Ministero dell'Istruzione, dell'Università e della Ricerca

02MI70800

ADMISSION TEST FOR THE DEGREE COURSE IN MEDICINE AND SURGERY

Academic Year 2017/2018

Cambridge Assessment Admissions Testing

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1 I have a tin of chocolates to share with some friends. In the tin are four types of chocolate – one type in red wrappers, one type in blue, one type in green and one type in yellow, with equal numbers of each.

The tin is passed around in turn from friend to friend. When the tin gets to them:

- John always takes three red chocolates.
- Peter always takes one of each colour.
- Jane always takes one yellow chocolate.
- I always take two green chocolates.

After six passings around of the tin, half of the chocolates remaining in the tin are blue.

How many chocolates were there in the tin when it was full?

A 48

B 24

C 72

D 96

E 60

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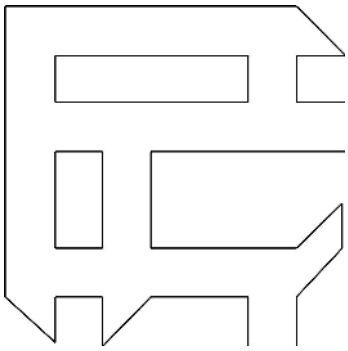
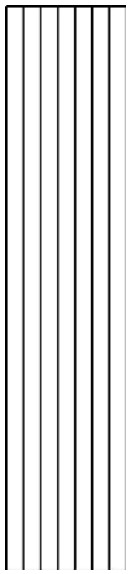
2 This is a view of a cross section of part of an aluminium window frame.



The cross section is uniform throughout its length.

Which one of the following is NOT a possible side view of this part of the aluminium window frame?

A



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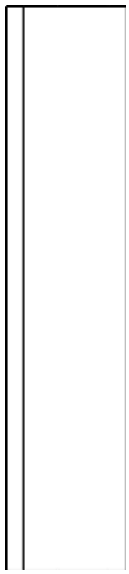

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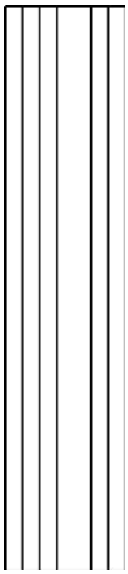
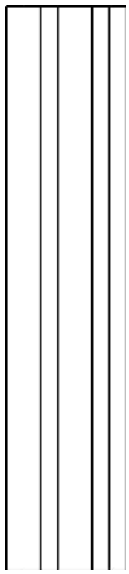


D

E



3 Sheelagh runs a business from London with regional headquarters located in seven cities – Jakarta, Nairobi, Prague, Ottawa, Moscow, Canberra and Hong Kong. The company also has plants in other cities shown in the table. Her senior managers at regional headquarters work from 8am to 5.15pm local time and constantly check their emails between these hours but are not available outside these hours. All her staff have an international time chart displayed at their place of work.

At 12 noon in London it is:

8pm	Beijing
10pm	Canberra
8pm	Hong Kong
8pm	Jakarta
1pm	Lisbon
3pm	Moscow

3pm	Nairobi
2pm	Nicosia
7am	Ottawa
1pm	Prague
7am	Quebec
5pm	Rawalpindi

3pm	Riyadh
9am	Rosario
8am	Santiago
1pm	Stockholm
4am	Vancouver
6am	Winnipeg

At 3pm in London she sends an urgent email to all her senior managers at her regional headquarters.

What is the longest possible interval between the first and last of her senior managers reading the email?

A 9 hours

B 14 hours

C 17 hours

D 16 hours

E 7 hours

4 I recently received a publications list and order form. I want to order seven items from the list. However, I noticed that the structure of the postage and packaging charges was very strange, as shown in the table below:

number of items	*cost of postage and packaging*
1	55p
2	70p
3	95p
4	£1.30
5	£1.60
6 or more	£3.30

I have decided that I will ask them to pack my order in the number of parcels that will have the lowest postal charge.

What is the lowest postal charge for my seven items?

A £1.90

B £2.45

C £3.30

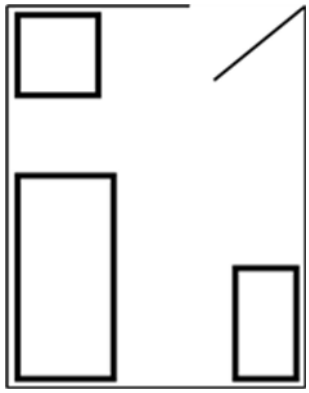
D £2.35

E £2.25

5 Alex's bedroom is rectangular. If you stand at the doorway looking into the room, there is a square wardrobe on your right hand side in the corner. The bed is on the same side of the room as the wardrobe and is over half the length of the room. There is a desk along the other wall.

Which one of these aerial views is the view of Alex's bedroom?

A



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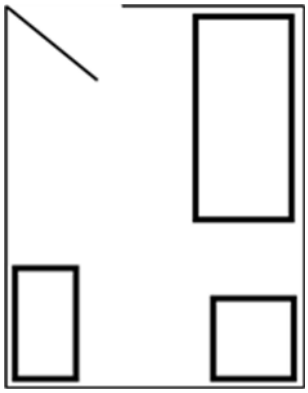

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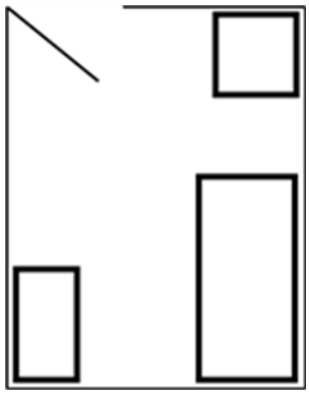

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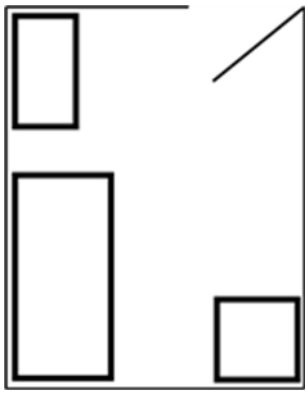

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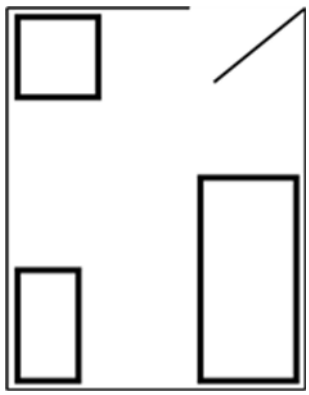

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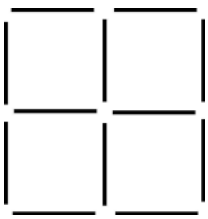
6 The diagram below shows how 12 matchsticks can be used to create a grid containing 4 squares, arranged in rows of 2.



I now intend to use matchsticks to create a grid containing 100 squares, arranged in 10 rows of 10.

How many matchsticks do I need?

A 220

B 242

C 300

D 200

E 400

7 E-cigarettes, which provide nicotine without cigarette smoke, have been praised by health campaigners. Research has suggested that success rates for quitting smoking are higher with e-cigarettes than with other methods. However, rather than tackling their nicotine addiction, e-cigarette users have simply replaced one habit with another. It is true that cigarette smoke contains many hazardous compounds, and also that quitting smoking increases life expectancy and reduces the risk of many health problems. But nicotine also has its dangers: it has been associated with a range of conditions that we do not fully understand, and research has yet to establish the long-term effects of nicotine use outside of cigarette smoke.

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

A Using nicotine patches is an ineffective way to give up smoking.

B Not everyone is able to give up smoking without nicotine replacement.

C Smoking traditional cigarettes still poses a major risk to health.

D E-cigarettes are just as harmful as traditional cigarettes.

E People should not assume e-cigarettes are a safe alternative to traditional cigarettes.

8 Though relatively few people know it by name, palm oil is found in over fifty per cent of processed supermarket goods, from soaps to snacks. This vegetable oil, which is taken from the fruit of the oil palm tree, causes a great deal of environmental concern. The clearing of tropical forests to grow oil palm plantations threatens the survival of orangutans and other endangered species. The land conversion often happens on carbon rich peat soils in a process which releases significant greenhouse gas emissions. Yet even some environmental organisations warn that alternative vegetable oil crops may require much larger areas of forest to be converted to agricultural land.

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

A A ban on palm oil alone would not solve all of the environmental problems associated with vegetable oil production.

B If farmers stopped clearing tropical forests for oil palm plantations, endangered orangutan populations would recover.

C The environmental risks associated with oil palm plantations are not well understood in tropical countries.

D To produce the most profitable crops, oil palm plantations must be grown on carbon rich peat soils.

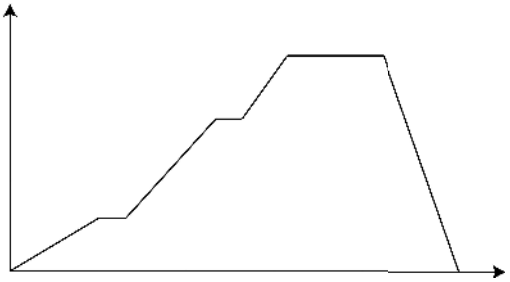
E There is no motivation for manufacturers to stop using palm oil in their products.

9 The distance from Ardale to Banby is 16 km and from Banby to Carston is a further 8 km in the same direction.

David leaves Ardale at 11.00 and runs for an hour at 6 km / h. He rests for 20 minutes and then completes the rest of the distance to Banby at an average speed of 10 km / h. He chats with some friends in Banby for 20 minutes and then borrows a bicycle from one of them and cycles to Carston at an average speed of 16 km / h. David leaves Carston at 15.00 and cycles back over his route, arriving home at 15.50.

Which one of the following correctly shows David's distance from Ardale as a function of time?

A



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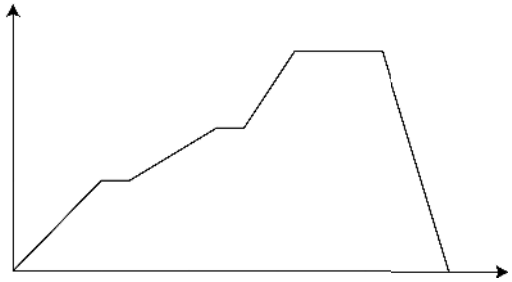

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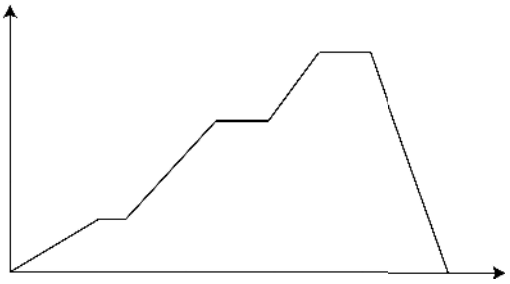

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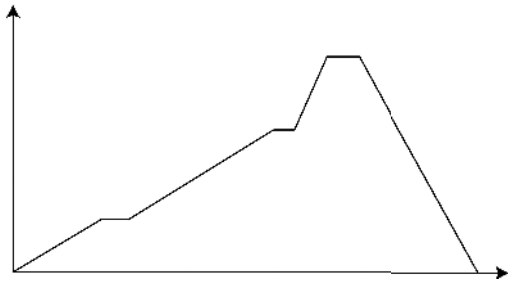

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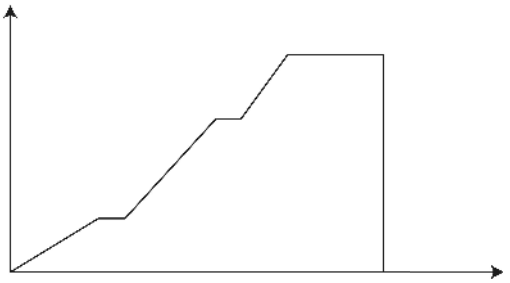

10 It is common practice to look online for a loan or a mortgage. This has led to a large number of 'comparison websites' where you type in your details and they search a range of companies for you based on these details. Night after night, there are adverts on television emphasising how much time and money comparison sites could save you. The experience of one user should make you consider the wisdom of using such sites. She gave her details to a comparison website and received no useful results. However, for weeks afterwards she was bombarded with emails and phone calls from companies she had never heard of.

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

A It assumes using the internet is the only way to get a loan.

B It attacks the website and not what the company does.

C It assumes that comparison websites save customers money.

D It assumes everyone uses comparison websites.

E It draws a conclusion based on one example of how a company operates.

11 Next week the European Parliament will vote on whether to ban trawling, a method of fishing that involves pulling large fishing nets behind boats. The fishing industry is opposed to a ban and has argued strongly against it. Trawling is not as damaging to ecosystems as environmentalists claim. Trawling the seabed doesn't always create 'dead zones' in the ocean. It can boost fish numbers, since the species that are more resistant to the effects of trawling can proliferate. So trawling on flat sandy beds in shallow areas can benefit marine life.

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

A Trawling creates new habitats by making parts of the sea more habitable.

B Trawling in deep waters is expensive and an ineffective use of fishing resources.

C Trawling in shallow waters can damage the bottom of fishermen's boats.

D Trawling in shallow waters can alter the ecology in beneficial ways.

E Trawling nets have a destructive impact on many endangered species.

12 The recently-appointed captain of the national football team has been publicly accused of adultery with several women, including the girlfriend of a former teammate. The newspapers have made a great deal of his extramarital activities and it has become a scandal. His behaviour has led him to be the subject of crude jokes. He has now been suspended from his duties. It is right that he has been removed from his position so that the team can start to pull together and have the best possible chance of winning the World Cup.

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

A The new captain's actions have weakened team morale.

B This new captain should not have been appointed.

C If the new captain is fired, the national team will win the World Cup.

D The national team will not win the World Cup.

E Newspapers have the right to report on people's personal lives.

13 Luke walks his puppy to a nearby park and lets the puppy off the lead.

As Luke starts walking along the path, the puppy runs on ahead, until it has gone 100 metres. The puppy then turns and runs back to Luke, who in that time has walked 50 metres. The puppy then goes on ahead again, turns after running 100 metres and runs back to Luke who has now walked another 50 metres.

This routine continues until Luke has walked 1 km.

If it takes 12 minutes for Luke to walk 1 km in the park, what is the puppy's average running speed during the same time?

A 12 km / h

B 5 km / h

C 10 km / h

D 14 km / h

E 15 km / h

14 Over the last ten years there has been a huge increase in the number of television programmes involving the work of forensic scientists. This media attention has been matched by a massive increase in the number of courses and qualifications available in this field. Although this new attention has led to greater public awareness, it has not led to the creation of more jobs in this field. The work of forensics professionals has continued unchanged. Therefore, those who choose to study these courses will find that there is fierce competition for difficult and unpleasant work.

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

A Each year around 1500 graduates in forensic science compete for 200 jobs in the sector.

B Many students of forensic science go on to pursue careers in other areas.

C New technologies have brought about a decrease in the number of forensics staff required in laboratories.

D The number of university courses in forensic science has grown at an unprecedented rate.

E Salaries for forensic scientists compare well with those in other scientific fields.

15 The table below shows calories burned depending on a person's weight:

Activity (1 hour)	*Calories burned by a 60 kg person*	*Calories burned by a 75 kg person*	*Calories burned by a 85 kg person*	*Calories burned by a 100 kg person*
Walking slow	150	175	200	240
Walking fast	210	260	310	350
Walking very fast	300	350	400	460
Running slow	360	420	450	510
Running fast	510	540	600	650

Five friends choose the following exercise routine:

	Weight	*Activity 1*	*Activity 2*
Harry	85 kg	walks fast for 30 minutes	walks slow for 30 minutes
Holly	60 kg	runs fast for 20 minutes	walks slow for 10 minutes
Jessie	75 kg	runs fast for 10 minutes	runs slow for 20 minutes
Josie	100 kg	walks fast for 30 minutes	walks slow for 30 minutes
Paul	60 kg	runs slow for 20 minutes	walks fast for 20 minutes

Which one of the five friends burns the most calories?

A Holly

B Paul

C Harry

D Jessie

E Josie

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16 Many banks encourage their customers to buy insurance against credit card fraud and other kinds of 'identity theft'. But the banks are really protecting themselves. Customers who are victims of credit card fraud suffer inconvenience but they are unlikely to lose money: the costs of any fraudulent transactions are met by the bank. It is therefore unnecessary for customers to spend money on additional insurance services.

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

A Customers whose identities have been stolen would have benefited from the banks' additional insurance services.

B Additional insurance services are widely available for credit card customers.

C The banks' additional insurance services protect only against the costs of fraudulent credit card transactions.

D People who are worried about identity theft worry only about their credit cards.

E Credit card fraud is a less serious problem than many people believe.

17 Car drivers understandably become very annoyed at high sales taxes on fuel. In the interests of fairness, money raised from fuel taxes should be spent on maintaining roads or even on subsidising public transport. In fact much of it is put to other uses, such as providing healthcare or improving national defence.

Which one of the following is an application of the principle underlying the above argument?

A Money raised by taxing fuel should be spent on improving roads rather than on public transport.

B Better transport is more important than national defence.

C Maintaining roads should be a higher priority than spending on healthcare.

D Profits from sporting events should be spent on encouraging people to participate in sport.

E There should be no sales taxes on consumer goods.

18 Many children from poor backgrounds would benefit from wearing spectacles but do not have them. Sometimes parents are not aware of their children's poor eyesight, but most often they suffer from financial constraints. The government should provide free glasses to poor children with eyesight problems. A recent study of underprivileged students with poor vision demonstrated that those who were given free glasses enjoyed an improvement in test scores equivalent to almost a year of additional schooling. Using the most conservative estimate of the impact of schooling on salary, this would significantly increase an average school-leaver's annual income and tax contributions, and by far more than the cost of a pair of glasses.

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

A Exam marking should take into account any disabilities the student might have.

B Parents should be educated about potential eyesight problems in children.

C Children from poor backgrounds with bad eyesight should be given additional schooling.

D The government should help financially with the provision of children's glasses.

E People's salaries should reflect whether or not they had eyesight problems during school.

19 Widespread underage drinking in certain countries prompted their governments to place restrictions on selling alcohol to young people. The aim was to protect young people's health, but the result was not as intended. Soon after the restrictions were in place, hospitals saw several cases of young people becoming ill as a result of drinking alcohol-based liquids such as medical spirits, ethanol solutions and perfumes. The young people claimed that the restriction on legal alcohol was the main reason they were drinking other substances. If the restrictions were abolished, the health risk would be reduced.

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

A It assumes that restrictions encourage young people to drink alcohol.

B It ignores the role of education in encouraging young people to drink alcohol responsibly.

C It ignores the problem of people drinking dangerous substances because they cannot afford to buy alcohol legally.

D It does not take into account the social and cultural importance of drinking alcohol.

E It ignores the fact that if there had been no restrictions more young people would have suffered from drinking alcohol.

20 I leave Victoria at 8:07 and arrive at Three Bridges at 8:41. I need to catch a train from Three Bridges at 8:45 to either Arundel or Chichester. I want to spend at least four hours in Chichester and four hours in Arundel. I have no preference in which order I will visit the towns. I then need to return to Victoria.

The tables below show extracts from the train timetables:

Depart	Three Bridges	8:45	Three Bridges	8:45
Arrive	Arundel	9:32	Chichester	9:34

Depart	Arundel	13:02	13:29	14:02	14:29
Arrive	Chichester	13:24	13:50	14:24	14:50

Depart	Chichester	12:25	12:41	13:25	13:41	14:25
Arrive	Arundel	12:46	13:12	13:46	14:12	14:46

Depart	Arundel	17:12	17:46	18:13	18:52
Arrive	Victoria	18:47	19:18	19:47	20:20

Depart	Chichester	17:13	17:21	17:43	18:13	18:37
Arrive	Victoria	18:47	19:15	19:18	19:47	20:20

What is the earliest possible time I can arrive back at Victoria?

A 19:18

B 20:20

C 19:47

D 19:15

E 18:47

21 Which one of the following introduced the metaphor of the 'invisible hand' in relation to a free trade economy?

A David Ricardo

B Thomas Robert Malthus

C Karl Marx

D Vilfredo Pareto

E Adam Smith

22 Which one of the following theories was publicly announced to the Prussian Academy of Science on 25th November 1915?

A String theory

B Quantum theory

C The Big Bang theory

D Dalton's atomic theory

E Einstein's general theory of relativity

23 Which of the following occurs in a healthy human testis cell before it undergoes meiosis?

1. DNA content of the nucleus doubles
2. spindle fibres form the spindle
3. crossing over

A 1, 2 and 3

B 2 and 3 only

C 1 and 2 only

D 1 only

E 1 and 3 only

24 Which of the following components of a human immunodeficiency virus (HIV) contain peptide bonds?

1. capsid
2. envelope
3. reverse transcriptase

A 2 and 3 only

B 1 and 2 only

C 1, 2 and 3

D 3 only

E 1 and 3 only

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25 The pathway shows some of the cells produced during oogenesis in the ovary of a healthy human female.

Which of the following cells in the pathway are diploid?

1. germinal epithelial cells in the ovary

↓

2. oogonia

↓

3. primary oocyte

↓

4. secondary oocyte

A 1, 2 and 3 only

B 1 only

C 4 only

D 1, 2, 3 and 4

E 2, 3 and 4 only

26 Which of the following statements is/are correct for all enzyme inhibitors?

1. They alter the shape of the active site.
2. They denature the enzyme.
3. They increase the activation energy of the reaction.
4. They reduce the rate of the enzyme catalysed reaction.

A 4 only

B 3 only

C 1, 2 and 3 only

D 1, 2 and 4 only

E 2 and 4 only

27 Which one of the following statements about unmutated nucleic acids is correct?

A rRNA has anticodons which bind to tRNA.

B Prokaryotic DNA is a single strand which forms a loop.

C tRNA is made up of one phosphate-sugar backbone and may have adenosine and thymine bases.

D mRNA is made up of a single nucleotide with a codon of uracil, cytosine and guanine bases.

E Bases in DNA may form hydrogen bonds with uracil bases.

28 Which of the following statements is/are correct in a healthy human?

1. During inspiration, the pressure within the chest cavity is lower than outside the body.
2. During ventricular systole, the pressure in the atrium is lower than in the ventricles.
3. During ventricular systole, the pressure in the aorta is lower than the pressure in the atrium.

A 1 only

B 3 only

C 2 and 3 only

D 2 only

E 1 and 2 only

29 Which of the following could be a consequence of a reduction in pituitary function in an otherwise healthy human?

1. more urine produced in a male or female
2. infertility in a female
3. infertility in a male

A 1 and 2 only

B 2 and 3 only

C 2 only

D 1, 2 and 3

E 1 and 3 only

30 The following structures are found in plant cells:

1. cell wall
2. cell membrane
3. nucleolus
4. mitochondrion

Which cell structures might contain molecules containing carbohydrate monomers?

A 1 only

B 1 and 4 only

C 2 and 3 only

D 1, 2, 3 and 4

E 4 only

31 Two adjacent healthy human cells, X and Y, contain the two molecules Q and R.

The concentration of molecule Q in cell X is 4 arbitrary units (a.u.) and in cell Y it is 6 a.u.

The concentration of molecule R in both cell X and cell Y is 7 a.u.

Which of the following statements about the net movement of ONLY molecules Q and R between cells X and Y could be correct?

1. Molecules of Q move by facilitated diffusion from cell X.
2. Molecules of Q move by active transport into cell Y.
3. Molecules of R move into and out of both cell X and cell Y.

A 2 and 3 only

B 2 only

C 1 only

D 1, 2 and 3

E 1 and 3 only

32 A person was admitted to hospital suffering from a loss of memory.

Which part of the central nervous system is most likely to have been affected?

A cerebellum

B spinal cord

C medulla

D cerebrum

E hypothalamus

33 Four students, 1, 2, 3 and 4, recorded different structures that they thought were found in a healthy animal kidney cell and a typical bacterial cell.

student	*animal cell*	*bacterial cell*
1	DNA found in a nucleus	70S ribosomes present
2	cell wall present	mitochondria present
3	70S ribosomes present	DNA found in a nucleus
4	circular DNA	plasmids present

Which students gave totally correct answers?

A students 2 and 3 only

B students 1 and 2 only

C students 1, 2, 3 and 4

D students 2 and 4 only

E students 1 and 4 only

34 A short section of the DNA strand that codes for a protein has the sequence:

CAT TGG GCA TCG

Which of the following statements about this section of the sequence is/are correct?

1. There are a total of 29 hydrogen bonds between this section of DNA and its complementary strand.
2. There are 12 phosphodiester bonds present within this section of DNA.
3. The unmutated tRNA molecules used to translate this sequence contain a total of 3 uracil bases.

A 2 and 3 only

B 1 and 2 only

C 1 and 3 only

D 2 only

E 3 only

35 A mother and a father, neither of whom has cystic fibrosis, conceive a child who has the condition.

What is the likelihood that the same parents will have another child who is a boy without cystic fibrosis?

A 1 in 4

B 3 in 4

C 1 in 2

D 3 in 8

E 1 in 8

36 Which of the following molecules is/are directly produced during BOTH glycolysis and pyruvate decarboxylation in a healthy human cell?

1. ATP
2. carbon dioxide
3. reduced NAD

A 1 and 3 only

B 2 and 3 only

C 1 only

D 3 only

E 1 and 2 only

37 Which one of the following most accurately describes the structure of a human haemoglobin molecule that can bind four oxygen molecules to form oxyhaemoglobin?

A It has a primary, tertiary and quaternary structure only.

B It has a primary, secondary and tertiary structure only.

C It has a primary and secondary structure only.

D It has a primary, secondary, tertiary and quaternary structure.

E It has a primary, secondary and quaternary structure only.

38 Which of the following processes take place during the establishment of a resting potential in the axon of a healthy human neuron?

1. active transport
2. facilitated diffusion
3. respiration

A 1, 2 and 3

B 2 only

C 1 and 3 only

D 1 and 2 only

E 2 and 3 only

39 Which one of the following is a correct outline of some main events in photosynthesis in a healthy wheat plant?

A Carbon dioxide combines with an acceptor compound which breaks into two and each is reduced by hydrogen split from water by light.

B Light splits water and the resulting hydroxyl group combines with a compound which has reacted with carbon dioxide.

C In the presence of light, oxygen reacts with a carbohydrate to produce water and carbon dioxide.

D Light splits carbon dioxide and the resulting carbon then combines with oxygen and hydrogen obtained from water.

E Light joins carbon dioxide to an acceptor compound which is then reduced by hydrogen obtained from water.

40 Which combinations of DNA could be present in a transgenic organism?

1. invertebrate animal DNA in mammal DNA
2. prokaryotic DNA in plant DNA
3. plant DNA in animal DNA

A 1, 2 and 3

B 2 and 3 only

C 1 and 3 only

D 1 and 2 only

E 2 only

41 Which one of the following statements correctly describes the type of mixture and the most appropriate method used to separate the specified component from the mixture?

A salt from salt solution – homogeneous; paper filtration

B water from salt solution – heterogeneous; simple distillation

C chlorophyll from a solution of different plant pigments – homogeneous; chromatography

D red blood cells from blood – homogeneous; centrifuge

E gasoline/petrol from crude oil – heterogeneous; simple distillation

42 Which one of the following options gives the correct electron structure of the particle $^{16}_{8}O^{2-}$?

A $1s^2 2s^2 2p^6 3s^2 3p^4$

B $1s^2 2s^2 2p^4$

C $1s^2 2s^2 2p^2$

D $1s^2 2s^2 2p^6 3s^2 3p^6$

E $1s^2 2s^2 2p^6$

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43 In which one of the following reactions is the underlined species acting as an oxidising agent?

A $\underline{Cl_2} + 2KBr \longrightarrow 2KCl + Br_2$

B $\underline{Zn} + CuSO_4 \longrightarrow ZnSO_4 + Cu$

C $3\underline{CO} + Fe_2O_3 \longrightarrow 3CO_2 + 2Fe$

D $\underline{H_2SO_4} + 2NaOH \longrightarrow Na_2SO_4 + 2H_2O$

E $2\underline{Mg} + O_2 \longrightarrow 2MgO$

44 A solution of hydrochloric acid has a concentration of 1.0 mol / L. If 10 mL of this acid is added to water and made up to a total volume of 1.0 L, what is the pH of the resulting solution?

A 9

B 2

C 5

D 6

E 0

45 Which one of the following samples of gases contains the most particles?

All gases are at 0 °C and 1 atm pressure, when 1 mole of gas has a volume of 22.4 L.

[Relative atomic mass, A_r: H = 1, He = 4, C = 12, O = 16, Cl = 35.5]

A 33.6 L of chlorine gas

B 66.0 g of carbon dioxide gas

C 22.4 L of hydrogen gas

D 10.0 g of helium gas

E 64.0 g of oxygen gas

46 In an experiment involving the reaction shown below, 150 cm^3 of F_2 reacts with 100 cm^3 of Cl_2.

$$3F_2(g) + Cl_2(g) \rightarrow 2ClF_3(g)$$

On completion of the reaction, what is the final gaseous volume at the same temperature and pressure?

A 250 cm^3

B 100 cm^3

C 350 cm^3

D 200 cm^3

E 150 cm^3

47 Which one of the following molecules is a structural isomer of methylcyclopentane?

A hexane

B cyclohexene

C hex-2-ene

D 2,2-dimethylbutane

E 2-methylpentane

48 Consider the following list of particles:

1. molecules
2. ions
3. single atoms

Which one of the following options correctly describes the particles that are present in an aqueous solution of sodium chloride?

A 1 and 2 only

B 1, 2 and 3

C 3 only

D 1 only

E 2 only

49 The solubility of potassium nitrate in water increases with temperature.

A saturated solution of potassium nitrate at 80 °C is cooled to 25 °C in a closed container.

Which of the following statements is/are correct?

1. The mass of undissolved potassium nitrate will increase.
2. The concentration of the potassium nitrate solution remains the same.
3. The total mass of solvent present remains the same.

A 2 and 3 only

B 1 and 3 only

C 1 only

D 2 only

E 1, 2 and 3

50 Element X is a grey solid.

It combines with chlorine to form a polar molecule with the formula XCl. In this compound, element X has an oxidation state of +1.

In potassium iodide solution, it dissolves to form a coloured solution.

At 500 °C, it becomes a coloured vapour.

What is the identity of element X?

A manganese

B fluorine

C iodine

D carbon

E lithium

51 Which option correctly describes the following features of a silane (silicon tetrahydride) molecule?

- number of bonding pairs (bp) of electrons
- number of lone/non-bonding pairs (lp) in the valence shell of the silicon atom
- bond angle

[Atomic number: Si = 14; H = 1]

A 3 bp; 1 lp; 107°

B 3 bp; 1 lp; 109.5°

C 4 bp; 0 lp; 109.5°

D 4 bp; 2 lp; 90°

E 4 bp; 0 lp; 90°

52 Which one of the following statements about the four atoms/ions below is correct?

$^{23}_{11}Na^{+}$ $^{16}_{8}O^{2-}$ $^{18}_{8}O$ $^{32}_{16}S$

A $^{16}_{8}O^{2-}$ and $^{18}_{8}O$ have exactly the same number of protons and electrons but not neutrons.

B Out of the four atoms/ions, only $^{23}_{11}Na^{+}$ has two more electrons than $^{18}_{8}O$.

C $^{16}_{8}O^{2-}$ has the same number of electrons but four fewer neutrons than $^{23}_{11}Na^{+}$.

D $^{32}_{16}S$ has twice the number of neutrons that $^{18}_{8}O$ has but only four more than $^{23}_{11}Na^{+}$.

E Both $^{16}_{8}O^{2-}$ and $^{32}_{16}S$ each have an equal number of protons, neutrons and electrons.

53 A car starts at point X. It travels 3.0 km due east, then 4.0 km due south, then 6.0 km due west and finally 8.0 km due north.

How far away is the car from point X when it has reached the end of this journey?

[Assume that all distances moved are on a flat horizontal surface, and that point X is on the equator. You may ignore any curvature of the Earth.]

A 5.0 km

B 21.0 km

C 10.0 km

D 7.0 km

E 2.0 km

54 A resistor has a resistance of 5.0 Ω. There is a direct current of 10 A in the resistor.

What is the power dissipated by the resistor?

A 50 W

B 2500 W

C 20 W

D 250 W

E 500 W

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55 Which one of the following is an expression for the mean of $\frac{x}{3}$, x, and $x+6$?

A $\frac{7x+6}{9}$

B $7x+2$

C $\frac{7x+6}{3}$

D $\frac{7x+18}{9}$

E $7x+18$

56 What is the gradient of the straight line passing through the points with coordinates (2, –3) and (–1, 6)?

A –1

B -9

C -3

D $-\frac{1}{9}$

E $-\frac{1}{3}$

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57 Given that

$\log_{10}7 = x$

$\log_{10}2 = y$

$\log_{10}3 = z$

What is $\log_{10}\left(\frac{14}{3}\right)$ expressed in terms of x, y, and z?

A $xy - z$

B $\frac{xy}{z}$

C $x + y - z$

D $xy + z$

E $\frac{x+y}{z}$

58 A solid wooden cube has sides of length a. The density of the wood is ρ.

The cube is completely immersed in a beaker of oil, which has a density σ. The top surface of the cube is horizontal. The gravitational field strength is g.

What is the upward force (upthrust) on the cube due to the oil?

[Assume that no oil is absorbed by the wood.]

A $(\sigma - \rho)a^3g$

B $\rho a^3 g$

C σa^3

D $\sigma a^3 g$

E ρa^3

59 A fixed mass of an ideal gas undergoes a change in which it is supplied with 3500 J of thermal energy. At the same time this gas does 3500 J of work on its surroundings.

Which type of change does the gas undergo during this time?

A adiabatic

B isothermal

C isochoric

D isomeric

E isobaric

60 How many ways are there to order the letters 'AABBC'? (For example, 'ACABB' and 'AABBC' are two ways.)

A 5

B 120

C 60

D 116

E 30