

IMAT HUMANITAS 2017

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ADMISSION TEST FOR THE DEGREE COURSE IN MEDICINE AND SURGERY

Academic Year 2017/2018

General Knowledge and Logical Reasoning

1. The number of foxes has risen dramatically in recent years, and foxes are moving further and further into urban areas. They are a menace, running in front of cars, raiding rubbish bins and destroying gardens. If numbers continue to increase, more people will be inclined to take action by poisoning or injuring foxes. Those who care about foxes should look for humane ways to reduce their numbers.

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

- A** People who like foxes are not prepared to reduce their numbers.
 - B** There are advantages to the increase in the numbers of foxes.
 - C** Fox numbers have not increased in all areas.
 - D** Reducing fox numbers is the only solution to the problem.
 - E** All gardeners consider foxes to be a source of trouble.
2. Children in the UK start school when they are four years old. Educational research suggests that an early start in education raises the overall academic achievement of young people, especially in key areas such as literacy and numeracy. But other countries do not follow the UK in this. For example, compulsory full time education does not begin in Denmark and Finland until the age of seven. Since 2000 the international PISA tests have measured the academic achievements of teenagers in participating countries. The PISA rankings have consistently placed Denmark and Finland ahead of the UK in terms of literacy and numeracy.

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

- A** The PISA tests are not an effective measure of academic achievement.
- B** An early start in education impedes academic achievement.
- C** Children should not start education until they are at least seven years old.
- D** Starting education early does not necessarily improve later academic achievement.
- E** There is no compelling reason for children to start school as young as four.

3. Bariatric surgery, which physically limits a person's stomach capacity, is being welcomed as a way to tackle obesity. A study shows that the surgery is effective in forcing the patient to eat much less, and that the subsequent weight loss helps to reduce the incidence of other health problems. Since obesity related conditions make significant demands on the health service, the taxpayer benefits from the surgery as well as the patient. But isn't there a much simpler solution to obesity? People should just eat less. All that's required is self discipline, which is simple and free.

Which one of the following best illustrates the principle used in the above argument?

- A Tests to detect health problems at an early stage should be used more widely to avoid complex treatment later.
 - B To reduce the need for dental treatment, children should not be allowed to eat sugary foods.
 - C The ban on smoking in public places should be extended to a total ban on smoking.
 - D The government should make taxes on alcohol much higher to reduce the incidence of excess drinking.
 - E People should adopt a daily exercise regime to prevent some heart problems that require surgery.
4. Politicians are often criticised for being interested only in short term measures, especially those which are popular when an election is close. But some unpopular decisions with long term benefits are also made, and they become accepted after a period of time. Take for instance the ban on drinking alcohol on the London underground. Initially unpopular, the ban is now widely accepted and praised. Politicians should act for the public good and risk short term unpopularity. In the long term, we may all benefit.

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

- A Decisions that are initially unpopular will be accepted after a period of time.
- B It was right to ban the drinking of alcohol on the London underground.
- C Elections are an incentive to politicians to make populist decisions.
- D Politicians are only interested in short term measures.
- E Politicians should worry less about criticism and act in the public interest.

5. In the UK, the number of couples getting married in religious services has fallen by six per cent in the last year. Civil ceremonies now account for seventy per cent of all weddings, a rise from sixty-five per cent a decade ago. This is an indicator that people in the UK are placing less importance on religion.

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

- A Wedding ceremonies are now more individualised than they used to be, allowing for more input from couples.
- B Fewer people are attending religious services than before.
- C Many religious couples opt for civil weddings because of long waiting lists for a religious ceremony.
- D Within many religions, it is still very important to have a religious wedding ceremony.
- E Some people choose religious wedding ceremonies because of pressure from their families.

6. In the UK, teachers' unions have rejected a plan to reduce the longest school holiday from six weeks to four. They claim that the full six week annual break is essential for teachers' health since teaching is such a stressful profession. They say this is shown by the number of teachers who fall ill as soon as the holiday starts.

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

- A The fact that teachers can't choose the dates of their holidays adds to their stress.
- B Many jobs are as stressful as teaching.
- C Not all teachers belong to a teachers' union.
- D Trainee teachers are fully aware from the start how demanding teaching is.
- E Just because teachers fall ill at the end of a term doesn't mean that the work caused it.

7. Good manners - polite behaviour in social interactions - are in decline. Rude and hostile language is becoming more common in communication between strangers in the street and even between neighbours. Social media and the internet only make things worse: people are rarely held accountable for what they 'say' online and can easily forget that they are communicating with and about other real human beings. For instance, people of all ages feel more comfortable using bad language or swearing in online communication than in face-to-face interactions.

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

- A It is possible for societies to improve standards of polite behaviour.
 - B Without the internet or social media there would be no problems with bad manners.
 - C People have not worried in the past about declining standards in manners.
 - D Standards of polite behaviour are very consistent across cultures and societies.
 - E The use of any bad language or swearing equates to bad manners.
8. Civil liberties organisations are concerned about what they see as a problematic invasion of privacy. There is a great deal of evidence that when people use email or the internet they are being spied on by some large organisation. 'Cookies' enable businesses to find out how customers behave online, and they use this information to target their advertising and marketing. In many countries, government intelligence services have the ability to monitor all email messages.

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

- A Loss of privacy is an inevitable consequence of using email and the internet.
- B Email and the internet have increased the opportunities for spying on people.
- C People should avoid using email and the internet.
- D People should use alternative methods if they want to retain their privacy.
- E The convenience of email and the internet is worth the loss of privacy.

9. The number of people who have stopped eating products derived from animals and have embraced vegan diets has doubled in the past three years. There are good environmental and health reasons to do this. Vegan diets are better for the environment because they produce fewer greenhouse gas emissions. They also prevent the killing of countless animals that spend their lives crammed into wire cages, windowless sheds, gestation crates and other confinement systems before being slaughtered. In addition, eating fruit, vegetables and wholegrains decreases our chances of suffering from heart disease caused by high consumption of animal products.

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

- A The production of vegan foods is causing land conversion and the loss of natural habitats.
- B Vegan diets are as tasty as meat based diets.
- C People who follow vegan diets use scare tactics to convince others not to eat animal products.
- D Rivers, lakes and underground water sources are drying up due to the excessive water used to farm animals and to grow their feed.
- E It may be difficult for vegans to get enough nutrients if they do not eat at least five portions of fruit and vegetables a day.

10. The common perception that cycling is dangerous is a long way from the truth. Cycling is safer than gardening. In the UK an estimated 300,000 people each year are hospitalised because of injuries sustained while gardening. That compares with 20,000 people injured while cycling - not even ten per cent of the number injured gardening. Nobody avoids gardening because it's dangerous, so we shouldn't think of cycling that way either.

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

- A It fails to take into account the fact that some people avoid cycling for reasons other than those of safety.
- B It fails to take into account the fact that some cyclists are professional.
- C It fails to take into account the fact that some people are both gardeners and cyclists.
- D It fails to take into account the fact that some people avoid both gardening and cycling.
- E It fails to take into account the proportion of gardeners and cyclists hospitalised with injuries.

11. Tam is playing a game where she gets 3 points for winning a round, 1 point for a draw, and 1 point deducted for losing a round.
- If she plays 10 rounds, what is the minimum number of wins she would have had to achieve to finish with exactly 16 points?
- A 2
 - B 6
 - C 3
 - D 5
 - E 4
12. A class of 20 students calculated that their mean mass was 45.4 kg. They then calculated it again, but this time including the teacher. The mean mass was now 47.5 kg.
- What was the mass of the teacher?
- A 42.0 kg
 - B 92.9 kg
 - C 89.5 kg
 - D 91.6 kg
 - E 44.1 kg
13. Jamie and his niece, Sophia share the same birthday. In 2015, Jamie was 7 times as old as Sophia. In 2035, Jamie will only be twice Sophia's age.
- What is the difference in their ages?
- A 24 years
 - B 20 years
 - C 28 years
 - D 8 years
 - E 4 years

14. There are 180 students in Year 10 at a local school. Biology is compulsory for all students and there is the option to add chemistry and/or physics to the programme of study.
- 50 students only study biology.
 - 100 students study chemistry.
 - 65 students study physics.

How many students study chemistry but not physics?

- A** 115
- B** 130
- C** 65
- D** 30
- E** 80
15. A woman is starting a new job and needs to order a uniform. She needs a skirt and a blouse. Her bust, hips and waist measurements are 82 cm, 110 cm and 77 cm respectively. Below is the chart she must use to select the correct sizes. The skirt is selected using the 'hips' size and the blouse the 'bust' and 'waist' size. She wants to order the smallest size skirt and blouse possible that will fit her dimensions. Which sizes must she choose to make sure the skirt and blouse fit her?

<i>sizes</i>	<i>bust</i>	<i>hips</i>	<i>waist</i>
extra small	78-82cm	82-86cm	54-61 cm
small	84-89cm	88-94cm	63-70cm
medium	92-96cm	99-103cm	73-78cm
large	97-105cm	108-114cm	83-89cm
extra large	108-113cm	119-124cm	95-105cm

- A** Skirt: extra small, blouse: medium
- B** Skirt: large, blouse: medium
- C** Skirt: medium, blouse: large
- D** Skirt: medium, blouse: medium
- E** Skirt: large, blouse: extra small

16. I am planning to buy a treat for the members of my youth group. I need to buy at least 40 chocolate bars. I only want to buy one type of bar to avoid arguments about them. One boy is allergic to nuts so I will not choose bars with nuts in. The options available at my local supermarket are shown below.

<i>type of bar</i>	<i>number per pack</i>	<i>contains nuts?</i>	<i>pack price</i>
Fruity Choe	8	no	€1.90
Choe Surprise	10	yes	€2.30
Choe Fudge	10	no	€2.35
Flaky Choe	15	no	€3.10

What is the cost of the cheapest option which meets all the criteria?

- A €9.50
- B €9.40
- C €9.30
- D €8.55
- E €9.20

17. Jeremy needs to print some leaflets to advertise his new business. Each leaflet is a piece of A4 paper which is printed on both sides and then folded. He has decided to print the leaflets in colour and would like to print as many as he can without exceeding his maximum budget of \$80. He does not want to pay for folding the leaflets as he is able to do this himself.

The table below shows the prices that the printers charge for Black and White printing. Colour printing costs twice as much for the first 200 copies, but is then the same price as Black and White for the remaining pages.

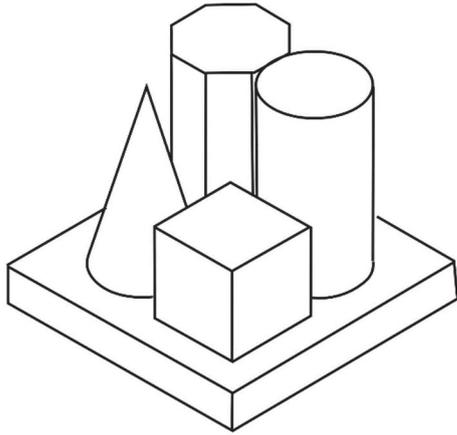
<i>paper size</i>	<i>double sided?</i>	<i>price per 50</i>		<i>folding charge (per 50)</i>
		<i>first 200</i>	<i>further copies</i>	
A4	<i>no</i>	\$4.00	\$3.00	\$2
	<i>yes</i>	\$7.00	\$4.50	\$2
A5	<i>no</i>	\$3.00	\$2.00	\$2
	<i>yes</i>	\$5.00	\$4.00	\$2
A6	<i>no</i>	\$2.00	\$1.50	\$1
	<i>yes</i>	\$3.50	\$2.00	\$1

Orders must always be in multiples of 50.

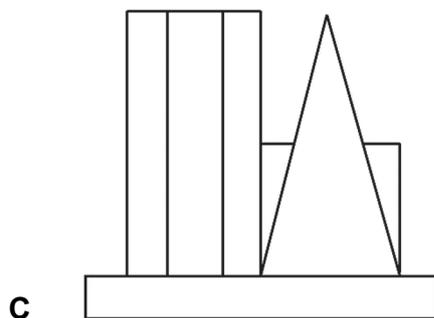
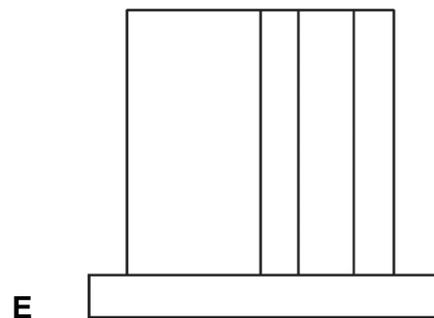
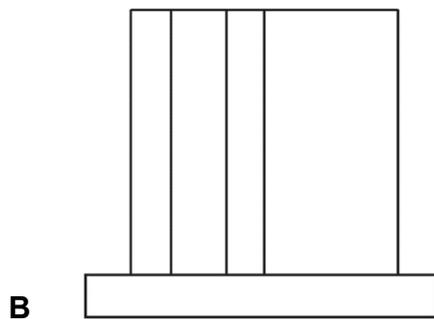
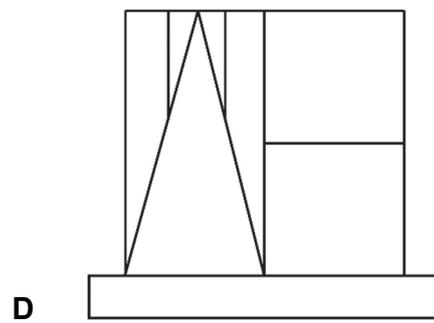
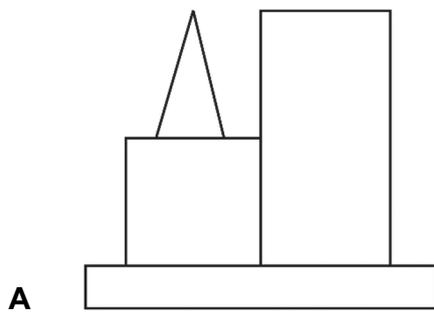
How much will Jeremy pay to produce the leaflets?

- A** 77.00
- B** \$80.00
- C** \$74.00
- D** \$78.50
- E** \$75.50

18. A pictorial view of a mathematical model is shown below.



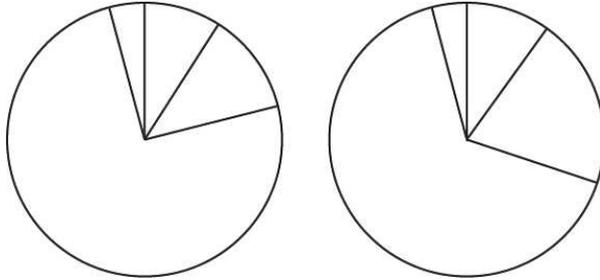
Which one of the following is NOT an accurate side view of the mathematical model?



19. The table below shows the comparison of dietary fats in five vegetable oils.

	<i>Saturated</i>	<i>Monosaturated</i>	<i>Polyunsaturated</i>	<i>Other</i>
Canola Oil	10%	66%	20%	4
Olive Oil	12%	75%	9%	4
Palm Oil	55%	32%	9%	4
Safflower Oil	9%	12%	75%	4
Sunflower Oil	10%	20%	66%	4

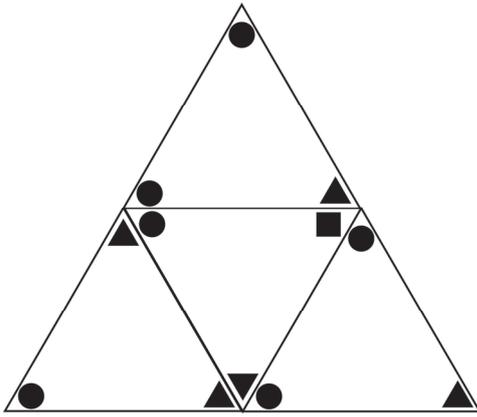
Labelled appropriately, each of four of the oils could be represented by one of the two pie charts below.



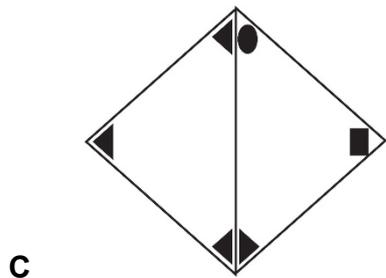
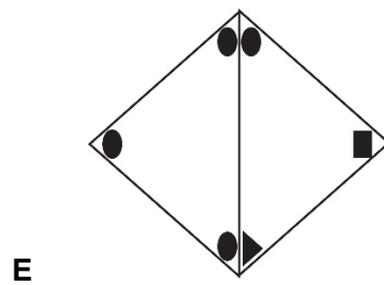
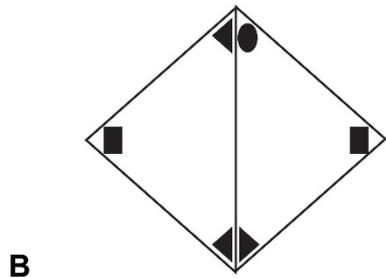
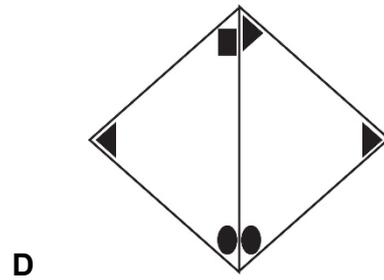
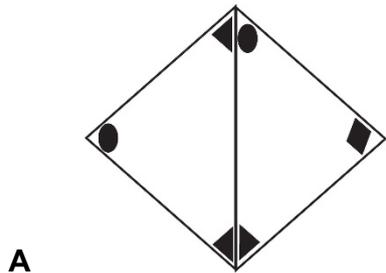
Which oil cannot be represented by one of the two pie charts above?

- A** Sunflower Oil
- B** Palm Oil
- C** Canola Oil
- D** Olive Oil
- E** Safflower O

20. The net below was folded together to make a tetrahedron.



Which one of the following tetrahedrons was formed from this net?



21. Which one of the following scholars is commonly known as 'The father of modern genetics', because of his studies on heredity?
- A Gregor Mendel
 - B Jean-Baptiste Lamarck
 - C Thomas Hunt Morgan
 - D James Dewey Watson
 - E Charles Darwin
22. Which one of the following pairs of scholar/scientific theory is NOT correct?
- A John Dalton - Atomic theory
 - B Edwin Hubble - expansion of the universe
 - C Pierre de Fermat - Non-Euclidean geometry
 - D Alfred Wegener - Continental drift
 - E James Clerk Maxwell - Electromagnetism

Biology

23. A healthy human liver cell contains unmutated molecules of mRNA, tRNA and DNA.

Which statement shows correct features of the three molecules?

- A** mRNA contains the bases A, U, G and C, tRNA attaches to ribosomes, DNA contains codons.
- B** mRNA is always double stranded, tRNA is a polynucleotide, DNA contains hydrogen bonds.
- C** mRNA attaches to ribosomes, tRNA contains hydrogen bonds and DNA contains the bases A, T, G and C.
- D** mRNA contains codons, tRNA contains the bases A, T, G and C and DNA is double stranded.
- E** mRNA is a polynucleotide, tRNA contains codons, DNA is found in the nucleus.

24. A student listed the molecules A, B, C, D and E as containing nitrogen.

Which one of the molecules in the student's list is wrong?

- A** haemoglobin
- B** glycoprotein
- C** deoxyribose
- D** adenine
- E** collagen

- 25.** Which of the following processes is directly required for the propagation of an action potential along the axon of a single neuron in a healthy individual?
- A** facilitated diffusion
 - B** diffusion
 - C** endocytosis
 - D** active transport
 - E** exocytosis
- 26.** Which option gives the correct description of events during atrial systole and ventricular systole in a healthy human?
- A** During atrial systole the semi-lunar valves are open. During ventricular systole the atrioventricular valves are open.
 - B** During atrial systole the atrioventricular valves are closed. During ventricular systole the pressure is higher in the ventricles compared to the atria.
 - C** During atrial systole the semi-lunar valves are closed. During ventricular systole the pressure is higher in the atria compared to the ventricles.
 - D** During atrial systole the pressure is higher in the ventricles compared to the atria. During ventricular systole the semi-lunar valves are closed.
 - E** During atrial systole the pressure is lower in the ventricles compared to the atria. During ventricular systole the semi-lunar valves are open.

27. Which of the following statements apply to both normally functioning chloroplasts and mitochondria?

- 1** Chemiosmosis can occur.
- 2** NADP can be oxidised.
- 3** Protein synthesis occurs.

- A** 3 only
- B** 1, 2 and 3
- C** 2 and 3 only
- D** 1 and 3 only
- E** 1 and 2 only

28. Most scientists now consider that the maximum yield of ATP molecules for each molecule of glucose entering respiration is 32.

Using this figure, how many ATP molecules and water molecules can be formed after EACH reduced NAD has been produced in the Krebs cycle?

- A** 3 ATP molecules and 2 H₂O molecules being formed
- B** 2.5 ATP molecules and 1 H₂O molecule being formed
- C** 3 ATP molecules and 1 H₂O molecule being formed
- D** 1 ATP molecule and 3 H₂O molecules being formed
- E** 2.5 ATP molecules and 2 H₂O molecules being formed

- 29.** Which of the following statements typically apply to meiosis?
- 1** Centromeres divide.
 - 2** Chiasmata occur.
 - 3** Chromatids are present.
- A** 1 and 3 only
- B** 1, 2 and 3
- C** 2 only
- D** 1 only
- E** 3 only
-
- 30.** Which statement is correct about the processes of DNA translation and transcription?
- A** Translation is semi-conservative and transcription produces mRNA.
 - B** Translation occurs in ribosomes and transcription is semi-conservative.
 - C** Translation produces mRNA and transcription is semi-conservative.
 - D** Translation occurs in ribosomes and transcription produces mRNA.
 - E** Translation produces mRNA and transcription occurs in ribosomes.

- 31.** In one family, the biological mother has blood group A and the biological father has blood group B and their child has blood group O.

These parents are expecting another child. Which of the following are possible genotypes of the unborn child?

- 1** $I^A I^A$
 - 2** $I^A I^O$
 - 3** $I^B I^B$
 - 4** $I^B I^O$
 - 5** $I^O I^O$
 - 6** $I^A I^B$
- A** 1,2, 3, 4, 5 and 6
 - B** 2 and 4 only
 - C** 1,3 and 6 only
 - D** 2, 4, 5 and 6 only
 - E** 1 and 3 only

- 32.** A dihybrid cross was carried out between two fruit flies each of which is heterozygous for both genes.

Assuming no mutations and many offspring, which of the following statements about the possible offspring is/are correct?

- 1** A 9:3:3:0 ratio was seen, as the presence of both genes being homozygous dominant is lethal prior to birth.
- 2** A ratio of 2:1 was found when the number of individuals heterozygous for one gene is compared to those that are heterozygous for both genes.
- 3** A phenotype ratio of 3:1 was found when studying either gene rather than both genes.

A 2 and 3 only

B 1 and 2 only

C 3 only

D 1 only

E 2 only

- 33.** A male has a sex-linked recessive condition, carried on the X chromosome.

In which of the following situations will his son and his daughter have the same probability of having the condition?

- 1** if their mother has the condition
- 2** if their mother is a carrier
- 3** if their mother does not have the condition

A 1,2 and 3

B 2 and 3 only

C 1 and 3 only

D 1 and 2 only

E 1 only

- 34.** Which of the following statements could help explain why a human gene that contains 2000 bases produces a protein that comprises 600 amino acids?
- 1** The gene is made up of introns and exons.
 - 2** The pre-mRNA is modified.
 - 3** The presence of start and stop triplets.
- A** 1 and 2 only
- B** 3 only
- C** 2 and 3 only
- D** 1 and 3 only
- E** 1, 2 and 3
-
- 35.** Which one of the following sequences of bases on the transcribed strand of DNA could produce an mRNA molecule with a sequence of bases that is the same as on the non-transcribed strand of DNA?
- A** TGGCCTGCT
- B** ACAGGACGC
- C** AGTCCTGAG
- D** CACAATTAC
- E** GATAAGGAA

36. A student wrote the following statements about microRNA:

- 1** binds with tRNA
- 2** regulates gene expression
- 3** associates with RISC
- 4** causes formation of mRNA

Which of the student's statements are NOT correct?

- A** 1 and 2 only
- B** 1,2, 3 and 4
- C** 2, 3 and 4 only
- D** 2 and 3 only
- E** 1 and 4 only

37. When an animal dies there is a stage where the muscles in the body contract slightly and are unable to relax. This process is called rigor mortis and is due to changes that occur in the muscle fibres.

Which of the following statements could explain why this occurs?

- 1** Aerobic respiration can no longer take place and ATP is no longer synthesised.
 - 2** Calcium ions remain in the sarcoplasmic reticulum of the muscle fibre.
 - 3** The myosin heads remain bound to the binding sites on the actin filaments.
- A** 2 only
 - B** 1 and 3 only
 - C** 1 and 2 only
 - D** 3 only
 - E** 1,2 and 3

38. Exercise increases the rate of respiration to meet an increased demand for ATP.

Which of the statements below will maintain or increase the ability of haemoglobin to bind to oxygen in the lungs of a healthy human after a period of intense exercise?

- 1** Breathing air with a high concentration of carbon monoxide.
- 2** A decrease in the acidity of the red blood cells.
- 3** A blockage in the pulmonary artery slowing blood flow.

- A** 2 only
- B** 1 only
- C** 1 and 2 only
- D** 2 and 3 only
- E** 1 and 3 only

39. A student wrote five statements about what happens when a motor neuron in a healthy human depolarises.

Which statement was wrong?

- A** The voltage changes across the neuron membrane.
- B** The Na⁺ concentration in the cell increases.
- C** A neurotransmitter may have been received.
- D** An action potential will always occur.
- E** The cell surface membrane permeability is always altered.

40. Which of the following is NOT a function associated with the healthy human small intestine?

- A** hydrolysis of peptide bonds
- B** production of fatty acids and glycerol
- C** lowering the pH for optimal enzyme function
- D** emulsification of lipids
- E** digestion of starch

Chemistry

41. How many of the following compounds are polyprotic acids in aqueous solution?



- A 6
- B 3
- C 4
- D 5
- E 2

42. Assuming equal molar quantities, which one of the following is a homogeneous mixture?

- A bromine (g), bromine (l)
- B octane (l), water (l), ethanol (l)
- C magnesium hydroxide (s), water (l)
- D oxygen (g), nitrogen (g), argon (g)
- E sand (s), sodium chloride (aq), water (l)

43. Which is the correct lowest energy electronic structure of atoms of the element in Group III, Period 2?
- A $1s^2 2s^3$
 - B $1s^2 2s^2 2p^1$
 - C $1s^2 2s^2 2p^6 3s^2 3p^1$
 - D $1s^2 2s^2 2p^6 3s^2 3p^3$
 - E $1s^2 2s^2 2p^6 2d^3$
44. What is the correct IUPAC name for $\text{CH}_3\text{CH}_2\text{C}(\text{CH}_3)_3$?
- A 2-ethylbutane
 - B 1,1,1-trimethylpropane
 - C hexane
 - D 2,2-dimethylbutane
 - E 3,3,3-trimethylpropane

45. Element R has the following properties:

- density = 1.54 g / cm^3
- melting point = $842 \text{ }^\circ\text{C}$
- reacts with oxygen to form a white solid compound, with the formula RO, that can act as a base

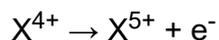
Which one of the following elements is R?

- A** calcium
- B** aluminium
- C** nickel
- D** iodine
- E** potassium

46. Many metals have high melting points. Which one of the following statements correctly explains this fact?

- A** The attractions between metal ions and delocalised electrons are strong.
- B** The attractions between the metal molecules are strong.
- C** The bonding in the metal is ionic, which is strong.
- D** The delocalised electrons in the metal structure allow heat to be conducted.
- E** The attraction between the nuclei of the metal atoms and a shared pair of electrons is strong.

47. One of the ionisation energy equations for element X is:



Which of the following statements, if any, are correct about this process?

- 1 It is the fifth ionisation energy equation.
- 2 The process is endothermic.
- 3 The ions must be in the gaseous state.

- A** 2 and 3 only
- B** 1, 2 and 3
- C** 1 and 3 only
- D** none of them
- E** 1 and 2 only

48. The table shows the atomic numbers of atoms X and Y.

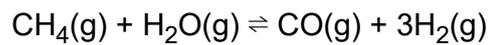
Which row will form a covalent molecule with formula X_2Y

	<i>atomic number of X</i>	<i>atomic number of Y</i>
1	3	8
2	6	8
3	1	9
4	1	16
5	12	17

- A** row 3
- B** row 4
- C** row 2
- D** row 5
- E** row 1

49. Methane reacts with steam to produce hydrogen in an endothermic reaction.

The reaction reaches the equilibrium below.



The reaction is catalysed by nickel. Which of the following statements is/are correct?

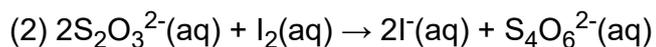
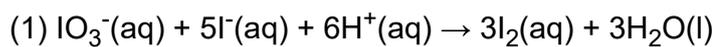
- 1 The catalyst raises the activation energy of the reverse reaction.
 - 2 The catalyst decreases the time taken to reach equilibrium.
 - 3 The catalyst increases the yield of hydrogen.
- A** 2 and 3 only
- B** 1 only
- C** 3 only
- D** 1 and 2 only
- E** 2 only

50. In which one of the following reactions are the oxidising agent and the element that is oxidised in the chemical equation correctly identified?

		<i>oxidising agent</i>	<i>element that is oxidised</i>
1	$2\text{FeCl}_2 + 2\text{HCl} + \text{H}_2\text{O}_2 \rightarrow 2\text{FeCl}_3 + 2\text{H}_2\text{O}$	H_2O_2	Cl (in FeCl_2)
2	$\text{PbO}_2 + 4\text{HCl} \rightarrow \text{PbCl}_2 + 2\text{H}_2\text{O} + \text{Cl}_2$	PbO_2	Cl (in HCl)
3	$\text{H}_2\text{S} + \text{Br}_2 \rightarrow \text{S} + 2\text{HBr}$	H_2S	Br
4	$\text{Cu} + \text{S} \rightarrow \text{CuS}$	Cu	S
5	$\text{H}_2\text{SO}_4 + 2\text{HBr} \rightarrow 2\text{H}_2\text{O} + \text{Br}_2 + \text{SO}_2$	HBr	S

- A** reaction 2
- B** reaction 1
- C** reaction 5
- D** reaction 4
- E** reaction 3
51. The solubility of copper(II) sulfate crystals ($\text{CuSO}_4 \cdot 5\text{H}_2\text{O}$) is 38.0 g per 100 g of water at 20°C.
- 100 g of the crystals are mixed with 200 g of water at 20 °C.
- What mass of copper(II) sulfate crystals will remain undissolved?
- A** 62.0 g
- B** 24.0 g
- C** 124 g
- D** 76.0 g
- E** 19.0g

52. Consider the two reactions below:



In reaction (1), 0.5 mol of IO_3^- reacts completely.

How many moles of $\text{S}_2\text{O}_3^{2-}$ would be needed in reaction (2) to react completely with the iodine produced in reaction (1)?

A 2.0

B 1.5

C 1.0

D 3.0

E 2.5

53. Here are five numbers:

$$1 \ 7 \ x \ 3 \ 8$$

These five numbers have a single mode, which is 1.

What is the mean of the five numbers?

A 3

B 4

C 5

D 1

E 8

54. Simplify:

$$\frac{\sqrt{32} - \sqrt{2}}{\sqrt{8}}$$

A $\frac{3}{2}$

B $\frac{4}{3}$

C 1

D 3

E $\frac{15}{4}$

55. The mid-point of the straight line starting at the point (6, -3) and finishing at the point (-4, 11) is the point (p, q) .

What is the value of $p + q$?

- A 2
- B 5
- C -4
- D -2
- E 10

56. The triangle PQR is right-angled.

$PQ = 20$ cm and the hypotenuse $PR = 40$ cm.

What is the angle at R ?

- A 45°
- B 30°
- C 2°
- D 0.5°
- E 60°

57. A square drawbridge in a castle is 4.0 m long and has a weight of 5000 N. It pivots about a hinge at one end. The centre of gravity of the drawbridge is 2.0 m from the hinge.

The drawbridge has been partly raised and is at an angle of θ to the horizontal; $\sin \theta = 0.80$ and $\cos \theta = 0.60$.

What is the magnitude of the moment about the hinge due to the weight of the drawbridge in this position?

[Ignore any effects due to the thickness of the drawbridge.]

- A 8000Nm
 - B 10 000Nm
 - C 12 000Nm
 - D 6000Nm
 - E 16 000Nm
58. A cuboid measures 15 cm \times 10 cm \times 5.0 cm and has a weight of 75 N. It stands on a horizontal surface. Assume that the cuboid rests with one of its faces fully in contact with the surface.

What is the maximum pressure that this cuboid can exert on the horizontal surface due to its own weight?

- A 2.0 N / cm²
- B 0.50 N / cm²
- C 1.5 N / cm²
- D 5.0 N / cm²
- E 3.0 N / cm²

- 59.** Three uncharged capacitors of different capacitances are connected in series to an electric power supply.

Below are three statements about the capacitors, once the current has reduced to zero.

- 1** The quantity of charge on the positively charged plates of the three capacitors is the same.
- 2** There is the same electrical potential difference across each capacitor.
- 3** The total capacitance is less than that of the capacitor with the least capacitance.

Which statement(s) is/are correct?

- A** 1, 2 and 3
- B** none of them
- C** 2 and 3 only
- D** 1 and 3 only
- E** 3 only
-
- 60.** A glass beaker of mass 0.10 kg contains 0.20 kg of water. The initial temperature of both the water and the glass beaker is 20 °C. This temperature is increased to 70 °C.
- Assuming that no water evaporates, how much energy is gained by the beaker and the water together to produce this temperature increase?
- [specific heat capacity of water = 4200 J / (kg °C);
specific heat capacity of glass = 600 J / (kg °C)]
- A** 81 000 J
- B** 45 000 J
- C** 27 000 J
- D** 72 000 J
- E** 63 000 J