Admissions Testing Service

KEY PAPER

ADMISSION TEST FOR THE DEGREE COURSE IN MEDICINE AND SURGERY

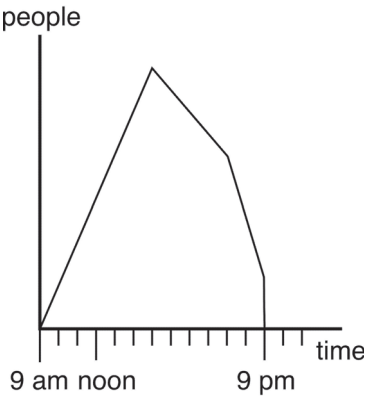
Academic Year 2014/2015

General Knowledge and Logical Reasoning

1 A survey was carried out of people entering and leaving a particular theme park during one day in late summer.

People entered at a steady rate of 600 per hour from opening time at 9 am until 7 pm, when the entrance gates were closed. Nobody left until 3 pm, from which time people came out at a steady rate of 15 per minute until 9 pm. At 9 pm the park closed and all remaining visitors had to leave.

Which one of these graphs best represents the number of people inside the park as the day progressed?

A


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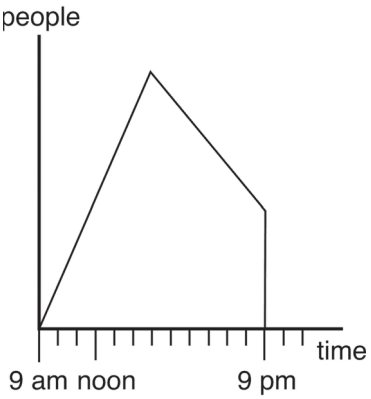

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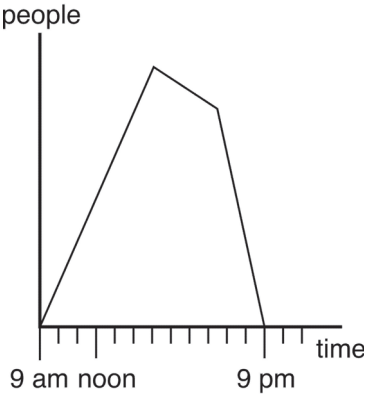

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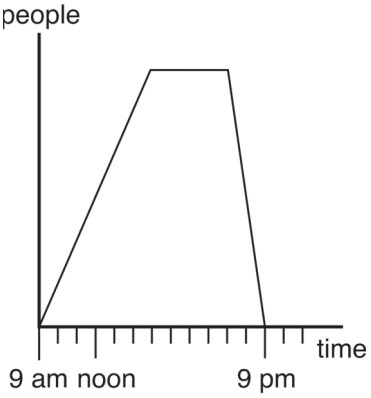

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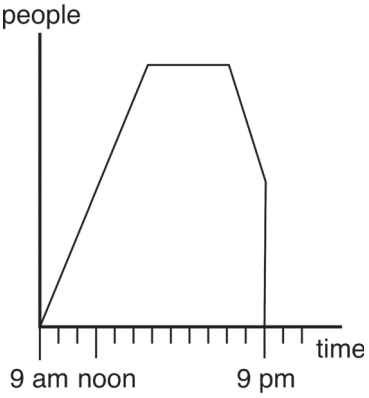


2 Some people have suggested that there is a difference between physiological addiction to a substance and psychological addiction. So they would want to distinguish between the physiological need for chemicals contained in certain substances – such as that for nicotine satisfied through smoking – and the mere psychological craving for, say, chocolate. However, studies show that chemicals are released in the brain when people satisfy a psychological craving. Therefore, there is no difference between the two types of addiction, as both involve a relationship between body chemistry and physical substances.

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

A A general statement is made on the basis of insufficient evidence.

B The availability of addictive substances is not sufficient to explain addiction.

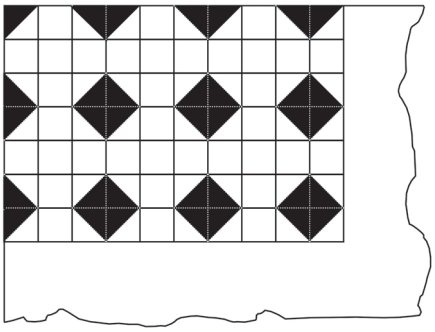
C It lacks consideration of the seriousness of the effects of different substances.

D The cause of an addiction is being confused with the effect of an addiction.

E It assumes that psychological and physical addiction have different causes.

3 The rectangular floor of my conservatory is 4.2 m long and 2.4 m wide. I am in the process of covering it with 20 cm by 20 cm square tiles (cut diagonally into two pieces where required), producing a repeating pattern.

This diagram shows my progress so far:



Including those already laid, how many black tiles do I need altogether to produce this pattern?

A 56

B 28

C 63

D 36

E 72

4 Many conceptual artists do not usually play any physical part in producing the artworks credited to their names beyond design and sometimes supervision. They do not draw, mould, sculpt, paint, etch or personally utilise any of the skills traditionally associated with artistic production. However, this is not important as the artwork is all that matters and without the ideas or concepts that they provide the artwork would not exist. Besides, this is a return to the workshop system of medieval European artists where a master employed several apprentices to do most of the work.

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

A Artists should be able to draw and paint.

B The medieval workshop system is the best way of producing art.

C Artists should physically produce their artworks.

D It is not important for conceptual artists to actually do the work.

E Apprentices are essential in the production of art.

5 The existence of so many conflicts in the world might tempt us to conclude that the world will always be violent. But there is evidence that human society is becoming less violent. Death rates in recent wars are proportionally far below those typical in tribal killing. The wars of the twentieth century, including both world wars, did not kill anything like that proportion of adults. Moreover, the motivation to behave aggressively is decreasing: as the world becomes increasingly interconnected we have more to lose by attacking our enemies. World peace is a distant prospect but we seem to be moving in a more peaceful direction.

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

A The two world wars of the twentieth century led to significant peace initiatives.

B Advances in medical care have enabled more servicemen to survive injuries in war.

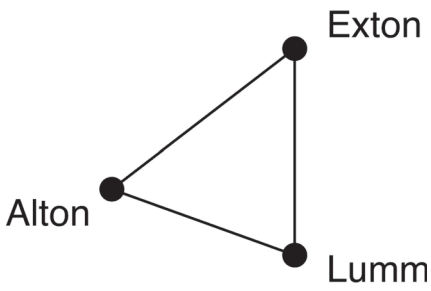
C Old rivalries between the world superpowers are lessening.

D Globalisation tends to lead to political as well as economic co-operation.

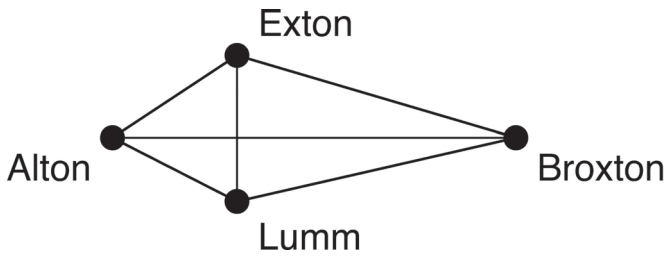
E Tribal societies had economies that fostered raiding and aggressive self-protection.

6 My company has offices across the country. There is an inter-office communication system which links the offices directly with each other so that any two offices can communicate without involving a third.

When there were only three offices we had three links.



We opened a fourth office in Broxton and had to install three more links so that the new office could communicate with each of the existing offices.



Each time we open a new office new links are installed. Today we have six offices and next year we will open two further offices.

How many new links will be needed next year?

A 7

B 13

C 6

D 14

E 9

7 Not only has the price of a bottle of juice been increased from £1.20 to £1.44, but the size of the bottle has also been reduced from 2.5 litres to 2.4 litres.

In terms of price per litre, by what percentage has the cost of juice risen?

A 25%

B 20%

C 16%

D 24%

E 12%

8 In tests designed to compare children's eating habits, children from primary schools in England and Germany were offered a choice between a chocolate bar and a piece of fruit. It was discovered that the English children were far more likely to choose the less healthy chocolate bar than their German counterparts. Television advertising of snack foods is restricted in Germany. If such advertising were to be similarly restricted in the UK, English children would adopt far healthier eating habits.

Which one of the following is an assumption that is required by the above argument?

A In England television advertising of snack food is aimed primarily at children.

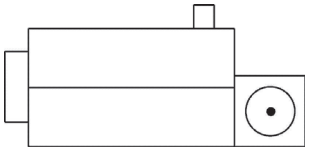
B If television advertising of snack food had been unrestricted in Germany, more German children would have chosen chocolate.

C Children in Germany are less influenced by television advertising than English children.

D The same brands of chocolate and sweets are not available in Germany as in England.

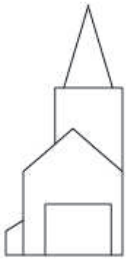
E Television companies have a responsibility to ensure that the advertising on their channels does not put children's health at risk.

9 Below is a line drawing of a church made by a surveyor as seen from directly above in an aeroplane. When the surveyor returns to the ground she wants to identify which particular church it was she drew.



Which one of the churches drawn below, as seen from ground level, could **NOT** be the one drawn above?

A



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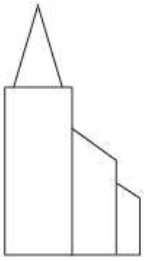

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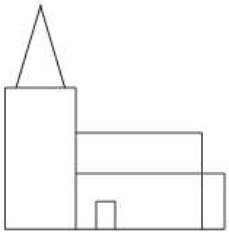

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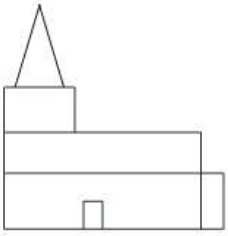
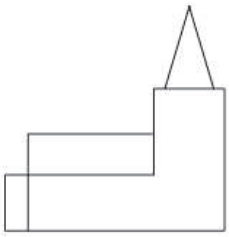


E



10 Some recent research has shown that bees learn better early in the morning when their energy levels are highest. The process of memorising new odours from flowers is very energy-intensive, so carrying out the process of drawing nectar from flowers, which then helps the bee to remember the flower, is most effectively done early in the morning. Furthermore, most flowers accumulate their nectar during the morning, making this the optimum time for pollination. In this way the two species exhibit a mutually beneficial behaviour pattern.

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

A Bees can remember the best nectar-producing flowers for long periods.

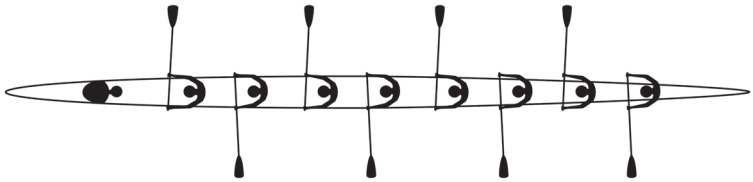
B Bees and the flowers they pollinate have co-evolved which has optimised their chances of survival.

C Bees have insufficient energy to memorise flower odours later in the day.

D Bees are the only insects to successfully pollinate flowers.

E Flowers that do not accumulate their nectar in the morning have no chance of being pollinated by bees.

11 A picture of a boat with eight rowers is shown below. The distance between the entry and exit point of each oar is 6 m (relative to the boat) and the oars are in the water for 50% of the time. The rowers are 1.5 m apart in a boat 17 m long. When the stroke rate is 30 per minute, the boat is moving forward at 5 m/s.



Relative to the water, what is the relationship between the oar entry and exit points?

A The oar exits 1 m ahead of where it enters the water.

B The oar exits 1 m behind where it enters the water.

C The oar exits 5 m ahead of where it enters the water.

D The oar exits 6 m behind where it enters the water.

E The oar exits 6 m ahead of where it enters the water.

12 Joey the balloon clown has 10,000 litres of helium with which to blow up his balloons for tomorrow's show. He has five different types of balloon and knows by experience how much extra helium must be put in the balloons if they are to have the correct amount of helium tomorrow, as they lose some overnight. Also, some shapes of balloon are more likely to burst than others. Joey wants the maximum number of balloons for tomorrow's show.

Balloon type	*Normal capacity (litres)*	*Extra helium required for overnight loss (litres)*	*% that burst*
Star	100	20	5
Heart	90	0	15
Flower	80	10	5
Diamond	70	20	10
Bubble	60	40	5

Which type of balloon does he choose?

A Diamond

B Star

C Bubble

D Heart

E Flower

13 The footpath through Thiska Park is 1,260 m long.

There are a number of litter bins along the path: one at each end, with the others situated at equal distances in between.

The Park Authority has today decided that three new bins should be introduced and the others repositioned (except those at each end) so that they all remain equal distances apart. When this happens the bins will be 35 m closer together than they are at present.

How many litter bins are there at present along the footpath through Thiska Park?

A 9

B 12

C 13

D 8

E 10

14 The Governor of California has recently announced that pupils will soon be learning only from digital texts, and experts in the UK said yesterday that the paperless classroom was becoming a reality here too. Although some educational publishers already offer a range of online resources, most of them are little more than electronic versions of the paper book. Books also offer something that digital resources just can't replicate; you can flick back and forth in them quickly and you can write in them. So the traditional textbook is not about to die a sudden death, especially not in the UK, where some children still do not have access to the internet at home and thus have every right to utter the postmodern excuse of not being able to download their homework.

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

A Using digital texts gives students a good excuse to avoid doing their homework.

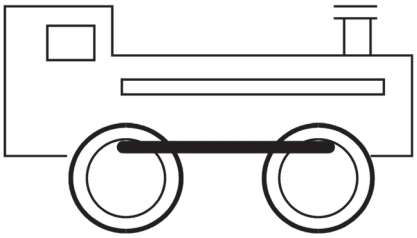
B Ordinary textbooks are not about to vanish from the classroom.

C Online resources offer educational publishers a new commercial opportunity.

D Books have important advantages over digital texts.

E The paperless classroom will become a reality in the near future.

15 The picture shows a steam railway locomotive. On each side the two wheels are connected together by a long steel connecting rod. The wheels have a circumference of 3 m. The locomotive moves forward 10 m.



Which one of these diagrams shows the wheels and the rod after the movement?

A

B

C

D

E

16 In principle, the larger the mirror of a reflecting telescope, the further one can see into space with it. The larger the mirror, however, the greater the weight of the steel needed to support it and maintain its shape. Such a mass of metal and glass stores a lot of heat during the day, enough to keep the mirror several degrees warmer than the surrounding air after sunset. The shimmering air above the warm mirror blurs the image of distant stars and galaxies. Given existing technology, therefore, there is no point building telescopic mirrors above a certain size.

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

A Distant stars and galaxies can be seen perfectly well with existing mirrors.

B There are no alternative types of telescopes that do not use mirrors at all.

C Telescopes are normally sited in areas of the world that have hot climates.

D Shimmering air caused by natural atmospheric conditions is not a problem for telescopes.

E For very large mirrors, the blurring caused by heating cancels out the benefits of increased size.

17 The 'Peter Principle' is commonly believed by many people, even if they do not know its name. It states that 'everyone rises to their level of incompetence': that is, that people are eventually promoted to a job that they are not capable of doing. Unfortunately, the principle is fatally flawed by the absence of any academic results to support it. Recent research in the field of psychology has provided no hard evidence for it and all the examples given by the general public are opinions and judgements, not proven fact.

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

A Employees can be demoralised if they are made to feel incompetent.

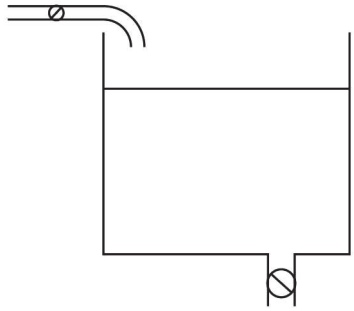
B Not everyone is incompetent in the job they are currently doing.

C Not everyone has the opportunity for promotion.

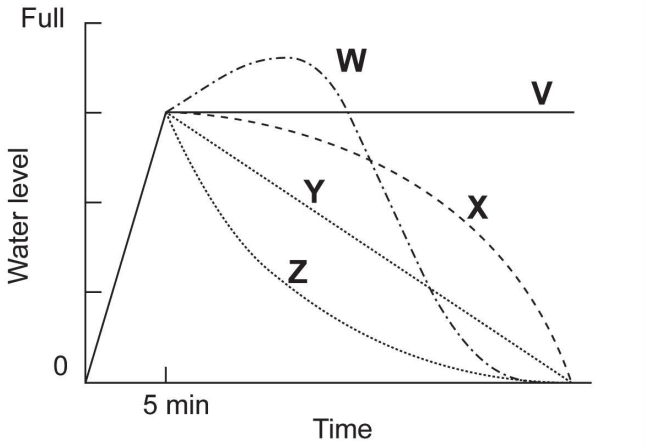
D Lots of decisions are based on opinions and judgements.

E Psychology is not the only discipline relevant to testing the 'Peter Principle'.

18 A farmer's water tank is filled from a tap. There is a valve at the bottom of the tank which lets water out.



The rate at which water can flow out through the valve (when it is open) increases with the depth of water in the tank. When the tank is almost empty, the rate at which water can flow out through the bottom just matches the rate at which water comes into the tank from the tap at the top. One day, the farmer shuts the valve at the bottom and starts filling the tank. He fills it for five minutes, by which time it is three-quarters full, but then, without noticing, he knocks the valve at the bottom open.



Which line on the graph above best represents what happens to the level of water in the tank?

A Line W

B Line Y

C Line X

D Line Z

E Line V

19 Psychologists have provided a dramatic demonstration of how childhood levels of self-control are linked with outcomes later in life. This is important because unlike other traits associated with life outcomes — such as cleverness, height and beauty — self-control tends to be amenable to improvement through training. Children with poor self-control were shown to be more likely in adulthood to have financial problems, health issues and criminal convictions, even when effects of intelligence and social class had been factored out. There would be measurable, long-term benefits to society as well as to individuals if programmes were provided to improve children's levels of self-control. Such programmes, however, would need to be universal to avoid the stigma of targeted intervention.

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

A Children with high levels of self-control tend to have more problems in adult life.

B Schools should identify those children who need to improve their self-control.

C Universal intervention programmes aimed at improving children's self-control should be considered.

D Targeted intervention programmes tend to be unsuccessful.

E The effects of poor self-control are more significant than the effects of low intelligence or social class.

20 Producing meat for consumption requires the breeding of livestock. Some people argue that the process of breeding involves animals being kept in very poor conditions with a low quality of life. Since we should respect the right to a good quality of life for these animals as much as any person, we should abandon the consumption of meat and adopt a vegetarian lifestyle. Additionally, the breeding of livestock produces greenhouse gases, so adopting a vegetarian lifestyle would assist the campaign against global warming.

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

A We should respect animals' rights to a good quality of life.

B Animals cannot be bred while preserving their quality of life.

C Becoming vegetarians will help us to combat global warming.

D If we become vegetarian then livestock breeders will go out of business.

E We should adopt a vegetarian lifestyle.

21 The ideal journey would be by train, in a corner seat in an empty compartment, with well-upholstered seats. A corridor provides access to an efficient bar and a place for the children to play. There is a toilet and there are no traffic jams. It is the best way to see the country (at a steady pace); the easiest place in the world to doze or to read. You reach your destination rested and lively.

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

A It is comfort that makes a journey ideal.

B It is important to be able to read while travelling.

C The author does not like children.

D The ideal journey is taken alone.

E It is possible to be lively and rested at the same time.

22 A 15 km wide asteroid smashing a 150 km wide crater into part of what is now Mexico is the best explanation for the extinction of the dinosaurs 65 million years ago. Previously, some experts believed that while there was no volcanic activity around the asteroid's impact site, a series of super volcanic eruptions over 1.5 million years, in what is now India, was responsible. However, the evidence shows that the fossil record ends too abruptly for a long period of volcanic activity to be the cause. Mathematical modelling also demonstrates that the impact of the asteroid would have created a dust cloud sufficient to kill off the dinosaurs within a couple of years and to leave the layer of deposits found just above those containing the last fossil remnants of the dinosaurs.

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

A The impact of the asteroid would have been a million times the force of an atomic bomb.

B The long series of volcanic eruptions in India would have produced as much dust as the impact of the asteroid.

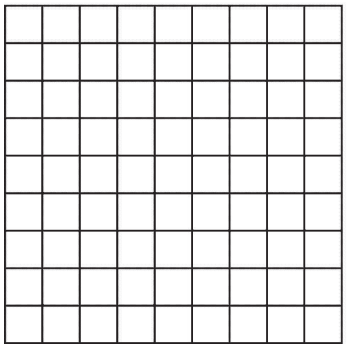
C Huge craters can be created by immense volcanic eruptions as well as the impact of asteroids.

D Detailed analysis of the fossil records shows that dinosaur numbers were already in serious decline before they died out 65 million years ago.

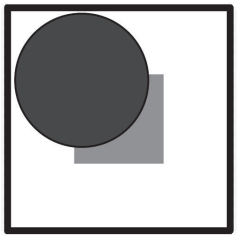
E Large asteroids smash into the earth on average only once every 100 million years.

23 In a fairground game, participants roll discs on to a flat sheet marked out with squares. The players pay £1 per disc and if it comes to rest not touching a line they receive £2. If the centre of the disc lies more than its radius from the edge of the square (i.e. within the shaded area) the player will win.

[Diagram not to scale.]



Enlarged view of one square with disc rolled onto it



Assuming the lines between the squares are very thin, if the squares are 5 cm on each side and the disc has a radius of 1.5 cm, what percentage of the takings will the stallholder retain as profit?

A 2%

B 16%

C 4%

D 32%

E 68%

24 Which one of the following countries is **NOT** a monarchy?

A Morocco

B Finland

C Thailand

D Spain

E Japan

25 The artists René Magritte and Salvador Dalí were associated with which artistic style?

A Expressionism

B Fauvism

C Impressionism

D Surrealism

E Cubism

26 'The World as Will and Representation' is:

A a doctoral thesis by Johann Gottlieb Fichte.

B a book by Arthur Schopenhauer.

C a text of the Buddhist tradition.

D a treatise by Sigmund Freud.

E a painting by Francisco Goya.

27 In which country are the headquarters of the International Red Cross?

A Switzerland

B United States

C Italy

D United Kingdom

E France

28 Which one of the following is **NOT** found in naturally occuring eukaryotic DNA?

A genes

B lipid

C carbohydrate

D alleles

E phosphodiester bonds

29 Mutations can occur in which of the following:

1. introns
2. exons
3. mitochondrial DNA

A 2 and 3 only

B 1 only

C 1, 2 and 3

D 1 and 2 only

E 1 and 3 only

30 A molecule made up of 10 glucose units (monomers) joined together by α 1–4 glycosidic bonds to form a straight-chain would have the formula:

A $C_{60}H_{102}O_{51}$

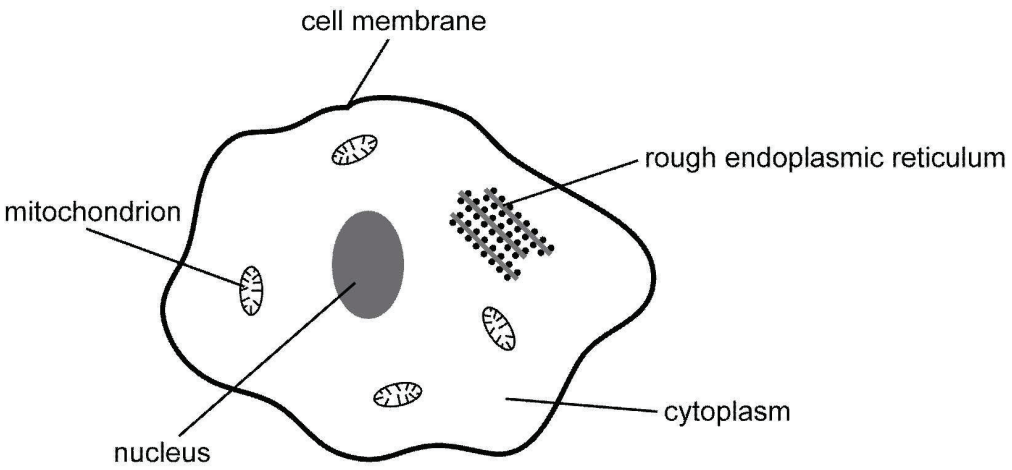
B $C_{60}H_{120}O_{60}$

C $(C_{12}H_{22}O_{11})_{10}$

D $C_{60}H_{100}O_{50}$

E $C_{60}H_{118}O_{58}$

31 Which labelled component on the diagram of a cell produces pyruvate (pyruvic acid) during respiration?



A cell membrane

B cytoplasm

C nucleus

D mitochondrion

E rough endoplasmic reticulum

32 A sample of mitochondria was isolated from an animal cell and provided with the substrates its enzymes can act on. Which one of the following reactions would **NOT** be able to take place?

[Assume the sample is not contaminated.]

A The phosphorylation of glucose

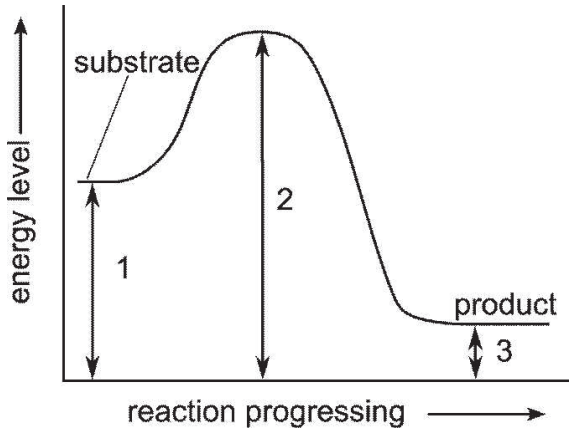
B Decarboxylation reactions that produce carbon dioxide

C The oxidation of reduced NAD

D The formation of acetyl coenzyme A

E The synthesis of ATP from ADP and inorganic phosphate

33 The graph shows the energy levels of a reaction as it progresses, without an enzyme.



Which of the energy levels, represented by the arrows above, would change if an enzyme that catalysed the reaction was present?

A 1 and 3 only

B 1 only

C 2 only

D 3 only

E 1 and 2 only

34 Which one of the following people is associated with the theory of evolution through inheritance of acquired characteristics?

A Watson

B Hawking

C Lamarck

D Wallace

E Darwin

35 In a mature mRNA molecule, which of the following binds to the phosphate?

1. ribose sugar
2. uracil
3. thymine

A 2 only

B 1 only

C 3 only

D 2 and 3 only

E 1 and 2 only

36 Photosynthesis in green plants includes which one of the following?

A fermentation

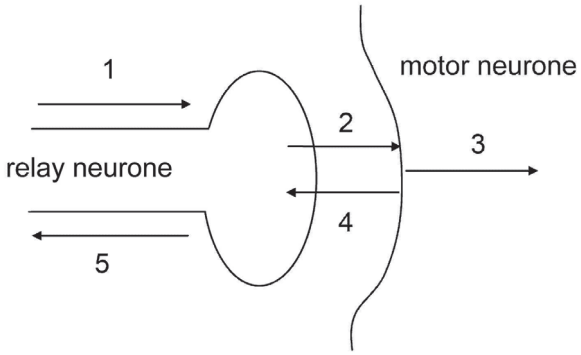
B glycolysis

C oxidative phosphorylation

D the Krebs cycle

E the Calvin cycle

37 The diagram shows a synapse. Which arrow represents the location and direction of neurotransmitter movement when an impulse initially arrives at the synapse?



A 4

B 5

C 1

D 3

E 2

38 Which one of the following describes the function of ligase in the production of recombinant DNA by scientists?

A Form bonds in DNA

B Break bonds in DNA

C Break bonds in tRNA

D Form bonds in mRNA

E Break bonds in mRNA

39 Ligases and restriction endonucleases are used in genetic modification. Which type of bond listed below must they both contain?

A phosphodiester

B peptide

C glycosidic

D hydrogen bonds between complementary bases

E ester

40 An mRNA molecule contains 60 nucleotides, which includes the start and stop codons. The number of bases in this mRNA molecule, other than those in the start and stop codons, is:

A 54

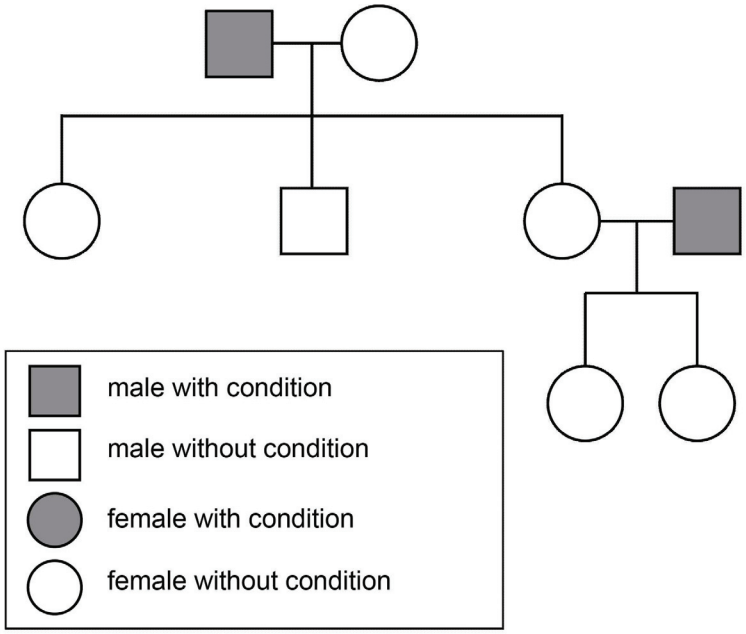
B 56

C 58

D 60

E 59

41 The diagram below shows the inheritance of a genetic condition within a family.



Using the information in the diagram, which of these statements are possible?

1. The condition is caused by a dominant allele.
2. The condition is caused by a recessive allele.
3. The gene that causes the condition is on the Y chromosome.
4. The gene that causes the condition is on the X chromosome.

A 1, 2 and 4 only

B 2, 3 and 4 only

C 1, 3 and 4 only

D 1, 2, 3 and 4

E 1, 2 and 3 only

42 Which pair of organelles in a human egg cell both have a double membrane and DNA?

A Golgi apparatus and rough endoplasmic reticulum

B mitochondrion and nucleus

C chloroplast and mitochondrion

D nucleus and rough endoplasmic reticulum

E ribosome and vesicle

43 Arrange the following in ascending order of the number of molecules present.

1 5.00 g Br_2
2 2.00 g CH_4
3 1.12 dm^3 SO_3 (g)

Use relative atomic mass: H = 1; C = 12; O = 16; S = 32; Br = 80.

Take the volume of 1 mole of gas to be 22.4 dm^3.

A 1, 3, 2

B 1, 2, 3

C 2, 1, 3

D 3, 1, 2

E 2, 3, 1

44 As Group 17 (VII) of the Periodic Table is descended (F→At) which of the following properties decrease?

1. number of electrons in the outer orbital
2. electronegativity (Pauling scale)
3. number of occupied orbitals

A 2 only

B 3 only

C 1 only

D 2 and 3 only

E 1 and 2 only

45 Which of the following results in a change from a homogeneous to heterogeneous system?

1. Stirring a lump of sugar in a beaker of water to completely dissolve the sugar
2. Cloud turning to rain
3. Salt crystals forming in concentrated solution

A 1 and 3 only

B 2 only

C 2 and 3 only

D 1 only

E 3 only

46 Which option below correctly describes the following features of a phosphorous trichloride molecule:

- number of bonding pairs of electrons?
- number of non-bonding / lone pairs of electrons on the phosphorus atom?
- shape of molecule?

Atomic number: Cl = 17; P = 15.

A 3 bond pairs; 1 lone pair; trigonal planar shape

B 3 bond pairs; 1 lone pair; trigonal pyramidal shape

C 3 bond pairs; 1 lone pair; square pyramidal shape

D 2 bond pairs; 2 lone pairs; linear shape

E 2 bond pairs; 2 lone pairs; T-shape

47 A gas is confined in a rigid tank that does not undergo thermal expansion. The temperature of the gas in the tank rises from 298 K to 310 K.

Which of the following increase?

1 volume of the gas
2 pressure of the gas
3 number of gas molecules
4 kinetic energy of the molecules

A 3 and 4 only

B 2 and 3 only

C 1 and 2 only

D 2 and 4 only

E 1 and 3 only

48 The table below shows some physical properties of five substances being tested for electrical conductivity.

	Melting point / °C	*Boiling point* / °C	*Conducts electricity when solid?* (*i.e.* $\sigma > 1\ \Omega^{-1}m^{-1}$)	*Conducts electricity when molten?* (*i.e.* $\sigma > 1\ \Omega^{-1}m^{-1}$)
Substance 1	-7	59	No	No
Substance 2	98	883	Yes	Yes
Substance 3	37	343	No	No
Substance 4	801	1413	No	Yes
Substance 5	1538	2862	Yes	Yes

[Electrical conductivity tests were performed using a field strength of 100 Vm^{-1}.]

Which substance (A – E) has a giant ionic structure at 20°C?

A Substance 4

B Substance 2

C Substance 1

D Substance 3

E Substance 5

49 Below are some equations:

1. [N_2] $N_2(g) + 3H_2(g) \rightarrow 2NH_3(g)$
2. [CuO] $CuO(s) + CO(g) \rightarrow Cu(s) + CO_2(g)$
3. [Mg^{2+}] $Mg^{2+}(aq) + 2e^- \rightarrow Mg(s)$
4. [Zn] $Zn(s) \rightarrow Zn^{2+} + 2e^-$
5. [H_2] $H_2(g) + CuO(s) \rightarrow Cu(s) + H_2O(g)$

Which of the above equations represent reduction of the substance in square brackets?

A 1, 3 and 5 only

B 2, 4 and 5 only

C 1, 2 and 3 only

D 3, 4 and 5 only

E 1, 2 and 4 only

50 When the following equation is balanced, what is the correct value of **c**?

$K_2Cr_2O_7 + \mathbf{a}H_2SO_4 + 6FeSO_4 \rightarrow \mathbf{b}Fe_2(SO_4)_3 + K_2SO_4 + Cr_2(SO_4)_3 + \mathbf{c}H_2O$

A 16

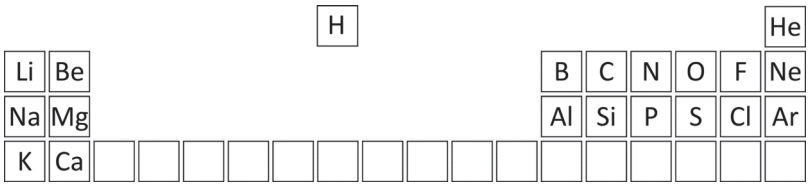
B 14

C 7

D 26

E 13

51 The positions of the first 20 elements in the Periodic Table are shown below.



Which one of the following pairs have the same electronic structure?

A KF and two atoms of Ar

B BH_3 and NH_3

C MgF_2 and K_2O

D PO_3^- and SO_3^{2-}

E $CaCl_2$ and three atoms of Ar

52 Which of the following is/are correct about the Avogadro Constant?

1. It is the number of atoms in 12 kg of carbon-12.
2. It has units mol^{-1}.
3. It is the number of particles of the substance per mole of the substance.

A 1 only

B 1 and 2 only

C 3 only

D 1, 2 and 3

E 2 and 3 only

53 What is the set of values of x for which $12 - x^2 > 8$ and $3 - 2x \geq 5$?

A $1 \leq x < 2$

B $-2 < x \leq -1$

C $-2 < x \leq 1$

D $2 < x$

E $x \leq -1$

54 In a right-angled triangle ABC, the length of side AB is 20 cm and the tangent of angle A is ½.

The hypotenuse is the side AC.

What is the length of the perpendicular from the hypotenuse to point B?

A $8\sqrt{5}$ cm

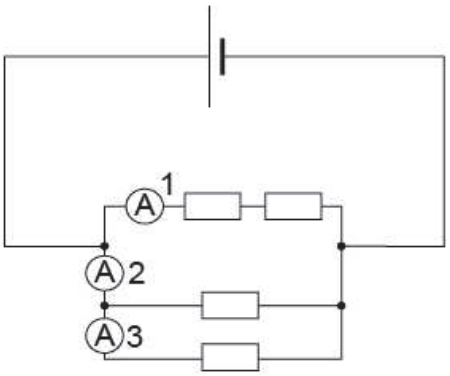
B $10\sqrt{2}$ cm

C $2\sqrt{5}$ cm

D $5\sqrt{2}$ cm

E $4\sqrt{5}$ cm

55 Three ammeters labelled 1, 2 and 3 are connected in the circuit below which contains four identical resistors.



What is the order of readings on the ammeters, smallest to largest?

[Assume that the ammeters and wires have negligible resistance.]

A 2, 3, 1

B 3, 2, 1

C 1, 3, 2

D 1, 2, 3

E 3, 1, 2

56 Given that aluminium has a thermal conductivity which is 3 times that of iron, which one of the following statements is correct?

[Assume all rods mentioned below are uniform and perfectly thermally insulated except for the ends of the rods.]

A The rate of heat flow through an aluminium rod is the same as that through an iron rod if the length of the aluminium rod is 3 times that of the iron rod of the same diameter and with the same temperature difference between its ends.

B The rate of heat flow through an aluminium rod is the same as that through an iron rod if the diameter of the iron rod is 3 times that of the aluminium rod of the same length and with the same temperature difference between its ends.

C The rate of flow of heat through an iron rod will be 3 times that through an aluminium rod of the same dimensions if the temperature difference between their ends is the same.

D The rate of heat flow through an aluminium rod is the same as that through an iron rod if the temperature difference between the ends of the aluminium rod is 3 times that of the iron rod of the same dimensions.

E The time taken for a particular quantity of heat to flow through an aluminium rod will be 3 times that for an iron rod of the same dimensions if the temperature difference between their ends is the same.

57 Which one of the following is the composite function $f \circ g(x)$ where:

$f(x) = 2x - 1$
$g(x) = 6 - x$

A $f \circ g(x) = 11 - 2x$

B $f \circ g(x) = 11 - x$

C $f \circ g(x) = 13 - 2x$

D $f \circ g(x) = 7 - 2x$

E $f \circ g(x) = 5 - 2x$

58 A man can swim in still water at a maximum speed of 0.40 m/s. He swims at his maximum speed from one side of a river to the other. The river has straight sides and is 20 m wide. There is a current in the river of 0.30 m/s which pushes the man along the river as he swims.

What is the minimum time it takes the man to swim across the river, and how far along the river does the current move him?

[Assume the man travels at a constant speed.]

A time = 62.5 s; distance = 25 m

B time = 62.5 s; distance = 15 m

C time = 40 s; distance = 15 m

D time = 50 s; distance = 15 m

E time = 50 s; distance = 25 m

59 What is the equation of the straight line passing through (4, 1) which is parallel to the line given by $3x + 2y = 12$?

A $3y = 14 - 2x$

B $2y = 11 - 3x$

C $2y = 14 - 3x$

D $3y = 2x - 5$

E $2y = 3x - 10$

60 A ball of mass 160 g is travelling at 1.5 m/s and hits a second identical ball that is at rest. The second ball moves off at 1.0 m/s. The two balls are in contact for 1.0×10^{-2} s.

What is the average force between the balls while they are in contact?

A 16 N

B 16000 N

C 8000 N

D 8.0 N

E 0.016 N