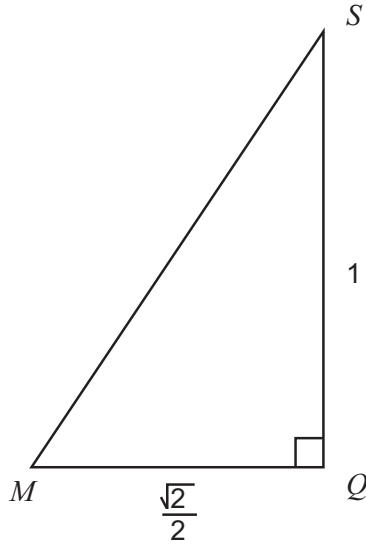


$$PQ^2 = 1^2 + 1^2 = 2$$

Giving $PQ = \sqrt{2}$

QM is half of PQ so $QM = \frac{\sqrt{2}}{2}$

Now looking at triangle MQS :



The angle at Q is a right angle so we can use Pythagoras' Theorem:

$$MS^2 = \left(\frac{\sqrt{2}}{2}\right)^2 + 1^2 = \frac{2}{4} + 1 = \frac{3}{2}$$

Giving $MS = \sqrt{\frac{3}{2}}$

26

The answer is option **D**.

When the minute hand is pointing to the 9 [indicating 45 minutes past the hour], the hour hand will have moved three-quarters of the angle between the 9 and the 10 on the clock dial. The angle between the 9 and the 10 is 30 degrees so the hour hand will have moved three-quarters of 30 degrees, or 22.5 degrees. The angle between the hands is, therefore, 22.5°.

27

The answer is option **B**.

To answer this we shall use:

$$\text{area of triangle} = \frac{1}{2} \times \text{base} \times \text{height}$$

This gives:

$$\text{area} = \frac{1}{2}(4 + \sqrt{2})(2 - \sqrt{2}) = \frac{1}{2}(8 - 4\sqrt{2} + 2\sqrt{2} - \sqrt{2}\sqrt{2}) = \frac{1}{2}(6 - 2\sqrt{2}) = 3 - \sqrt{2}$$

28

The answer is option **D**.

As the cylinder has the same internal diameter as the sphere, it has the same radius, r . As the length of the cylinder is the same as the diameter of the sphere, it has length $2r$. So we can write:

$$\text{Volume of the sphere} = \frac{4}{3}\pi r^3$$

$$\text{Volume of cylinder} = \text{base area} \times \text{height} = \pi r^2 \times 2r = 2\pi r^3$$

This then allows us to calculate the fraction of the space in the cylinder taken up by the sphere:

$$\frac{\frac{4}{3}\pi r^3}{2\pi r^3} = \frac{2}{3}$$

29

The answer is option **A**.

For $0 < x < 1$, we have:

$$0 < x^2 < 1$$

$$0 < \sqrt{x} < 1$$

and also:

$$1 < \frac{1}{x}$$

$$\frac{1}{\sqrt{x}} < \frac{1}{x}$$

$$\frac{1}{1+x} < \frac{1}{x}$$

so $\frac{1}{x}$ has the largest value in $0 < x < 1$

30

The answer is option **C**.

Using the fact that triangle ABC is similar to triangle ADE [they have the same angles], we can write:

$$\frac{AB}{AD} = \frac{BC}{DE}$$

This gives:

$$\frac{4}{x} = \frac{x}{x+3}$$

From which we get:

$$4(x+3) = x^2$$

Rearranging:

$$x^2 - 4x - 12 = 0$$

Factorising:

$$(x-6)(x+2) = 0$$

Giving $x = 6$ [as we cannot have a negative value for x as it represents a length].

And so $DE = x + 3 = 6 + 3 = 9$

31

The answer is option **C**.

$$P \propto \frac{1}{Q^2} \text{ so } P = \frac{k}{Q^2} \text{ for some } k$$

We can use multiplying factors to work out how each symbol changes; for instance, as Q increases by 40% its new value is $1.4Q$

For this question, we have:

$$Q_{new} = 1.4Q$$

Giving:

$$P_{new} = \frac{k}{(1.4Q)^2} = \frac{k}{1.96Q^2} = \frac{1}{1.96}P$$

We then notice:

$$\frac{1}{1.96} \approx \frac{1}{2} \text{ and } \frac{1}{1.96} > \frac{1}{2}$$

so P_{new} is a little over 50% of P and so we can deduce that P has decreased by a little under 50%.

32

The answer is option **D**.

We are given: $x \propto z^2$ and $y \propto \frac{1}{z^3}$ which allows us to write: $x = kz^2$ and $y = \frac{c}{z^3}$

We want to eliminate z so we need both expressions to have the same power of z in them:

$$x^3 = k^3 z^6 \text{ and } y^2 = \frac{c^2}{z^6}$$

Eliminating z and ignoring the constants gives:

$$x^3 \propto \frac{1}{y^2}$$

33

The answer is option **C**.

To make the question easier to answer, we can let $QX = 2$

We then find, using the given ratios, that $PX = 12$ and $XR = 3$ and so $PR = 15$

As M is the midpoint of PR then $PM = 7.5$ and so $MX = 4.5$

We can then calculate the ratio asked for:

$$\frac{QX}{MX} = \frac{2}{4.5} = \frac{4}{9}$$

34

The answer is option **D**.

$$x^2 \geq 8 - 2x$$

Rearranging:

$$x^2 + 2x - 8 \geq 0$$

Factorising:

$$(x + 4)(x - 2) \geq 0$$

Giving:

$$x \leq -4 \text{ or } x \geq 2$$

35

The answer is option **A**.

We are told:

surface area of cylinder = volume of cylinder

We can write this as follows:

$$2\pi r^2 + 2\pi rh = \pi r^2 h$$

Rearranging:

$$2r = rh - 2h$$

$$2r = h(r - 2)$$

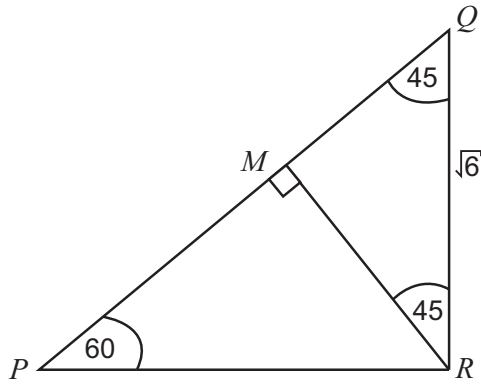
Giving:

$$\frac{2r}{r-2} = h$$

36

The answer is option **A**.

Draw a line from R perpendicular to QP (as shown) to meet QP at M:

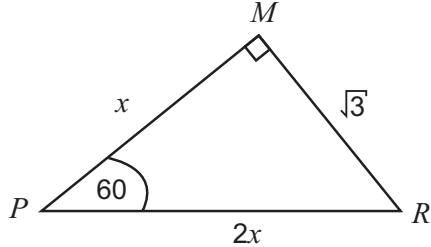


We can deduce $\angle QRM = 45^\circ$

and using Pythagoras' theorem in $\triangle QMR$:

$$MR = \sqrt{3}$$

Now, note that $\triangle MRP$ is half an equilateral \triangle , so we can set $MP = x$, $PR = 2x$:



Using Pythagoras theorem in $\triangle MRP$:

$$x^2 + 3 = 4x^2 \text{ gives } PR = 2$$

Alternatively, we can use the sine rule:

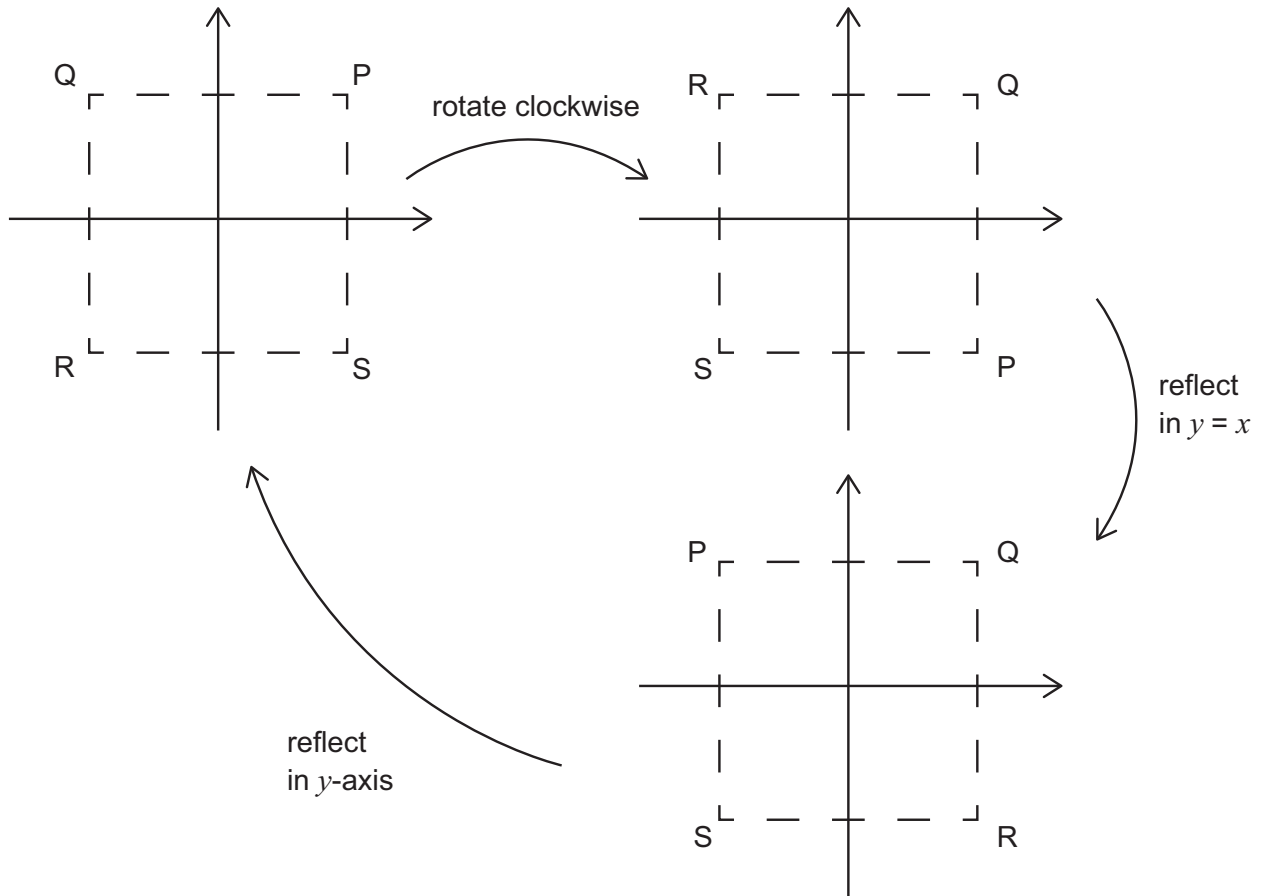
$$\frac{PR}{\sin 45} = \frac{QR}{\sin 60}$$

$$\left(\frac{PR}{\sqrt{2}} \right) = \left(\frac{\sqrt{6}}{\frac{\sqrt{3}}{2}} \right)$$

$$PR = \sqrt{6} \times \frac{2}{\sqrt{3}} \times \frac{1}{\sqrt{2}} = 2$$

37

The answer is option **B**.



38

The answer is option **D**.

Statement 1 is incorrect as gamete formation occurs due to meiosis. Both statement 2 and statement 3 are also incorrect. However, they are common misconceptions held by students. Growth of an organism such as a human occurs by mitosis as the number of cells increases. The size of a cell does not increase due to mitosis. Mitosis results in the production of new cells which can be used to replace damaged cells in tissues such as muscles and organs such as skin. However, mitosis cannot repair cells, so statement 3 is incorrect.

Therefore the only correct statement is statement 4 – replacement of skin cells.

39

The answer is option **D**.

As oxygen is being supplied and used, aerobic respiration is occurring in these muscle cells. However, as the oxygen demand between 0 and 11 minutes is greater than the supply, as shown by the higher position of the oxygen demand line on the graph, the muscle cells are also carrying out anaerobic respiration.

40

The answer is option **F**.

Competition for limiting resources can occur both within a species (intraspecific – statement 1) and between species (interspecific – statement 2). Likewise, natural selection can lead to evolution due to individuals with advantageous adaptations being more likely to survive and pass on their alleles, thus passing on the advantageous adaptations to their offspring (statement 3). For a species that competes less well, natural selection may lead to extinction (statement 4). Therefore all four statements are correct.

41

The answer is option **D**.

The main factors affecting the rate of photosynthesis are light intensity, temperature and carbon dioxide concentration. Any change in the level of a factor will affect the rate of reaction and the process will be limited by the factor which is in the shortest supply.

In the case of temperature, the rate of reaction will increase until the optimum temperature for the enzymes controlling the reaction is reached, as long as the other factors are present in sufficient amounts. Therefore statement 1 is correct. After this point the enzymes start to become denatured and no longer work, so statement 2 is correct. An increase in temperature produces an increase in kinetic energy and, up to a temperature of 22 °C the rate of photosynthesis also increases. However temperature does not increase the rate across the whole of the range studied as after the optimum temperature has been reached, the rate of photosynthesis decreases. Therefore statement 3 is incorrect.

42

The answer is option **F**.

Statement 1 is incorrect as at position 21 there are three chromosomes rather than two. As such, this is an example of a chromosome mutation and leads to Down's syndrome. Statement 2 is correct as the 23rd pair of chromosomes are the sex chromosomes and as they are XY this means the cell has been donated by a male. White blood cells are diploid body cells and so they contain two copies of each chromosome with two sex chromosomes as shown in the karyogram, so statement 3 is also correct.

43

The answer is option **F**.

Bone marrow stem cells will divide by mitosis, rather than meiosis, to produce genetically identical offspring, so statement 1 is incorrect. Human stem cells, including bone marrow stem cells, are diploid and so contain 46 chromosomes (statement 2 is correct). Stem cells of the bone marrow are able to differentiate into white blood cells so statement 3 is also correct.

44

The answer is option **C**.

The frequency of occurrence is the proportion of quadrats containing at least one individual of a given species.

In this study there are 25 daisies, occurring in a total of 10 quadrats.

In order to calculate the frequency of occurrence you need to divide the total number of quadrats in which the species (daisy) occurs (which is 10) by the total number of quadrats (in this case 25).

This equals 0.40.

45

The answer is option **F**.

The two females with attached ear lobes are homozygous recessive. The female in the first generation must be heterozygous, as she has the dominant phenotype, but must have inherited the recessive allele from her mother (who is homozygous recessive). The male parent, the male in the first generation, and the people in the second generation who have unattached ear lobes could be either heterozygous or homozygous dominant. So the maximum possible number of heterozygous individuals is 7.

46

The answer is option **A**.

A change from 0.12 mol dm^{-3} to $0.084 \text{ mol dm}^{-3}$ gives an increase in percentage haemolysis (read graph from right to left) from 2% up to 72%, which is an increase of 70%. The increase is due to the uptake of water through osmosis into the cells, which occurs as a result of the reduction in the concentration of the NaCl solution.

47

The answer is option **H**.

A positive phototropic response is shown by shoots when they grow towards a source of light.

In the diagram, three of the shoots have shown phototropism but the shoot without a tip has not responded, although it was uncovered. Statement 1 is therefore incorrect.

The diagram shows that when the shoot tip is covered by an opaque cap, or if the whole shoot is placed in an opaque box, there is no phototropic response. However, both the shoot with its tip covered by a transparent cap, and the shoot with its base covered by an opaque sheath, do show growth towards the light. Statement 2 is therefore incorrect.

Statement 3 is also incorrect – the shoot enclosed in an opaque box has grown taller.

48

The answer is option **D**.

In order to interpret this data correctly you need to ensure that you understand what is represented by the graph.

The x-axis shows the years studied from 1959 to 2008.

The left-hand vertical axis represents the number of wolves, with a range from 0 to just over 50.

The right-hand vertical axis represents the number of moose, with a range from 0 to just under 2500.

Trend 1 is quickly determined to be incorrect, since from 1959 to 1965, overall both the wolf and moose populations are increasing. Additionally, with no knowledge of what has happened before 1959 it cannot be said that there has been an increase in the wolf population as there was an earlier increase in moose population.

Trend 2 is correct. You need to remember that the two vertical scales are different. Reading from the graph, the maximum wolf population is 50, whilst the minimum moose population is about 400.

Trend 3 is incorrect. Whilst the point plotted for wolves is higher than that for moose in 1965, you need to remember that the two vertical scales are different. There are about 30 wolves but there are about 750 moose.

Trend 4 is correct. When wolf populations are low on the graph, such as from 1968 to 1973 and from 1982 to 1995, there is a corresponding increase in the size of the moose population.

This means that trend 4 must be correct, so you only need to identify which of trend 2 or trend 3 is correct.

49

The answer is option **G**.

The ratio of X:A in columns 1 and 2 is 0.5:1 which makes the flies male, irrespective of the presence or absence of the Y chromosome. The ratio of X:A in columns 3, 4 and 5 is 1:1 which makes the flies female, irrespective of the presence or absence of the Y chromosome.

50

The answer is option **H**.

Process 1 is photosynthesis and therefore should not feature in any answers. For carbon to be incorporated into animals and decomposers, digestion of carbon-rich compounds must initially occur (processes 2 and 3). Respiration can release carbon into the air as CO₂ which is illustrated by process 4.

51

The answer is option **B**.

The y-axis represents the variable being measured as the enzyme-catalysed reaction progresses with time. The only variable which increases with the progress of the reaction will be the enzyme-substrate complexes which will then decrease as the substrate is broken down so fewer complexes can form.

52

The answer is option **B**.

In order to genetically modify bacteria to produce human insulin you need to cut out the DNA coding for human insulin from a normal, healthy human's DNA. A special enzyme is used to cut the DNA. Therefore statement 1 is correct.

This DNA is then inserted into the DNA of a bacterium. Bacteria do not have a nucleus, so statement 2 is incorrect.

The modified bacteria have to be cultured. This means that they are grown in a fermenter so that large numbers of bacteria are produced. Therefore statement 3 is correct.

The bacteria are used to produce human insulin, which is extracted from them and purified. This insulin is then used to treat diabetics. Therefore, statement 4 is incorrect, since bacteria are not injected into humans with diabetes.

READING COMPREHENSION

53

The answer is option **B**.

The view that ICT-led initiatives can play an important role in democratic reform is announced in the first sentence. The abstract then draws a distinction between genuine e-democracy and other types of ICT initiative, arguing that only the former can lead to actual reform. The abstract then returns to the theme of possibilities of democratic reform resulting from effective use of e-democracy.

Option **A** is wrong because the abstract concentrates on the form of ICT likely to promote democratic reform rather than expressing a preference.

Option **C** is wrong because although the final sentence refers to the increased role of e-democracy in the future, it does not suggest a wholesale shift to a new model of government.

Option **D** is wrong because the abstract actually distinguishes between 'e-democracy' and other forms of 'e-government'; moreover, it only really distinguishes between two types of ICT use ('one-way' 'e-government', and 'two-way' 'e-democracy').

54

The answer is option **B**.

The text is making a distinction between e-government and e-democracy; the former comprises a predominantly 'one-way' process, furnishing the government with information on which to base decisions, which the text contrasts with a more active process of civic engagement (whereby, presumably, the citizens are involved in the actual decision-making process).

Options **A**, **C** and **D** are all facets of e-democracy itself.

55

The answer is option **A**.

The abstract bemoans the fact that existing analyses of e-democracy are both incomplete ('non-comprehensive') and also something of a 'jungle', which the article has aimed to 'simplify ... into four' models.

Option **C** is wrong because although in order to achieve this simplification the abstract has introduced a new model into the equation, the purpose of the article was not explicitly to do this; this was a means to achieving the stated end: of providing a comprehensive and simplified analysis. Moreover, there is nothing in the abstract to say that this model is 'new'; we are simply told that it has been 'absent from contemporary theoretical literature'. It may be an old model that has dropped out of fashion.

Option **D** is wrong as the aim of the report is to 'simplify' existing analyses; this does not amount to a rejection of all the models – some of the existing models, for example, are evidently being kept.

Option **B** is wrong because making the link between theory and practice is not cited as the purpose of the report.

56

The answer is option **B**.

The authors have effected a simplification of the existing 'jungle' of models of e-democracy into four models which they term 'idealised'. By saying this, they are allowing for the fact that the models may not accurately represent the actual forms of e-democracy in action.

Option **A** is wrong, as they seem to be confident their analysis (of the essential/defining features) is right; any imperfections are (necessarily) to occur in the mapping and matching of the models to actual existing forms.

Option **C** is wrong, as the purpose of the models is better to understand e-democracy – to describe or explain it, rather than to shape or inform it.

Option **D** is wrong, as the aim of the report is to provide a comprehensive analysis of existing forms of e-democracy. This does not preclude the possibility of future forms of e-democracy that do not fit the four models.

57

The answer is option **C**.

The sense that democracy needs to change and reform is implicit throughout much of Abstract One, beginning in the first sentence (where it is declared that ICT presents 'opportunities for greater participation in democratic reform'), and then revived in the later sentences ('in order to maintain legitimacy ... a shift in governmental culture is required', and then at the end, whereby 'initial steps ... undertaken by governments ... enable e-participation to shape democratic reform').

Abstract Two, however, is concerned solely with providing an accurate theoretical analysis of e-democracy (both with a view to capturing its true shape and structure in its current state, and also to informing how it might be best implemented in the future). This rules out options **A**, **B** and **D**.

58

The answer is option **B**.

Abstract One makes it clear that e-democracy needs to be implemented alongside ('...when coupled with...'), rather than as a replacement of, traditional methods of participation.

Abstract Two ends with the conjecture/hypothesis that successful implementation of e-democracy will inevitably contain a blend of aspects of the different models the authors identify ('...may in fact require elements from all four models...').

59

The answer is option **D**.

In paragraph 2 the writer says that emotions encourage organisms to make rapid decisions, and that humans also make decisions that 'seem to come from the gut', i.e. emotional or non-cognitive.

In options **A** and **B** the writers focus only on differences between animals and humans, while in option **C** the writer does not make his own view clear, and only reports the views of others.

60

The answer is option **A**.

According to the writer, even if evidence were found that animals can be motivated by emotions, philosophers would not accept this as evidence that animals have 'moral motivation'.

61

The answer is option **B**.

The writer says there is 'a world of difference' between the instinctive responses found in animals and humans, and the ability to make 'considered moral choices' based on reflection, which she claims is found only in humans. The strength of the writer's rejection is further revealed by her describing of philistine efforts to reduce things to their simplest form to reveal parallels between humans and animals.

In option **A** the writer also rejects the idea that human and animal responses are comparable in that he argues against the notion that animals can behave morally, but there is nothing to support 'strongly rejects'. He is also principally attributing views to philosophers and is not asserting his own views. He does express one part quite strongly ('clearly no one wants to go back') but he is referring to putting animals on trial as opposed to the idea that animals are subject to morality.

In option **C** the writer describes the arguments of competing groups as opposed to asserting his own view.

In option **D** the writer asserts that animal and human decision-making are in some respects comparable.

62

The answer is option **C**.

In the first paragraph the writer gives two points of view put forward by philosophers (although the points of view are also put forward by other academics as well).

In option **A** the writer also gives two points of view, but these are from different disciplines.

In option **B** the writer gives one point of view which is opposed to her own, but we don't know about either her discipline or that of Petersen.

In option **D** the writer does not refer to different disciplines.

63

The answer is option **D**.

The writer says that studying animal decisions provides 'a window on behavioural adaptation', meaning that it helps researchers to find out more about this topic.

In options **A**, **B** and **C**, while the writers give opinions of academics about academic morality, there is nothing to support the idea of actual research, or indeed the notion of evolution.

64

The answer is option **A**.

The writer refers to animal trials in the medieval era.

In options **B** and **C** the writers do not present examples which have this purpose.

In option **D**, the writer refers to the controversy of talking about dogs as 'loving' or 'mean' but this is not intended to provoke a certain reaction from the reader.

65

The answer is option **D**.

The writer says that in the past, any suggestion that animals were capable of cognition was rejected, but that this 'fight' is now 'behind us'.

In options **A**, **B** and **C** the writers do not make connections between views in the near past and now.

66

The answer is option **C**.

The end of the first paragraph refers to practices towards non-humans that may cause pain and discomfort, and the following paragraph describes the assumption by those who believe that humans can be distinguished from the rest of the natural world that we do not need to grant moral consideration to animals.

In option **A**, the writer refers to the 'execution' of animals by humans, but there is nothing about attempts to excuse this.

In options **B** and **D** the writers do not refer to what humans do to animals.

67

The answer is option **A**.

Williams says that Dodds 'apologised, or rather declined to apologise, for using anthropological material' to study ancient Greece, but that since then the use of such methods has become familiar. So while Dodds was aware that an apology might be seen as due to his use of such material (whether or not he was prepared to give this apology), this is now no longer the case.

Option **B** is wrong in that the fact that Dodds declined to apologise suggests that he believed he was right to use the material.

Option **C** is wrong as there is no reference to any later development in the field; what occurred later was just a more general application of anthropological material.

Option **D** is wrong in that while the text refers to recent work that has uncovered 'structures of myth and ritual', there is nothing to suggest that Dodds was aware it would provide insights in these specific areas.

68

The answer is option **C**.

Williams says that using the methods of cultural anthropology 'helps us to understand the Greeks by first making them strange', and says that we must 'keep a sense of their otherness'.

Option **A** is wrong as it suggests we might need to share their feelings.

Option **B** is also wrong as the text says the approach used avoids the problem of assimilating the lives of the Greeks too closely to 'modern conceptions'.

Option **D** is wrong because although cultural anthropology treats the communities it studies as different so making them seem 'strange', the text does not refer specifically to 'atypical social structures'.

69

The answer is option **B**.

Williams concedes in paragraph 3 that cultural anthropology has to describe similarities between different societies, as 'human beings everywhere need a cultural framework to deal with reproduction, eating, death, violence'.

Option **A** is wrong because he suggests in paragraph 2 that the lives of the ancient Greeks should not be 'too benignly assimilated to modern conceptions', but the ancient Greeks themselves can clearly not be exposed to these ideas.

Option **C** is wrong because although paragraph 3 has a reference to myths and rituals and their reflection in literature, there is nothing to support the idea of an imaginative or a factual interpretation by scholars.

Option **D** is too extreme; while cultural anthropologists may think of the lives of their subjects as different, they may in some cases (though not with the ancient Greeks) 'come very close to the people with whom they are living' (paragraph 2) and the possibility of communication is not ruled out.

70

The answer is option **C**.

In paragraph 3 the writer says that he will stress the similarities in 'the concepts that we use in interpreting our own and other people's feelings and actions'.

Option **A** is wrong. While Williams uses the expression 'historical considerations' these are not the stated target of his study.

Option **B** is wrong in that Williams raises this as a possible focus, but states that it will not be the basis for his study.

Option **D** is wrong because although there are unusual human needs, Williams explicitly states that the similarities he is interested in are those to do with concepts for interpreting action.

71

The answer is option **D**.

Williams refers to 'the basic asymmetry between the parties' (the cultural anthropologists and those whom they study) due to the different status they have in the study and the researchers' use of a theoretical apparatus.

Option **A** is wrong as the expression 'circle a little warily' refers to the tension between the reasons for not feeling superior, and the realities of the situation – it does not refer to those being studied.

Option **B** is wrong as there is no suggestion that explanations are oversimplified – in fact the reference to 'theoretical apparatus' suggests the opposite.

Option **C** is wrong as there is nothing to suggest that the researchers are influenced by the people they study, or by anyone else.

72

The answer is option **B**.

This is supported by the following sentence: 'They are among our cultural ancestors...!'

Option **A** is wrong because other peoples may have had comparable social and cultural achievements, but according to Williams it is the link with Western civilisation that makes the Greeks particularly significant to us.

Options **C** and **D** are wrong as Williams says that reference to the history of European domination and the study of human diversity are less immediate parts of self-understanding than study of the Ancient Greeks.

73

The answer is option **C**.

Williams says that learning about the Greeks is central to our understanding of who we are, and that our exposure to other traditions in the modern world will not affect this special relationship between Greek civilisation and the modern (Western) world.

Options **A** and **B** are both wrong as in this part of the text Williams is talking about the influence of ancient Greece on the modern world, not about the learning or interpretation of Greek history.

Option **D** is wrong as Williams does not say these other traditions have become more important than they were.

74

The answer is option **A**.

The writer has introduced the idea of self-understanding in paragraph 4, and develops this in paragraph 5 by justifying its importance in global rather than European terms by saying that this may 'help us to see ways in which our ideas may be wrong'.

Option **B** is wrong because while both modernity and other traditions are referred to, the paragraph does not develop a distinction between them.

Options **C** and **D** are wrong as ideas of language and culture, and modern ideas vs those of the ancient Greeks, are referred to in passing, but the distinction is not used by the writer to make a further point.

75

The answer is option **D**.

The basic meaning of 'untimely' is 'at an unsuitable time' which is supported in the text by 'to act against the age'.

Option **A** is wrong because Williams evidently thinks his investigation can be worthwhile and therefore helpful.

Option **B** is wrong because Williams' project is predicated on the intelligibility of the Greeks, otherwise we could not study our relation to them at all.

Option **C** is wrong because there is no reference in the text to anything being chosen.

76

The answer is option **B**.

Williams starts by discussing the work that has already been done in studying the ancient Greeks, then goes on to describe and justify his own approach, but stresses throughout the importance of studying the thought of the ancient Greeks, for the reason given in the final sentence.

Option **A** is wrong as the writer, while accepting the value of such methods, specifically rejects them for his own study.

Option **C** is wrong as there is nothing to support the reference to the ideas being 'distorted'.

Option **D** is wrong as his focus is on self-understanding by people today, not the ancient Greeks.