Ministero dell'Istruzione, dell'Università e della Ricerca

B10537

ADMISSION TEST FOR THE DEGREE COURSE IN MEDICINE AND SURGERY

Academic Year 2019/2020

Cambridge Assessment Admissions Testing

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1 A study involving a brain-training exercise was carried out on more than a thousand adults aged 65 and over, some of whom later developed dementia. Results showed that the benefits of the five-week mental agility course undertaken by some of the adults lasted for at least five years. This led to an improvement in everyday activities such as money management and the ability to do housework. If those with trained brains developed dementia, they did so later than those in the control group. The results also showed that, for those people in the study who developed dementia, after the diagnosis their mental decline occurred faster than for those who had not undertaken the training.

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

A Keeping the mind active delays the onset of dementia.

B All over-65s who undertake brain training live for at least five years afterwards.

C Older people do not perform mentally challenging tasks unless forced to do so.

D People do a decreasing amount of housework as they grow older.

E It is preferable to have swift mental decline once dementia develops.

2 Once again it has become fashionable for householders to replace their carpets with wooden floors. Sales of laminate and solid floors, such as oak, have seen a massive increase in the last ten years. This trend seems more in tune with our eco-friendly aspirations: carpets are often plastic-based and use vast quantities of underlying material, or underlay, made from petrochemicals. For this reason, it seems unlikely that wooden floors will go out of fashion in the near future.

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

A Most types of laminate and wood floors use petrochemicals in their manufacture.

B Not all wooden floors need a layer of underlay.

C Carpets can harbour dust mites and allergens.

D Sales of carpets made of synthetic materials have decreased in the last ten years while woollen carpets have seen an increase.

E Wooden floors may look longer-lasting but can be more easily damaged than carpets.

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3 According to the current mainstream scientific view, Near Death Experiences (NDEs) are explicable in purely physiological terms. Specifically, they are caused by cerebral anoxia (oxygen deficiency in brain tissue), which occurs in a dying brain. On the other hand, recent research on hundreds of successfully resuscitated cardiac patients found that only twenty per cent reported NDEs. If NDEs had purely medical causes then most of the patients should have experienced them, since they had all been clinically dead and experienced cerebral anoxia. NDEs therefore do not have purely physiological causes.

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

A NDEs are not necessarily caused by physical events alone.

B Not all clinically dead patients have NDEs.

C NDEs are a physical property of the human brain.

D NDEs are caused by oxygen deficiency in the brain.

E Not all successfully resuscitated cardiac patients have NDEs.

4 Increasingly, the quality of a teacher, and of his or her lessons, is to be judged by feedback from their pupils. This is dangerous, as pupils have a tendency to focus too much on whether or not they enjoyed the lesson, in other words, on how much 'fun' they found it. The purpose of education, however, is not to keep children entertained; it is not to make their lives more fun. Arguably, it is not even to make them happier, per se. The purpose of schools is to make their pupils better, more educated people. This is all that matters, and therefore it is whether the teacher succeeds at this – not at being a children's entertainer – that counts.

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

A It fails to consider that enjoying lessons could result in pupils ending up better educated.

B By simply asserting that the purpose of education is not even to make people happier, the argument rests on a questionable contention.

C It patronises young people by thinking that their judgement will be based solely on how much fun they found the lesson.

D It doesn't specify precisely what it means by making someone a better, more educated person.

E The comparison with being a children's entertainer is an unfair exaggeration of what a teacher tries to do by making lessons more fun.

5 Researchers have tried to establish reasons for a recent drop in the catch of marlin near the Madeira coast. This drop cannot be explained by environmental conditions; there was no significant change in the temperature or composition of the region's water. Nor could one blame the human factor, because the size of the fishing fleet, catch quotas and pollution levels have been strictly observed. The environmentalists then analysed the records of the fishing catch of marlin over the last six centuries. This research identified that regular five-year periods of significant decrease in the catch alternated with fifteen-year periods of gradual growth of the catch. In view of this, the study concluded that the current drop in the marlin catch is part of a long-term cycle related to fish migration and food-chain balance.

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

A The records provide accurate information about the catch of marlin off the Madeira coast.

B The change in fishing technology has affected the change in the fishing catch.

C There is no correlation between the fishing catch today and the deep-sea stock of marlin in the sixteenth century.

D The fishing catch of marlin around Madeira does not depend on the condition of the water around the island.

E Climate change did not affect the temperature of ocean water off the Madeira coast.

6 A student packs books into a box which is 20 cm high, 30 cm wide, and 40 cm long. She ties string around the box in the pattern shown. A further 20 cm of string is needed for a knot.

What length of string is needed to tie up her box?

A 3.8 m

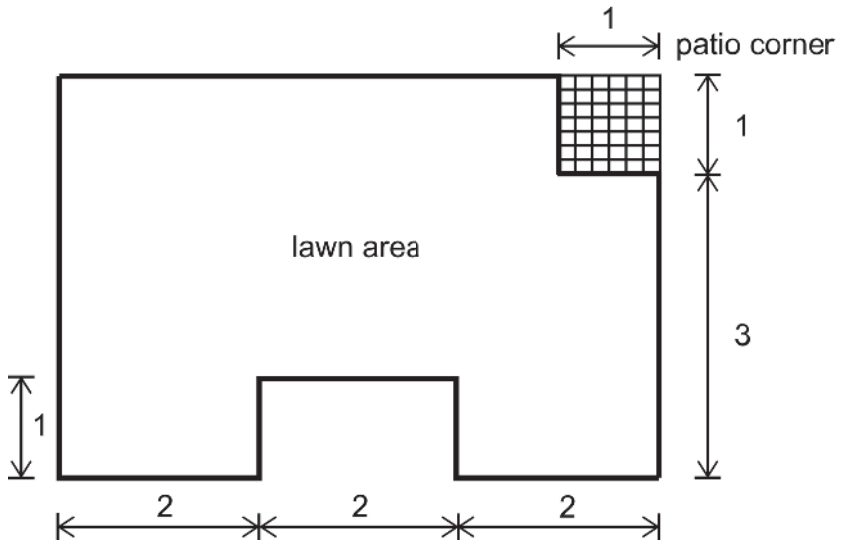
B 5.4 m

C 2.0 m

D 2.6 m

E 2.9 m

7 The plan of a domestic lawn with dimensions in metres is shown below.



The lawn area is to be reseeded. Seed must be applied at the rate of 50 grams per square metre.

Appropriate grass seed is available only in the following quantities:

grass seed packet prices	
1.6 kg	£20.00
1.2 kg	£16.50
1.0 kg	£14.00
500 g	£8.00
200 g	£3.00
100 g	£2.00

What is the least amount of money that needs to be spent to buy sufficient seed to reseed the lawn?

A £16.00

B £13.50

C £14.00

D £16.50

E £22.00

8 Five girls competed in five events at their sports day. The following scoring system was used for each event:

1st place	6 points
2nd place	3 points
3rd place	1 point
4th/5th place	0 points

Before the events started, each girl nominated the event in which they wished to play their joker card – this doubled the number of points gained in that event. The table below shows the results of each event and the athletes' final points scores:

competitor	*800 m run*	*100 m hurdles*	*high jump*	*long jump*	*shot put*	*total points scored*
Tia	4th	1st	5th	3rd	3rd	14
Jessica	1st	3rd	1st	5th	4th	19
Carolina	3rd	4th	2nd	1st	2nd	14
Kelly	2nd	2nd	4th	2nd	5th	12
Helena	5th	5th	3rd	4th	1st	13

How many of the girls won the event in which they had elected to play their joker?

A 3

B 1

C 2

D 4

E 5

9 At the Shawilde Theatre, tickets are priced as follows:

Front stalls £35
Centre stalls £28
Rear stalls £20

Every row in the theatre contains 30 seats.

Last night's performance was a sell-out and the ticket sales were £21 000. Exactly 60% of this income came from tickets for the centre stalls, and the rest was split equally between the front stalls and the rear stalls.

How many rows of seats make up the centre stalls at the Shawilde Theatre?

A 15

B 11

C 19

D 22

E 26

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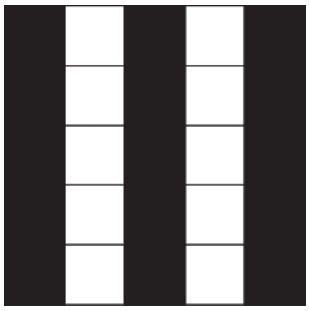
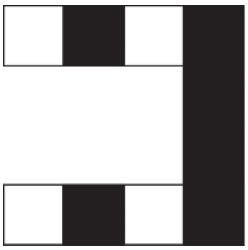
10



Four of the following five pieces can be fitted together to make the above pattern.

Which one of the pieces is NOT needed?

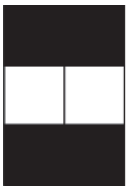
A



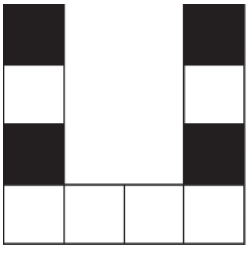
B

C

D



E



11 Which one of the following literary works does NOT originate in the corresponding country?

A The Poems of Rumi – China

B The Tale of Genji – Japan

C Oedipus Rex – Greece

D The Divine Comedy – Italy

E Don Quixote – Spain

12 Which one of the following composed the opera *Madama Butterfly*?

A Giacomo Puccini

B Giuseppe Verdi

C Gioachino Rossini

D Georges Bizet

E Richard Wagner

13 Which one of the following plays by William Shakespeare is NOT set in Italy?

A A Midsummer Night's Dream

B Much Ado About Nothing

C Othello

D The Taming of the Shrew

E Romeo and Juliet

14 Which one of the following writers is the author of the novel *To Kill a Mockingbird*?

A Harper Lee

B Georges Simenon

C Iris Murdoch

D Elena Ferrante

E Ernest Hemingway

15 The 'prisoner's dilemma' is a common example analysed in the field of

A Game theory

B Chaos theory

C Asymptotic theory

D Network theory

E Quantum theory

16 Who was the first woman to be awarded a Nobel Prize?

A Marie Curie

B Mother Teresa

C Grazia Deledda

D Selma Lagerlöf

E Doris Lessing

17 Which one of these events in world history happened most recently?

A The October Revolution in the Russian Empire

B The fall of the Western Roman Empire

C The Taiping Rebellion in China

D The building of the Taj Mahal

E The crowning of Charlemagne

18 Which one of the following religions is NOT considered to have been revealed to or founded by an individual?

A Hinduism

B Confucianism

C Islam

D Christianity

E Buddhism

19 The governance of modern states is often based on the separation of which three powers?

A Legislative – executive – judicial

B Legislative – elective – jurisprudential

C Electoral – regulatory – jurisprudential

D Regulatory – executive – judicial

E Legislative – elective – executive

20 The Constitution of the Italian Republic was enacted on 22 December 1947 by

A The Constituent Assembly

B The Supreme Court

C The Ministry of Justice

D The Ministry of Defence

E The Government

21 Which one of the following is NOT a stated purpose of the United Nations?

A To encourage peaceful trade between nations

B To maintain international peace and security

C To develop friendly relations among nations

D To achieve international co-operation in solving international problems

E To be a centre for harmonizing the actions of nations

22 Which one of the following countries did NOT adopt the coins and banknotes of the Euro as its currency on 1 January 2002?

A Sweden

B Austria

C Portugal

D Luxembourg

E Finland

23 Which of the following rows are correct about these naturally occurring biological molecules?

	biological molecule	*presence of carboxylic acid groups*	*presence of 2 or more hydroxyl groups*
row 1	ALL amino acids	yes	no
row 2	glucose	no	yes
row 3	glycerol	no	no
row 4	ALL fatty acids	yes	no

A 1, 2 and 4 only

B 1, 2 and 3 only

C 1, 3 and 4 only

D 2, 3 and 4 only

E 1, 2, 3 and 4

24 Which of the following is/are tissues?

1 cartilage

2 skin

3 endothelium

A 1 and 3 only

B 1, 2 and 3

C 1 and 2 only

D 2 and 3 only

E 1 only

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25 Which of the following statements about the metabolism of plants is/are correct?

1 CO_2 is produced during the day.

2 CO_2 is produced at night.

3 The CO_2 produced can be used by the plant.

A 1, 2 and 3

B 1 only

C 2 only

D 2 and 3 only

E 1 and 2 only

26 Which one of the following occurs during anaphase of mitosis in a healthy human liver cell?

A Sister chromatids are pulled by the spindle fibres towards opposite poles of the cell.

B Chromatin condenses so that the chromosomes are visible under the microscope.

C Chromosomes move towards the equator of the cell and attach to the spindle fibres.

D DNA replicates so that each chromosome is made up of two sister chromatids.

E Centrioles migrate to opposite poles of the cell and help to assemble the spindle fibres.

27 Which row shows a correct component of each of the three structures listed?

	viral envelope	*capsid*	*genetic material*
row 1	glycogen	glycosidic bonds	adenine
row 2	glycosidic bonds	glycogen	ester bonds
row 3	phosphodiester bonds	hydrogen bonds	amino acids
row 4	fatty acids	amino acids	phosphodiester bonds
row 5	phosphate	phosphodiester bonds	cytosine

A row 4

B row 2

C row 3

D row 1

E row 5

28 Beetroot is a root vegetable with cells that contain a red pigment. Normally the pigment cannot pass out of the cells because it cannot diffuse through their cell surface membranes. An investigation was carried out into the effect of various chemicals on the permeability of the cell surface membranes of beetroot cells.

1 cm^3 samples were cut from the beetroot and washed in running water for 20 minutes to remove any pigment that was released from the damaged cells.

Five experiments were carried out. In each experiment, one cube of beetroot was placed in liquid P and one cube placed in liquid Q, and the results were observed.

Which row shows the correct results and conclusions?

Key
✓ does happen
x does not happen

		result	*conclusion*		*result*	*conclusion*
	liquid P	*liquid P turns red*	*phospholipids dissolve*	*liquid Q*	*liquid Q turns red*	*protein denatures*
row 1	dilute HCl	x	x	water at 20 °C	✓	✓
row 2	dilute HCl	✓	✓	ethanol	✓	✓
row 3	ethanol	✓	✓	dilute HCl	✓	✓
row 4	ethanol	x	x	water at 20 °C	✓	✓
row 5	water at 20 °C	✓	✓	dilute HCl	x	x

A row 3

B row 2

C row 1

D row 4

E row 5

29 If a cell divides by mitosis ten times, what is the number of cells at the end of the process?

[Assume that all cells remain alive.]

A 1024

B 10

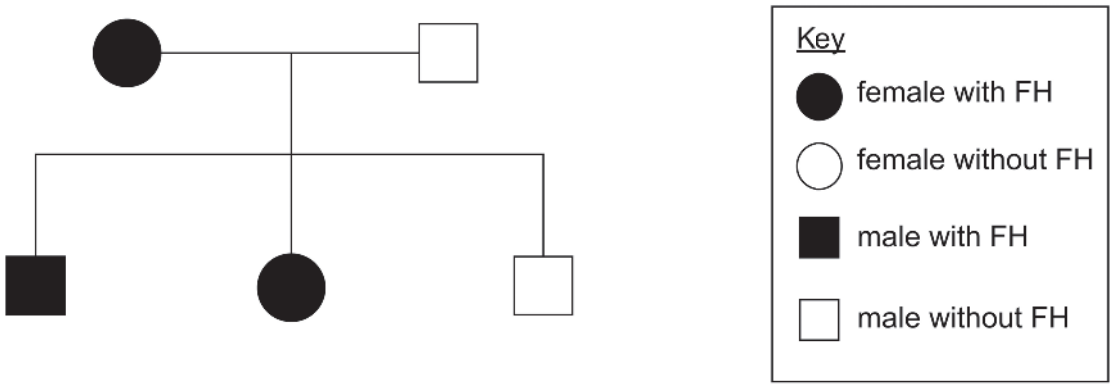
C 100

D 64

E 11

30 Familial hypercholesterolaemia (FH) is an inherited disease caused by a dominant allele. People with FH have high concentrations of cholesterol in the blood, which can lead to an increased risk of coronary heart disease.

The family tree shows the inheritance of this disease in one family.



Which row shows the number of individuals in the family tree with each genotype?

	genotype		
	homozygous dominant	*homozygous recessive*	*heterozygous*
row 1	3	2	0
row 2	2	3	0
row 3	0	2	3
row 4	0	3	2
row 5	3	0	2

A row 3

B row 2

C row 1

D row 4

E row 5

31 The diagrams show some pathways between the central nervous system and effector organs in a healthy human.

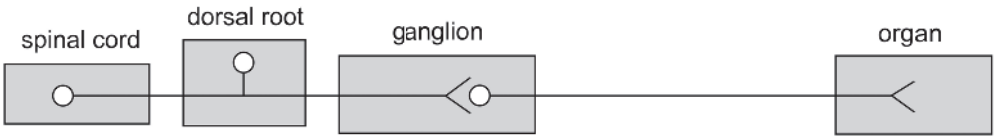
Which pathway is a possible route for impulses passing along a parasympathetic neuron?

A

B

C

D



E

32 An electron microscope (EM) was used to view a cell.

The maximum dimension of the cell was observed at a magnification ×30 000. The image on the EM screen showed a maximum length of 30 mm.

Which of the following mature healthy cells was being magnified?

A one coccus bacterium in a Staphylococcus cluster

B one lymphocyte from a human

C one mature human red blood cell

D one sensory neuron from a human

E one palisade cell from a wheat plant

33 Which statement about an enzyme involved in genetic modification is correct?

A A restriction enzyme causes phosphodiester bonds to be broken.

B A ligase causes phosphodiester bonds to be broken.

C A restriction enzyme causes H-bonds to form between sticky ends.

D A restriction enzyme causes only H-bonds to be broken.

E A ligase causes H-bonds to form between sticky ends only.

34 Which statement is correct in healthy humans?

A In active tissues where the carbon dioxide concentration is high, haemoglobin has a low affinity for oxygen.

B Blood leaving active muscles that are respiring aerobically will contain hydrogencarbonate ions and raised levels of lactic acid.

C At a low partial pressure of oxygen, myoglobin is less saturated with oxygen than haemoglobin.

D Increasing the partial pressure of oxygen makes it more likely that haemoglobin will release its oxygen.

E The majority of carbon dioxide transported in the blood is in the form of carbaminohaemoglobin.

35 Which of the following regions within a sarcomere remain UNCHANGED in length when a healthy human muscle cell contracts?

1 A-band

2 I-band

3 H-zone / band

A 1 only

B 2 only

C 3 only

D 1 and 3 only

E 2 and 3 only

36 Which row is correct for the three given features of typical human B lymphocytes?

Key
✓ correct
x incorrect

	formed from bone marrow stem cells	*processed in the thymus*	*contain genes coding for antibodies*
row 1	✓	✓	✓
row 2	✓	✓	x
row 3	✓	x	✓
row 4	x	x	✓
row 5	x	✓	x

A row 3

B row 2

C row 1

D row 4

E row 5

37 Which of the following processes involve ions?

1 contraction of a muscle

2 transmission of a nerve impulse across a synapse

3 transfer of light energy into chemical energy in photosynthesis

4 oxidative phosphorylation in a mitochondrion

A 1, 2, 3 and 4

B 2 and 3 only

C 3 and 4 only

D 1, 2 and 3 only

E 1 and 2 only

38 An animal has a coat that has some patches of white hair and some patches of black hair. Cells that make up a hair follicle form a single hair, which is either white or black.

Assume that there are no mutations following formation of the zygote.

A student wrote the following statements:

1 The cells in all the hair follicles contain the same genes.

2 The alleles in a hair follicle forming a white hair are different from the alleles in the hair follicle forming a black hair.

3 Each white hair follicle cell contains two recessive alleles.

Which statement(s) is/are correct?

A 1 only

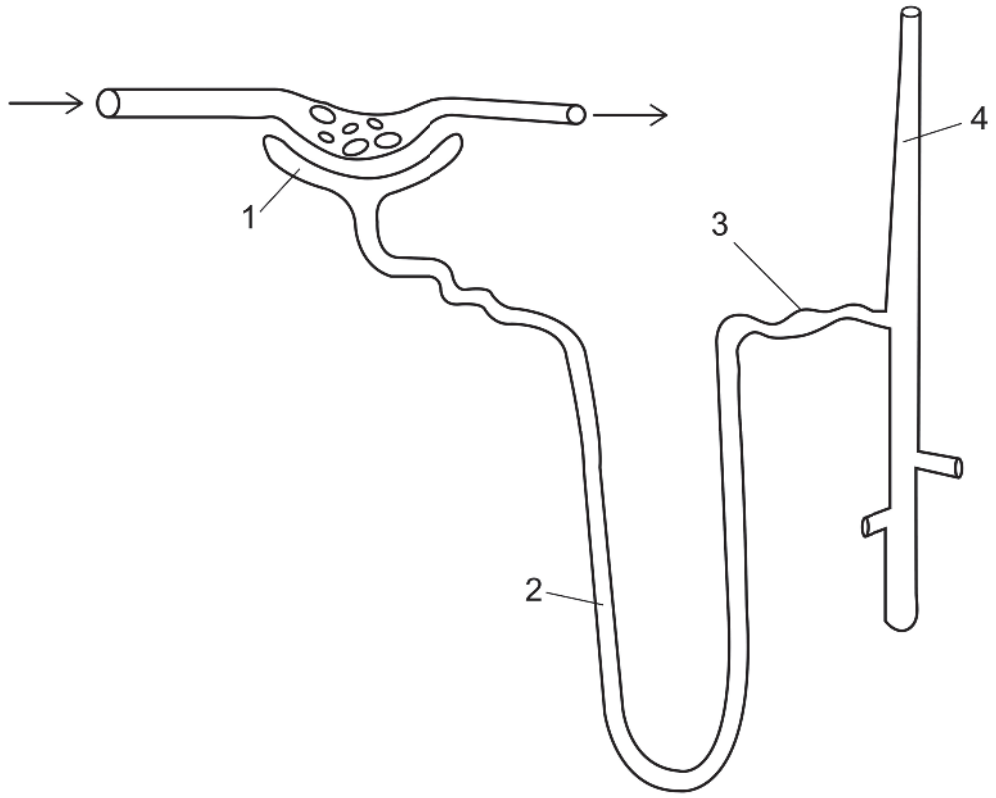
B 2 only

C 1 and 2 only

D 2 and 3 only

E 1, 2 and 3

39 The diagram shows a nephron with collecting duct from a healthy human.



Which of the regions (1-4) contain a liquid with no urea?

A none of them

B 1 only

C 1 and 2 only

D 2 and 3 only

E 2, 3 and 4 only

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40 The same section of an allele coding for five amino acids from two different individuals, P and Q, is shown.

P	ATTCCGGGATTCCCT
Q	ATTCCGGATTGCACT

Which of the following types of mutation could explain the differences between P and Q?

1 addition

2 deletion

3 substitution

A 1, 2 and 3

B 1 only

C 1 and 3 only

D 2 and 3 only

E none of them

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41 Which statement about a positive ion explains why it is positively charged?

A The ion has more protons than electrons.

B The ion has more electrons than neutrons.

C The ion has more electrons than protons.

D The ion has more protons than neutrons.

E The ion has the same number of protons and neutrons.

42 A few drops of universal indicator solution were added to exactly 50 mL of sodium hydroxide solution, NaOH, of concentration 1 mol / L. Exactly 50 mL of hydrochloric acid, HCl, of concentration 1 mol / L, was added drop by drop to the sodium hydroxide solution containing the universal indicator solution.

What colour changes would be observed as the hydrochloric acid was added?

A violet → blue → green

B red → orange → yellow → green

C violet → blue → green → yellow → orange → red

D blue → red

E red → orange → yellow → green → blue → violet

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43 A student observed that when powdered sugar at $-1\,°C$ was added to ice at $-1\,°C$ all of the ice melted.

Which of the following statements explain this observation?

1 Sugar has given the water molecules energy.

2 The melting point of the mixture is higher.

3 The melting point of the mixture is lower.

A 3 only

B 2 only

C 1 only

D 1 and 2 only

E 1 and 3 only

44 Which of the following pairs of structural formulae represent structural isomers?

1 CH_3CH_2OH and CH_3OCH_3

2 $CH_3CH(CH_3)CH_2CH_2CH_3$ and $CH_3CH_2CH_2CH(CH_3)CH_3$

3 $CH(OH)=CHCH_2OH$ and CH_3CH_2COOH

A 1 and 3 only

B 2 only

C 1 only

D 2 and 3 only

E 1, 2 and 3

45 Element Z reacts with water at room temperature and hydrogen gas is released.

The oxide of element Z is a solid at room temperature and does not conduct electricity. The oxide reacts with acids and has the formula ZO.

To which group/part of the Periodic Table does element Z belong?

A Group II

B Group I

C Group III

D Transition metals

E Group VII

46 Which of the following equations represent(s) a redox reaction?

1 $4LiH + AlCl_3 \rightarrow 3LiCl + LiAlH_4$

2 $N_2O_3 + 3H_2O \rightarrow 2H_3O^+ + 2NO_2^-$

3 $NH_4NO_3 \rightarrow 2H_2O + N_2O$

A 3 only

B 2 only

C 1 and 2 only

D 1 and 3 only

E 1, 2 and 3

47 Which of the following molecules have an overall permanent dipole moment?

1 CO_2

2 H_2O

3 NH_3

[C is in Group IV, N is in Group V, O is in Group VI]

A 2 and 3 only

B 1 and 2 only

C 1 and 3 only

D none of them

E 1, 2 and 3

48 Why does hydrogen iodide (HI) have a higher boiling point than hydrogen bromide (HBr)?

[Atomic numbers: bromine = 35; iodine = 53]

A The induced dipole-induced dipole (dispersion) forces between HI molecules are stronger than those between HBr molecules.

B The permanent dipole-permanent dipole forces between HI molecules are stronger than those between HBr molecules.

C There are hydrogen bonds between HI molecules but not between HBr molecules.

D The H – I covalent bond is stronger than the H – Br covalent bond.

E The iodide ions in HI are larger than the bromide ions in HBr.

49 What is the minimum mass of sulfur dioxide needed to make 500 mL of a solution of concentration 3.0 mol / L?

[A_r values: O = 16; S = 32]

A 96 g

B 48 g

C 32 g

D 192 g

E 384 g

50 A compound consists of carbon, hydrogen and oxygen only.

8 g of this compound contains 3 g of carbon and 1 g of hydrogen.

Which one of the following could be the molecular formula of the compound?

[A_r values: C = 12; H = 1; O = 16]

A CH_4O

B CH_2O

C C_2H_4O

D C_2H_8O

E C_3HO_4

51 Hydrogen has a radioactive isotope called tritium. Tritium atoms have two neutrons.

The most abundant naturally occurring isotope of hydrogen has a relative atomic mass of 1.0.

What is the value for the relative atomic mass of a sample of hydrogen gas that has an equal amount of these two isotopes of hydrogen?

A 2.0

B 1.0

C 1.5

D 3.0

E 4.0

52 Consider the following reversible reaction at temperature *T*.

$$A + 2B \rightleftharpoons 2C + D$$

At equilibrium, there are 0.5 moles of A, 0.2 moles of B, 0.5 moles of C and 0.8 moles of D, all in a vessel of volume *V*.

What is the value of the equilibrium constant, K_c, at this temperature?

A 10

B 4

C 2

D 0.25

E 0.1

53 Which of the following expressions is equal to $\frac{8^{2n} \times 4^{n}}{2^{n}}$ for all integers n?

A 2^{7n}

B 2^{6n}

C 2^{6n+1}

D 2^{2n+5}

E 2^{14n}

54 The mean mass of three babies is 2.1 kg. The range of their masses is 0.7 kg. The lightest baby has a mass of 1.8 kg.

What is the median mass of the three babies?

A 2.0 kg

B 1.95 kg

C 2.1 kg

D 2.15 kg

E 2.3 kg

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55 What is the highest common factor of 360, 500 and 700, given as the product of powers of its prime factors?

A $2^2 \times 5$

B 2×5

C $2^3 \times 5^3$

D $2^2 \times 3^2 \times 5 \times 7$

E $2^3 \times 3^2 \times 5^3 \times 7$

56 What is the sum of the solutions to the equation $\frac{3}{x} + \frac{2}{x-2} = 1$, where x is a real number and $x \neq 0$ and $x \neq 2$?

A 7

B 5

C -7

D 2.4

E -3

57 A car, which is initially stationary, accelerates for 5.0 seconds at 4.0 m / s^2 along a straight road. It then continues in the same direction for 20 seconds at a constant speed.

What is the maximum speed of the car, and what is the distance travelled by the car in the final 20 seconds of its motion?

A maximum speed = 20 m / s; distance = 400 m

B maximum speed = 20 m / s; distance = 80 m

C maximum speed = 9.0 m / s; distance = 180 m

D maximum speed = 9.0 m / s; distance = 200 m

E maximum speed = 24 m / s; distance = 480 m

58 A stone of density 5.20 g / cm^3 and volume 200 cm^3 is completely submerged in a liquid of density 1.20 g / cm^3.

What is the magnitude of the upthrust acting on the stone?

[gravitational field strength = 10.0 N / kg]

A 2.40 N

B 6.40 N

C 8.00 N

D 10.4 N

E 2.00 N

59 Two charged particles P and Q are 0.10 m apart. The charge on P is 1.50×10^{-7} C and the charge on Q is 1.50×10^{-7} C. Particle P experiences an electrostatic force of magnitude *F* because it is near to the charge on particle Q.

The distance between the two particles is increased to 0.20 m. The charge on P is increased to 4.50×10^{-7} C and the charge on Q is increased to 6.00×10^{-7} C.

What is the magnitude of the force that particle P experiences now?

A 3*F*

B 12*F*

C 6*F*

D $\frac{F}{4}$

E $\frac{3F}{4}$

60 A fixed mass of an ideal gas is compressed at constant temperature. The pressure is recorded continuously as the volume decreases. The pressure (y-axis) and volume (x-axis) are plotted on a linearly scaled graph.

Which statement describes the plotted line?

A a curved line with negative gradient of decreasing magnitude

B a straight line of positive gradient starting at the origin of the graph

C a straight line parallel to the pressure axis

D a straight line parallel to the volume axis

E a curved line of increasing positive gradient starting at the origin of the graph