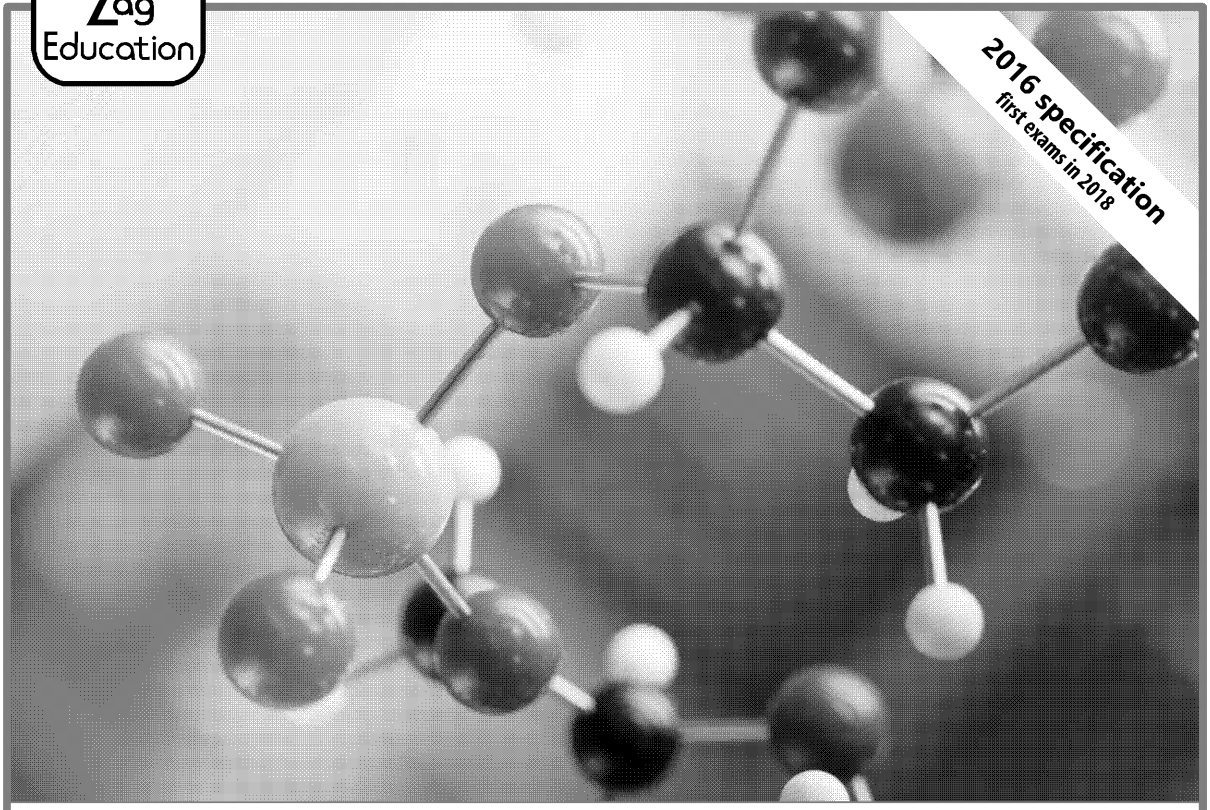
Zig Zag Education

Chemistry GCSE (9–1) | AQA | 8462/8464



Multiple-Choice Practice Questions

for GCSE (9–1) AQA Chemistry Topics 6–10 (Paper 2)

zigzageducation.co.uk

POD 9832

Contents

Teacher's Introduction

The return of multiple-choice questions!

The GCSE reformation has seen the return of multiple-choice questions on all GCSE Science specifications. Multiple-choice questions now feature on both Paper 1 and Paper 2 of the AQA Chemistry GCSE. Where previously multiple-choice questions may have been viewed as easier questions to answer, the reformed GCSE has led to the cognitive demand on students dramatically increasing. As a result, it is vital that students have a chance to practise answering more multiple-choice questions.

Remember!
Always check the exam board website for new information, including changes to the specification and sample assessment material.

Save on marking!

Multiple-choice questions have been included in the new linear GCSE exams, as they allow exam boards to access a greater breadth of content across their exams. This also makes them excellent tools for teachers! Multiple-choice questions are an excellent formative assessment for students and teachers alike. By setting pupils questions with a high demand, it allows teachers to identity misconceptions in students' understanding through less-onerous marking. Through setting carefully designed questions to truly assess learning, such as within this resource, you can gauge students' progress in a shorter amount of time than setting open questions.

A carefully designed resource to be useful to both pupils and teachers

This resource closely links to the AQA GCSE Chemistry specification for Paper 2, assessing areas of the course in which there are common misconceptions. The questions have been designed to test students at a higher level of demand to 'unpick' learning. There are also questions on most of the required practical activities for topics 6–10 and opportunities to assess working scientifically and mathematical skills.

This resource is split into two parts: Bank A and Bank B. Each part contains approximately 100 multiple-choice questions. Bank A includes fully explained answers, describing either the correct method or, for incorrect choices, where the student has gone wrong. Bank B provides an opportunity to repeat the same skills to test the student's understanding after completing the first set of questions.

A versatile and formative resource

This resource would be best used when students have already covered and revised the content, so that they can fully focus on practising the skills needed to get the multiple-choice section right. They could be provided with the full set of questions from Part A and the solutions with the commentary. The students should be encouraged to make notes from those questions they got wrong so that they can then review and reflect on particular skills or areas of content, ready to try similar questions in Part B. Encouraging students to reflect in between can help develop their growth mindset and, therefore, likelihood of making progress.

Alternatively, some of the questions could be used throughout teaching as part of formative assessment, or within tests as part of summative assessments. You could review any common areas of weakness in class, using the commentary to help you, and then give the students the resource at the end of the course as an opportunity to practise the skills again. Then provide them with Part B as further practice.

September 2019

Students' Introduction

The new GCSE reformation has seen the return of multiple-choice questions on all GCSE Science specifications. Multiple-choice questions now feature on both Paper 1 and Paper 2 of the AQA Chemistry GCSE.

You might view multiple-choice questions as easier questions on the paper, and, in some cases, they might be. However, multiple-choice questions are being used by the exam board to assess a broad range of content, so they can be tricky! Many of the multiple-choice questions link lots of different topics together and assess maths skills; therefore, it is vital that you have a chance to practise answering more multiple-choice questions.

How to use this resource

This resource has been written to closely match the specification you are studying and give you lots of opportunity to practise answering questions relating to some of the more demanding skills and content of the course.

- If you are completing the foundation tier paper, ignore questions which start with '**Higher tier only.**'
- If you are completing the combined science course, ignore questions which start with '**Chemistry only.**'

We recommend you use this resource when you have already covered and revised the content. You can then use this resource as a way of practising skills and identifying any areas for development.

Bank A comes with a mark scheme with a full commentary on it. If you get an answer incorrect, read the commentary carefully to look at how you should have approached the question. Make notes as you are doing this and spend time reviewing content if lack of knowledge is a problem. If you get the answer correct, still read the commentary as it will still act as part of your revision!

Once you have completed Bank A and reviewed any necessary content or skills, complete Bank B and mark it. Then, review any content or skills you need to develop further.

When you have finished Bank B, complete both sections again until you get 100 %! There is no such thing as too much practice!

Good Luck

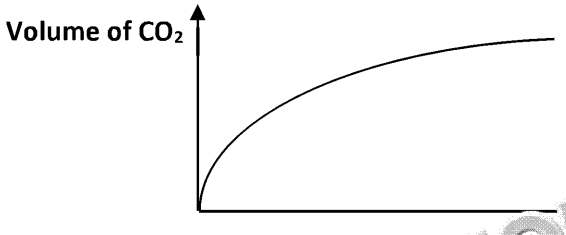
1. Which of the following is **not** a measure of the mean rate of a chemical reaction?

A quantity of a reactant used up / time taken
B quantity of a product produced / time taken
C time taken for the concentration of a reacta… to zero
D 1 / time taken to complete the r…

2. Which of the follow… increase the rate of reaction between marble … hy… chloric acid if everything else remained the same?

A usin… marble chips
B increasing the pressure on the system
C lowering the temperature
D increasing the acid concentration

3. Which of the following statements about the graph shown below, showing the volume of carbon dioxide formed plotted against time in the reaction between marble and hydrochloric acid, is correct?



The graph shows that, as tim… .

A The gr… t g… …
B Th… ge… aster.
C The … goes at the same rate.
D The reaction slows down.

4. Which o… point A … against t…

A Divi…
B Mul…
C Dra…
D Dra…

5. The follo… describe…

Tim… (min…
Volum… ga… (cm…

Which o…

A The…
B The…
C No…
D The…

6. Which of the following statements explains the increase in the rate of reaction between gas particles brought about by an increase in pressure at constant temperature?

A The particles gain energy and collide more frequently. ☐
B The particles become smaller and move faster. ☐
C The particles become closer together and collide more ☐
D The particles will be more likely to have the activation ☐

7. Which of the following statement does **not** explain the increase in the rate of a chemical reaction brought about by an increase in temperature?

A The ☐
B The move faster. ☐
C More ☐
D The particles expand and move closer. ☐

8. When sodium thiosulfate and hydrochloric acid react, the time taken for a cross marked on paper to disappear provides a measure of the rate.

When studying the effect of the concentration of the sodium thiosulfate on the rate of the reaction it is very important for valid results to:

A use the same size of reaction flask throughout ☐
B have the same room temperature throughout ☐
C use the same volume of acid throughout ☐
D have different people taking the time readings ☐

9. Which one of the following could represent the unit of the rate of a reaction involving gases?

A cm^3 ☐
B s ☐
C ☐
D ☐

10. Magnesi

Which o

Keep ev

A incr
B use
C use
D coo

11. Which o

A typical

A will
B rais
C will
D is n

12. Mangan water ar

Which o

Mangan

A sho
B is in
C mus
D wou

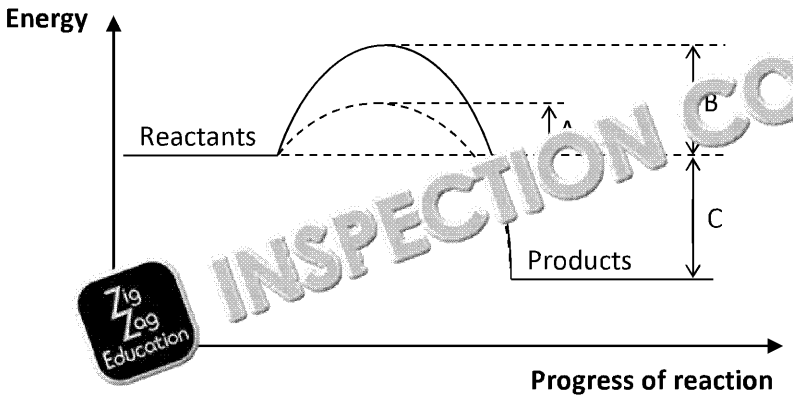
13. A studer solid cat

Which o

A The
B The
C The
D The

14. The energy level diagram given shows two profiles for the same reaction.

One is for the catalysed reaction and the other without the catalyst.



Which of the following represents the activation energy of the catalysed reaction?

A A ☐
B B ☐
C C ☐
D none of the above ☐

15. **(Higher tier only)**

Nitrogen, N_2, combines with hydrogen, H_2, to make ammonia, NH_3 according to the reversible equation shown below. An iron catalyst is used in the reaction.

$N_{2(g)} + 3H_{2(g)} \rightleftharpoons 2NH_{3(g)}$

Which of the following changes to the equilibrium would move the equilibrium to the right?

A adding more nitrogen ☐
B removing some of the hydrogen ☐
C adding more ammonia ☐
D adding more catalyst ☐

16. The equ
given by

$CuSO_4 \bullet 5$

Blue cry

Heating

If water
then the

Which o

A 32 J
B 640
C 32 J
D 640

17. Which o

A chemi

A can
B alw
C has
D has

18. **(Higher**

The equ

$2NO_{2(g)}$

brown g

Which o
equilibri

A The
B The
C The
D The

19. (Higher tier only)

The equation below shows a reversible reaction.

$H_{2(g)} + I_{2(g)} \rightleftharpoons 2HI_{(g)}$

Which of the following changes will occur if the pressure on the equilibrium is **decreased**?

	Effect on the rate of the reaction	Effect on position of equilibrium
A	slows down	moves left
B	slows down	no effect
	increases	moves right
	increases	no effect

A ☐
B ☐
C ☐
D ☐

20. Which of the following statements about reversible reactions is correct?

A reversible reaction in a closed system will:

A under the correct conditions, go to completion ☐
B come to equilibrium faster using a suitable catalyst ☐
C always have its position of equilibrium affected by pressure ☐
D always come to equilibrium very quickly

21. (Higher

The equ

$2NO_{2(g)}$

brown g

Given th
the colo

A No
B The
C The
D The

22. The alkanes are the major components of crude oil.

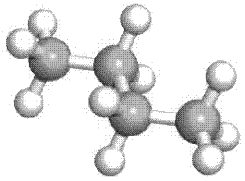
Which of the following represents the general formula of the alkanes?

A C_nH_{2n-2} ☐
B C_nH_{2n} ☐
C C_nH_{2n+2} ☐
D C_nH_{2n+4} ☐

23. Which o… fol… ing substances is **not** directly obtained from crude oil during … l distillation?

A poly(ethene) ☐
B petrol ☐
C kerosene ☐
D diesel oil ☐

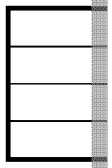
24. The structure of butane is shown below.



What is the simplest ratio of carbon atom… hydrogen atoms?

A 4 : 10 ☐
B 2 : 5 ☐
C 10 … ☐
D 5 : … ☐

25. Which of …



A
B
C
D

26. Which of …

Fractiona…

A the …
B eva…
C sep…
D the …

27. The fracti…

Moving d…
each frac…

A thei…
B thei…
C thei…
D the …

28. Which of the following is the balanced equation for the complete combustion of methane?

A $2CH_4 + 3O_2 \rightarrow 2CO + 4H_2O$ ☐
B $2CH_4 + O_2 \rightarrow 2CO + 4H_2$ ☐
C $CH_4 + 2O_2 \rightarrow CO_2 + 2H_2O$ ☐
D $2CH_4 + 2O_2 \rightarrow 2CO_2 + 2H_2O$ ☐

29. Which of the following statements applies to the cracking of hydrocarbon fractions?

A Cracking involves joining small molecules into large ones. ☐
B Cracking produces only alkanes. ☐
C Cracking produces alkanes and alkenes. ☐
D Cracking can only be done with heat and a catalyst. ☐

30. Which one of the following is a correct statement about alkenes?

A Alkenes are less reactive than alkanes. ☐
B Alkenes do not decolourise bromine water. ☐
C Alkenes only contain carbon-to-carbon single bonds. ☐
D Alkenes can be easily polymerised. ☐

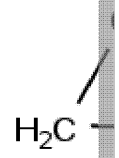
31. Which of the following could represent the cracking of dodecane, $C_{12}H_{26}$?

A $C_{12}H_{26} \rightarrow C_{10}H_{22} + C_2H_4$ ☐
B $C_{12}H_{26} \rightarrow 2C_5H_{11} + C_2H_4$ ☐
C $C_{12}H_{26} \rightarrow C_{10}H_{22} + C_2H_6$ ☐
D $C_{12}H_{26} \rightarrow C_8H_{22} + C_2H_4$ ☐

32. Which of the following is true of alkenes?

A The first member of the alkenes is methene. ☐
B The general formula for the homologous series of alkenes has the form C_nH_{2n}. ☐
C The alkenes are said to be unsaturated. ☐
D The alkenes are widely found in crude oil. ☐

33. Cyclic alk
are show



Cyclop

Which of
hydrocar

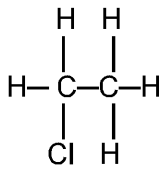
A CH_2
B C_nH
C C_nH
D C_nH

34. How man
react wit

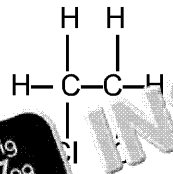
A 1
B 2
C 3
D 4

35. Ethene, C_2H_4, reacts with chlorine at room temperature. Which of the following represents the structure of the product?

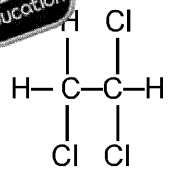
A



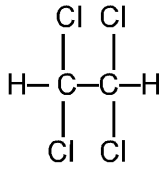
B



C



D



36. A hydrocarbon has a molecular mass of 30. Which of the following could it be?

[H = 1, C = 12]

A ethene
B ethane
C propene
D propan

37. Ethanol,

Which o
ferment

A pler
B yea
C gluc
D a te

38. A 10 kg
ethanoi

Calculat

A 0.0
B 0.2
C 36.
D 275

39. A sampl

How ma
sample

Give you

A 7.9
B 8.0
C 7.9
D 8.0

40. Which of the following statements is correct about the reactions of propanol?

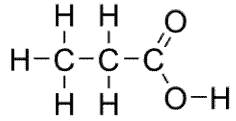
A Propanol reacts with sodium, releasing bubbles of hydrogen. ☐
B Propanol burns in air, releasing carbon dioxide and hydrogen. ☐
C Propanol reacts with water, releasing bubbles of oxygen. ☐
D Propanol reacts readily with reducing agents. ☐

41. Which of the following is **not** a use of eth[illegible]

Tick one box.

A as a f[illegible] ☐
B to [illegible] ho[illegible] drinks ☐
C to k[illegible] ☐
D to make polyesters ☐

42. To which of the following groups of organic compounds does the substance shown below belong?



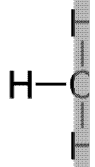
A alcohols ☐
B carboxylic acids ☐
C esters ☐
D alkanes ☐

43. Which one of the following correctly [illegible] behaviour of a carboxylic acid, e.g. ethanoic [illegible]

Carboxyli[illegible]

A are [illegible]lly dissociate in water ☐
B dissoc[illegible] water giving a solution with a pH greater than 7 ☐
C react with alcohols to form esters ☐
D are able to release hydrogen from metal carbonates ☐

44. What is [illegible]



A met
B eth
C met
D eth

45. **(Chemis[illegible]**

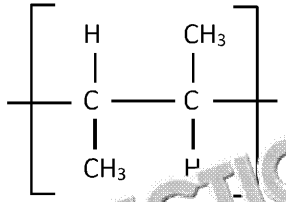
Which o[illegible]
shown b[illegible]

n

A The
B The
C The
the
D The

46. (Chemistry only)

When polymerised, which of the following monomers would produce the polymer with the structure shown below?



A $CH_3–CH=CH–CH_3$ ☐

B $CH_3=C$ ☐

C CH ☐

D CH_3 ☐

47. Burning 1 kg of polystyrene cups releases 40 MJ of energy. How much energy does each 1.5 g polystyrene cup release on burning?

A 0.06 MJ ☐

B 6 MJ ☐

C 60 MJ ☐

D 2667 MJ ☐

48. Which of the following correctly completes the equation started below?

n HO–□–OH + n HOOC–□–COOH → 2n H_2O +

A –[–□–C–CO–□–COO–]$_n$– ☐

B –[–□–COO–□–C–O–]$_n$– ☐

C –[–□–C–O–□–COO–]$_n$– ☐

D –[–□–O–C–□–CO–]$_n$– ☐

49. (Higher

Glycine,
followin

All amin

A con

B und

C con

D can

50. DNA is e

Which o

A DNA

B DNA

C DNA

D DNA

51. How can a sample of water be shown to be pure?

Water is pure if it:

A has been filtered ☐
B boils at a fixed temperature ☐
C is safe to drink ☐
D has a pH of 7 ☐

52. One ex… a fo… …lation is an NPK fertiliser.

Complet… …owing sentence.

A formulation is…

A … a compound designed for a particular purpose. ☐
B … a compound that keeps pollution to a minimum. ☐
C … a mixture designed for a particular purpose. ☐
D … a mixture that keeps pollution to a minimum. ☐

53. Which one of the following **cannot** be described as a formulation?

A alloys ☐
B detergents ☐
C paints ☐
D distilled water ☐

54. A sample of ethanol was thought to h… …s found to contain 5.1 % by mass of water. Calcul… …ma… …f water in an 85 kg sample of ethanol.

Give yo… …to … appropriate number of significant figures.

A 0.06… ☐
B 4.3 kg ☐
C 4.34 kg ☐
D 6.0 kg ☐

55. The diag… substan…

Solven…

Base…

What is …

A 0.78…
B 0.78…
C 1.27…
D 1.27…

56. Which o… produce…

A **X** d…
B The…
C The…
D **X** is…

57. In an experiment using paper chromatography, a substance Y has an R_f value of 0.72. If the spot for Y moves 5.8 cm, how far did the solvent front move?

A 4.6 cm ☐
B 5.7 cm ☐
C 7.1 cm ☐
D 8.1 cm ☐

58. A gas which relights a glowing spli[illegible].

A oxygen ☐
B hyd[illegible] ☐
C chl[illegible] ☐
D carb[illegible]ide ☐

59. A gas which turns damp litmus paper white is:

A oxygen ☐
B hydrogen ☐
C chlorine ☐
D carbon dioxide ☐

60. **(Chemistry only)**

Flame tests are used to identify:

A some metal cations ☐
B all metal cations ☐
C some anions ☐
D all anions ☐

61. Complete the following [illegible]e.

When c[illegible]t a[illegible]me test...

A ... a [illegible]ire must be used to support the sample. ☐
B ... a luminous Bunsen flame must be used. ☐
C ... the test sample must be dissolved in water. ☐
D ... the wire being used must be cleaned with acid between tests. ☐

62. A compo
- a ye
- on t

Which o

A pota
B pota
C sodi
D sodi

63. When pe
a small a
detected

Which o

A Both
B Neit
C The
D Cop

64. Certain
hydroxi
a metal

A white
the sodi

Which o

A Ca^{2+}
B Al^{3+}
C Fe^{2+}
D Fe^{3+}

65. Adding sodium hydroxide solution to copper(II) chloride forms a precipitate of the metal hydroxide.

Which of the following represents the correctly balanced equation with the correct state symbols for this reaction?

A $CuCl_{2(aq)} + 2NaOH_{(aq)} \rightarrow Cu(OH)_{2(s)} + 2NaCl_{(aq)}$
B $CuCl_{2(aq)} + 2NaOH_{(aq)} \rightarrow Cu(OH)_{2(aq)} + 2NaCl_{(s)}$
C $CuCl_{2(aq)} + 2NaOH_{(aq)} \rightarrow Cu(OH)_{(s)} + 2NaCl$
D $CuCl_{2(aq)} + 2NaOH_{(aq)} \rightarrow Cu(OH)_{2}$

66. A group of students tested a range of metal ion solutions with sodium hydroxide solution and obtained the same results as the other groups in the class.

Which of the following describes the first group of students' results?

A repeatable
B reproducible
C accurate
D precise

67. When testing for halide ions in solution, an acid is added before testing with silver nitrate solution. The acid destroys any carbonate present, which would also give a precipitate.

Which acid is normally used?

A nitric acid, HNO_3
B hydrochloric acid, HCl
C hydrobromic acid, HBr
D hydriodic acid, HI

68. When metal carbonates react with acids, what is used to test for the gas given off?

A litmus paper
B lime water
C bromine water
D a burning splint

69. When te
silver nit
below a

- Th
- Th
- Th

A 0
B 1
C 2
D 3

70. When te
followin

A bari
B bari
C silve
D silve

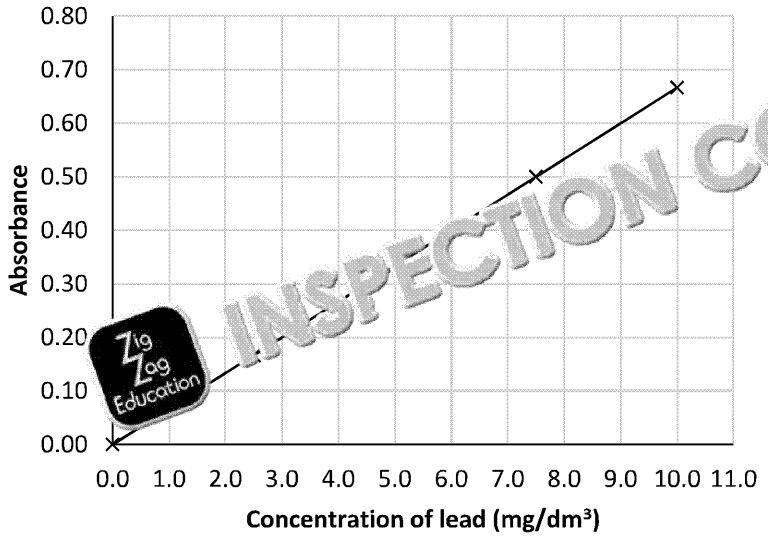
71. Modern
traditio

How ma
these m

Moder
- re
- pr
- or
- ar

A 1
B 2
C 3
D 4

72. The diagram below shows the calibration curve for the atomic absorption spectroscopy values for various standard solutions of lead.



Which of the following best describes the relationship between the absorbance and the concentration of lead in the samples?

They show:

A direct proportionality ☐
B positive correlation ☐
C inverse proportionality ☐
D negative correlation ☐

73. This question relates to the graph shown in qu

What would be the absorbance of a solution of lead containing 1.5 mg of lead per 200 cm^3 of wa

A 0.17 ☐
B 0.3 ☐
C 0.50 ☐
D 0.67 ☐

74. Flame e
analysis.

Which o

A Fla
B The
C The
D The

75. Which o

A add
B pas
C add
D add

Q76	A		It is thought that Earth has had its present atmosphere (about 4/5 r the last 200 million years.
	B		
	C		
	D	✓	
Q77	A		The volume ratio of oxygen to carbon dioxide is 20 : 0.04, which, by number (0.04), gives a ratio of 500 : 1.
	B		
	C	✓	
	D		
Q78	A	✓	A number of theori[illegible] because there is little direct evidence fr There cann[illegible]ecoded data (precise or otherwise) because t
	B		
	C		
	D		
Q79	A	✓	The dramatic reduction in the amount of carbon dioxide in Earth's a by it dissolving in the oceans and forming carbonate rocks. Also, the carbon dioxide was absorbed by the plants, which becam
	B		
	C		
	D		
Q80	A		280 tonnes = (280 × 1000 kg) = 280 × 1000 × 1000 g = 280 000 000 This is 3×10^8 in standard form and to one significant figure.
	B		
	C		
	D	✓	
Q81	A		Volume of oxygen removed by the iron = 25.0 – 20.3 = 4.7 cm^3 Percentage of oxygen in the sample of air = (4.7 / 25.0) × 100 = 18.8 To the nearest whole number this is 19 %.
	B		
	C		
	D	✓	
Q82	A		The percentage of oxygen in the atmosphere has increased since it This is due to photosynthesis by plants, which convert carbon dioxi The percentage of nitrogen has increased because of the reaction b
	B	✓	
	C		
	D		
Q83	A		It has been suggested that early volcanic activity produced carbon d also probably produced methane and amm[illegible]
	B	✓	
	C		
	D		
Q84	A		During the da[illegible] plants undergo photosynthesis. They [illegible]rbon dioxide from the air along with water from the [illegible]form glucose, which is stored, and, at the same time, release
	B		
	C	✓	
	D		
Q85	A		A line graph is used to plot data if both variables are continuous. The gases in the air can be assigned labels, i.e. are a categoric varia All the other plots have a categoric variable.
	B	✓	
	C		
	D		

Q86	A		Plants and originally algae remove carbon dioxide from the atmosp turned into fossil fuels such as coal, oil and gas. Plants do remove oxygen at night during respiration, but not to for
	B	✓	
	C		
	D		
Q87	A		Percentage by volume of carbon dioxide = (412.6 / 1 000 000) × 10 This is 0.0413 to three significant figures. The zeros do not count as
	B	✓	
	C		
	D		
Q88	A		Percentage increase = (increase / original v… × 100 The increase in carbon dioxide in p… million = 412.4 – 404.8 = Percentage increase in car… oxide = (7.6 / 404.8) × 100 = 1.88
	B		
	C	✓	
	D		
Q89	A	✓	…ogen is the only one of the listed gases that is not regarded as a …t capable of further raising Earth's temperature.
	B		
	C		
	D		
Q90	A		Greenhouse gases do affect Earth's temperature and climate to diff and emit infrared radiation to different extents. Methane is a far more potent greenhouse than carbon dioxide. It is important to realise that greenhouse gases in our atmosphere Earth would be a frozen wasteland. At the present time, there is growing concern about the human po of the greenhouse gas carbon dioxide into our atmosphere.
	B		
	C		
	D	✓	
Q91	A		Increasing levels of greenhouse gases like carbon dioxide are thoug increase in Earth's temperature. This in turn is responsible for the i well as causing dramatic climate change. Ozone depletion is caused by CFCs from fridges, etc.
	B		
	C	✓	
	D		
Q92	A		There is little doubt that increasing levels of carbon dioxide are cau fossil fuels. The rise in carbon dioxide levels may or may not continue in the fut fossil fuels running out, government intervention. Rising levels of carbon dioxide probably is the cause of climate chan
	B		
	C	✓	
	D		
Q93	A		Incomplete combustion of methane could pr… ce carbon and/or ca
	B	✓	
	C		
	D		
Q94	A	✓	Soot does … global dimming as well as causing respiratory prob …bon … oxide is a toxic gas but does not add to acid rain. …es of nitrogen add to acid rain and other problems. Methane is a greenhouse gas but is not toxic.
	B		
	C		
	D		
Q95	A		Both graphs show a rising trend, although they do not match exactl It is, therefore, reasonable to assume that rising levels of carbon di responsible for the rise in temperature. However, since correlation is not causation there may possibly be s Earth's temperature.
	B		
	C	✓	
	D		

Q96	A		Thioethanol, C_2H_5SH, on complete combustion would produce carb
	B	✓	warming) and sulfur dioxide from the sulfur present.
	C		Sulfur dioxide adds to acid rain and causes respiratory problems in
	D		Soot would not be released to cause global dimming.
Q97	A		The rising oxygen content from 375 to 300 million years ago could h
	B	✓	releasing oxygen by photosynthesis.
	C		The oxygen content of the atmosphere has changed little over the l
	D		The graph does not cover the period from Earth's formation, which
			The oxygen content of the atmosphere has been above 25 % for ve
Q98	A		Oxides of nitrogen released by cars are respo ble for adding to ac
	B		problems in humans. They are form by n rogen and oxygen from
	C	✓	heat of the engine.
	D		Oxides of nitrogen a t present in the fuel, nor is nitrogen.
Q99	A	✓	The p ge of nitrogen has increased since Earth was formed, t
	B		xygen has also increased, to about 20 %.
	C		The percentage of carbon dioxide has decreased dramatically to its
	D		There was some ammonia in Earth's early atmosphere but there is
Q100	A		The increased use of renewable energy resources will tend to reduc
	B		burned, thus reducing the amount of carbon dioxide released into t
	C		Burning more fossil fuels and biomass will release more carbon dio
	D	✓	The cutting down of forests will mean fewer plants to remove carb
			photosynthesis.
Q101	A		The ratio by volume of oxygen to carbon dioxide = 16 / 0.16 = 100 /
	B	✓	Therefore, the volume of oxygen was two powers of 10 greater tha
	C		concentration, i.e. two orders of magnitude greater.
	D		

Q102	A		Biofuels are not a finite resource, since they come from plants whic plants that have been harvested. Crude oil, copper ores and coal are mostly not replaced in the earth as finite.
	B		
	C	✓	
	D		
Q103	A		Assuming we use oil at the present rate and no new oil fields are fo happen) then present supplies should last 1687.9 / 31.6 years. This works out to 53.414 ..... years. Since neither of the assumptions used is likely to happen, then a re and 60 years.
	B		
	C		
	D	✓	
Q104	A		The only natural product listed is wool (obtained from sheep). All the other substances are man-made polymers.
	B	✓	
	C		
	D		
Q105	A	✓	Potable water is water that is fit to drink. It normally contains small and has been treated to kill bacteria. It is not just obtained from rivers – it is often obtained from lakes a
	B		
	C		
	D		
Q106	A		Fresh water can be obtained by distilling seawater. The water is col left behind. Filtration and sterilisation by chlorine are not used. The process uses a vast amount of heat energy and is, therefore, ex
	B		
	C		
	D	✓	
Q107	A	✓	The mineral water contains 55 mg of calcium per 1 dm^3 of water. This is 55 mg per 1000 cm^3 of water. In 100 cm^3 of mineral water th Since 1 g = 1000 mg, then the mass of calcium in 100 cm^3 = 5.5 / 10
	B		
	C		
	D		
Q108	A		This procedure is called distillation and involves evaporation of the condensation, leaving any dissolved solids in the flask. Fractional distillation is used to separate mixtures of liquids. Reverse osmosis is used to obtain water from seawater, but it is no
	B	✓	
	C		
	D		
Q109	A		Screening is used to remove large objects and a sewage works treat industrial waste. Anaerobic digestion (without oxygen) occurs in a sewage works. Chlorine is later added to kill bacteria, not to remove smells.
	B		
	C	✓	
	D		
Q110	A		Copper is extracted by all the methods described except the second Leaching (not photomining) is used to extract copper from low-
	B	✓	
	C		
	D		
Q111	A		200 tonnes = 200 × 1 × 10^6 = 2 × 10^8 g 0.27 % of the mass of ore = (0.27 / 100) × 2 × 10^8 = 540 000 g
	B		
	C		
	D	✓	

Q112	A		Life-cycle assessments are carried out to assess how the process wi
	B		
	C	✓	All the other statements are important to consider but are only pa
	D		
Q113	A	✓	Disposing of 1000 plastic bags by burning would release 2500 kg of
	B		disposal by landfill would add 1500 kg of carbon dioxide to the air.
	C		This is a difference of 1000 kg of carbon dioxide.
	D		In terms of solid waste and sulfur dioxide, landfill would produce m
Q114	A		To recycle materials it is often necessa[illegible] them. All the grou
	B		ceramics are normally recycled by melting. Ceramics cannot be mel
	C		
	D	✓	
Q115	A		Iron (steel) will only rust in the presence of air (oxygen) and wa
	B		[illegible] does not rust but it will corrode (more slowly than iron).
	C	✓	[illegible] is put in contact with iron to prevent it rusting.
	D		Some iron alloys will rust, i.e. some steels.
Q116	A		Volume of oxygen gas removed by the rusting of iron (forming hydrate
	B		
	C	✓	Percentage of oxygen in the sample of air = (5.6 / 30.0) × 100 = 18.66
	D		
Q117	A	✓	Corrosion involves metals reacting with oxygen, water, etc. from th
	B		increasing the mass.
	C		Aluminium does not appear to corrode because it has a protective
	D		metal is manufactured.
			Iron and steel objects are recycled (i.e. in the blast furnace), corrod
			objects is done to prevent the iron corroding.
Q118	A		Stainless steel is an alloy of iron containing chromium and nickel. It
	B	✓	it will not rust.
	C		Brass and bronze are alloys of copper.
	D		Iron containing high amounts of carbon is hard and brittle.
			Aluminium alloys are used in alloy wheels because they are strong
Q119	A		The data suggests that each carat in a gold object represents 100 /
	B		14 carat gold objects, therefore, contain 14 × 4.166 = 58.3 % of gol
	C		
	D	✓	
Q120	A	✓	Fibreglass is a composite (combination of materials) used in boats a
	B		its low density and strength.
	C		Thermosetting plastics are used in plugs because they will not melt
	D		Pottery and bricks are not flexible and also are heated in a kiln and
			The properties of a polymer depend on the monomer used and the
			catalyst used.
Q121	A		The Haber process is normally carried out at about 200 atmosphere
	B	✓	use of nitrogen from the air and hydrogen from natural gas.
	C		The catalyst used is iron.
	D		

Q122	A		The graph shows that as the pressure increases at a particular tem yield of ammonia increases. It also shows that, at a particular pressure, reducing the temperatu Therefore, theoretically, the Haber process should be carried out a temperature.
	B		
	C	✓	
	D		
Q123	A		A catalyst is used in the Haber process to set up the equilibrium mo Catalysts cannot increase the yield in a reaction. All the other statements about the Haber process are correct.
	B		
	C	✓	
	D		
Q124	A		In a 24-hour period, Fritz Haber could have produced 24 × 125 cm^3 Since 1 dm^3 = 1000 cm^3, then he could have produced 3 dm^3.
	B	✓	
	C		
	D		
Q125	A		NPK fertilisers are mixtures of compounds which together provide phosphorus (P) and potassium (K), which are vital to plant growth. Only sodium nitrate, which contains nitrogen, and potassium phosp phosphorus, would together provide all three elements vital to Ammonium nitrate and potassium chloride would lack phosphorus. Sodium nitrate and ammonium phosphate would lack potassium. Calcium phosphate and potassium chloride would lack nitrogen.
	B	✓	
	C		
	D		
Q126	A	✓	Phosphate rock is mined to make other substances not used direct All the other statements related to fertilisers and their production a
	B		
	C		
	D		

51. How can a sample of water be shown to be pure?

Water is pure if it:

A has passed through a sewage works ☐
B has been treated with chlorine ☐
C melts at 0 °C ☐
D has a pH of 7 ☐

52. One ex… a fo… …ulation is an NPK fertiliser.

Complet… …owing sentence.

A formulation is best described as…

A … a recipe for a certain type of cake. ☐
B … a fertiliser to grow certain plants. ☐
C … a useful mixture of substances. ☐
D … a drug to treat a specific disease. ☐

53. Which one of the following is a formulation?

A a cosmetic ☐
B crude oil ☐
C ethanol ☐
D river water ☐

54. A sample of ethanol was thought to h… …s found to contain 1/120 by mass of water. Calc… …ac… …mass of ethanol in a 25 kg container of this sam… …nc…

Give yo… …to … decimal places.

A 0.20… ☐
B 0.208 kg ☐
C 24.79 kg ☐
D 24.792 kg ☐

55. The diag…

Solven…

Base…

What is …

A 0.6…
B 1.6…
C 3.9…
D 3.9…

56. Which o… produce…

A The… of X…
B This… sub…
C The…
D The…

57. In an experiment using paper chromatography, a substance Y has an R_f value of 0.64. If the spot for Y moves 10.5 cm, how far did the solvent front move?

A 6.7 cm
B 9.9 cm
C 11.1 cm
D 16.4 cm

58. Complete the following sentence.

Oxygen is tested for by seeing if it...

A ... gives a squeaky pop when a light is applied to it.
B ... relights a glowing splint.
C ... turns damp indicator red.
D ... is able to rust iron.

59. Complete the following sentence.

Hydrogen is tested for by seeing if it...

A ... relights a glowing splint.
B ... gives a squeaky pop when a light is applied to it.
C ... turns damp indicator blue.
D ... turns lime water cloudy.

60. **(Chemistry only)**

In a flame test, which of the following would give a lilac colour?

The presence of:

A potassium
B copper
C sodium
D calcium

61. Complet

When ca

A ... th
B ... a
C ... th
D ... th
bet

62. A compo

- a gr
- on t

Which o

A lithi
B lithi
C copp
D copp

63. When pe
with a sr
was not

Which o

A Both
B Both
C Sod
D The

64. Certain r

Sodium
compou

Which o

A Ca^{2+}
B Cu^{2+}
C Fe^{2+}
D Fe^{3+}

65. Adding sodium hydroxide solution to iron(III) chloride forms a precipitate of the metal hydroxide.

Which of the following represents the correctly balanced equation with the correct state symbols for this reaction?

A $FeCl_{3(aq)} + 3NaOH_{(aq)} \rightarrow Fe(OH)_{3(s)} + 3NaCl_{(aq)}$ ☐
B $FeCl_{3(aq)} + 3NaOH_{(aq)} \rightarrow Fe(OH)_{3(aq)} + 3NaCl_{(s)}$ ☐
C $FeCl_{3(s)} + 3NaOH_{(aq)} \rightarrow FeOH_{(s)} + 3NaCl_{(aq)}$ ☐
D $FeCl_{3(aq)} + 3NaOH_{(aq)} \rightarrow Fe(OH)_{3(s)} + 3NaCl_{(aq)}$ ☐

66. A group of students tested a range of metal ion solutions by adding sodium hydroxide solution and noting the colour of any precipitate formed.

One student suggested using potassium hydroxide solution instead of sodium hydroxide.

How would the results have differed, if at all?

A No precipitates would have formed. ☐
B The precipitates would have been darker in colour. ☐
C The precipitates would have been lighter in colour. ☐
D No visible change would be observed. ☐

67 When testing for halide ions in solution, an acid is added before testing with silver nitrate solution. The acid destroys any carbonate present.

Which of the following statements about the use of acid in this test is correct?

A Nitric acid, HNO_3, should be used because it does not fizz too much. ☐
B Nitric acid, HNO_3, should be used because it would not form a precipitate. ☐
C Hydrochloric acid, HCl, should be used because it does not fizz too much. ☐
D Hydrochloric acid, HCl, should be used because it would not form a precipitate. ☐

68. When m
lime wat

Which g

A carb
B carb
C chlo
D hyd

69. When te
silver nit
below a

- Th
- Th
- Th

A 0
B 1
C 2
D 3

70. When te
followin

A bari
B bari
C bari
D bari

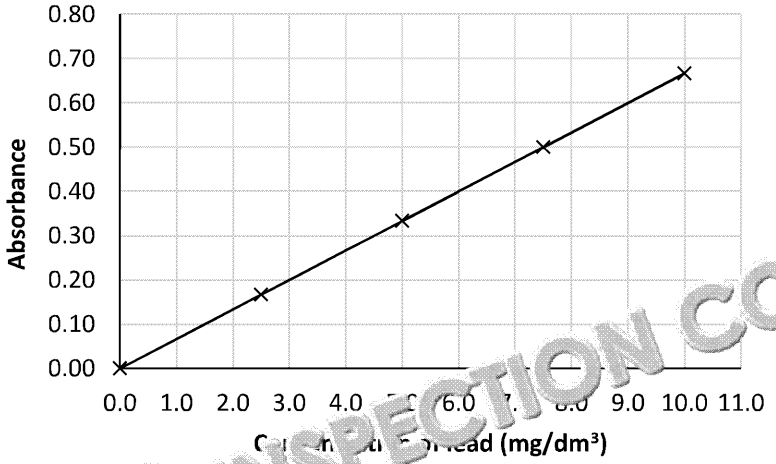
71. Modern instrumental methods have some advantages over more traditional methods of analysis.

How many of the statements listed in the box below are advantages of these modern methods?

Modern instrumental methods:
- require highly trained technicians to use the equipment
- produce the results very quickly
- need only a very small amount of sample to work with
- are very accurate

A 1 ☐
B 2 ☐
C 3 ☐
D 4 ☐

72. The diagram below shows the calibration curve for the atomic absorption spectroscopy values for various standard solutions of lead.



Which of the following statements about this calibration curve is correct?

The absorbance of 25 mg/dm³ of lead would be:

A impossible to predict ☐
B about 1.2 ☐
C about 1.6 ☐
D about 2.0 ☐

73. This que
absorba
there be
A 0.1
B 2.5
C 10
D 40

74. Flame e
analysis.
spectros
A Flan
B The
eac
C The
con
D The

75. Which o
A add
mag
B add
C add
D add

76. For approximately 200 million years, the composition of our atmosphere has been constant.

Which of the following statements describes our atmosphere?

Our atmosphere is approximately:

A 80 % nitrogen ☐
B 80 % oxygen ☐
C 20 % hydrogen ☐
D 20 % nitrogen ☐

77. Our pres sphere contains about 1 % argon and about 0.04 % carbon d y volume. What is the simplest volume ratio of argon to carbon dioxide in our atmosphere?

A 1 : 4 ☐
B 1 : 40 ☐
C 5 : 1 ☐
D 25 : 1 ☐

78. Which of the following statements about Earth's early atmosphere is true?

A There is only one theory about its formation and composition. ☐
B It is thought to have been mainly carbon dioxide. ☐
C It remained largely unchanged until the arrival of humans. ☐
D There is a lot of evidence available to help determine its composition. ☐

79. Our atmosphere today contains much les on e than when it was first formed.

Which of the following i o t explanation about the reduction in carbon e c ur atmosphere?

The car le:

A was bed by humans during respiration ☐
B absorbed by the plants to become fossil fuels ☐
C was absorbed by the oceans ☐
D became limestone rock ☐

80. The gro atmosp

Over a c oxygen

What is

Give you

A 2.66
B 2.7
C 2.66
D 2.7

81. A studer the rusti to 32.5

What pe removal

Give you

A 18.7
B 19 %
C 81.2
D 81 %

82. Which o Earth's a

The amo

A oxyg
B nitr
C wat
D carb

83. One theory suggests that Earth's early atmosphere was created by volcanic activity.

Which of the gases listed is not thought to have been released by volcanoes?

A carbon dioxide
B nitrogen
C oxygen
D methane

84. Respiration by anim... is essentially the reverse of photosynthesis carried ... ant.

Which o... wing is the word equation for respiration?

A water + oxygen → glucose + carbon dioxide
B carbon dioxide + water → glucose + oxygen
C glucose + oxygen → carbon dioxide + water
D glucose + water → carbon dioxide + oxygen

85. The percentage of carbon dioxide in Earth's atmosphere can be recorded very accurately on a daily basis.

Which of the following would the most suitable way of representing the data over a period of one year?

A a table
B a line graph
C a pie chart
D a bar chart

86. For which of the follow... was the arrival of algae and plants on Earth ...por...

A the ... of carbon dioxide
B the r... of oxygen into the atmosphere
C the formation of coal
D the formation of limestone rock

87. The amo... 5120 pa...

Which o... dioxide i...

A 0.0...
B 0.0...
C 0.51...
D 0. 5...

88. The perc... Mauna L... per milli...

In Septe...

Which o... in the ai...

A 0.0...
B 0.0...
C 0.49...
D 0.49...

89. Scientist... certain g...

Which o...

A met...
B argo...
C nitr...
D oxyg...

90. Which of the following statements is correct about greenhouse gases in our atmosphere?

A It is vitally important to have certain levels of greenhouse gases in our atmosphere to maintain life on Earth. ☐

B We can exactly predict what will happen to our climate in the future, due to increasing levels of greenhouse gases. ☐

C Greenhouse gases in the air affect climate because the[y] light energy. ☐

D We are not concerned about the effe[ct] th[e] gas methane has on our clima[te] ecau[se] very low concentration in the a[ir] ☐

91. Which [of] ow[ing] st[a]tements is a consequence of increasing levels of greer[house] ses in our atmosphere?

There wi[ll] be an increase in:

A global dimming ☐

B sea levels ☐

C ozone depletion ☐

D the frequency of earthquakes ☐

92. The percentage of carbon dioxide in our atmosphere has been gradually rising over the last 200 years.

Which of the following statements is correct?

The rise in carbon dioxide concentration is due to an increase in:

A volcanic activity ☐

B deforestation ☐

C the use of renewable energy sources ☐

D the size of the oceans ☐

93. Hydrocarbon fuels can undergo incom[plete] c[om]b[u]stion under certain circumstances.

Which of the followi[ng] st[a]tements is correct about the incomplete combust[ion] hyd[ro]ca[rbon] fuel like methane?

Incomple[te] bustion occurs in:

A limite[d] xygen and can produce hydrogen ☐

B limited oxygen and can produce carbon monoxide ☐

C plenty of oxygen and produces carbon dioxide ☐

D plenty of oxygen and produces carbon soot ☐

94. Scientist[s] pollutant

Which o[f] pollutant

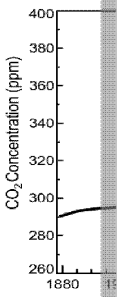
A Oxi[d] brea

B Unb

C Any

D Met

95.



By consi[der] conclusi[on] reasonab

A Both

B Both

C The[y]

D The leve

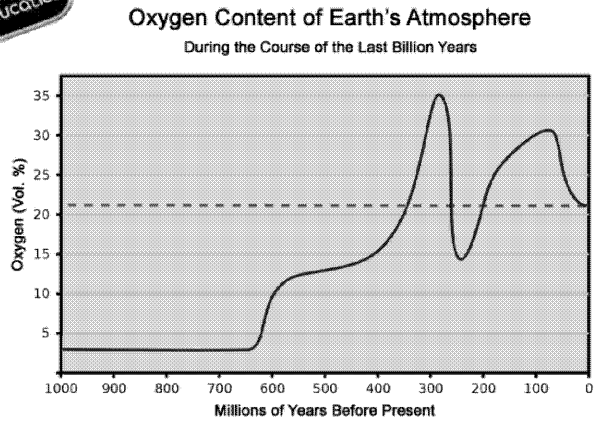
96. Thioethanol, C_2H_5SH, is a minor component of petroleum.

On complete combustion of thioethanol, which of the following gases could be released?

A carbon monoxide
B hydrogen
C sulfur dioxide
D oxygen

97. The graph below shows the ch[illegible] percentage of oxygen in our atmosphere over th[illegible] million years.

Which o[illegible] wi[illegible] statements does the graph suggest is true?



A 300 million years ago, forest fires would have burned ve[illegible] fiercely.
B 300 million years ago, plant growth was [illegible] t any other time over the last 1000 million y[illegible].
C The graph suggests th[illegible] rst formed the air contained abo[illegible] n dioxide.
D The [illegible] that the percentage of oxygen has never bee[illegible] 3 %.

98. Oxides o[illegible]

Which of[illegible]

A Nitr[illegible] heat[illegible]
B The[illegible]
C The[illegible] the[illegible]
D The[illegible] the[illegible]

99. The com[illegible] formed b[illegible]

Which of[illegible]

There ha[illegible]

A oxyg[illegible]
B wat[illegible]
C carb[illegible]
D met[illegible]

100. Over the[illegible] has dram[illegible]

Which of[illegible]

A less[illegible]
B a dr[illegible]
C an i[illegible]
D incr[illegible]

101. Our pres[illegible] 0.9 % arg[illegible]

By appro[illegible] greater t[illegible]

A 1
B 2
C 3
D 4

102. Which of the following substances is not normally regarded as finite?

A limestone
B wood chips
C aluminium ores
D natural gas

103. Recently i… sti… …t 950 million tonnes of recoverable copper remain … It was also estimated that we use 15 million tonnes of copper p…

Which of the following gives the best answer as to when copper will run out?

In:

A 53.33 years' time
B about 60 to 70 years' time
C 14,250 years' time
D about 14,000 years' time

104. Which of the following is a natural product?

A silk
B paper
C glass
D glass fibre

105. Which of the following is a … …ption of potable water?

Potable …

A has … solved substances removed
B is fit to drink
C has been filtered to remove bacteria
D is only ever is taken from lakes

106. In some … from sea…

Which o…

The proc…

A invo…
B is ca…
C invo…
D is de…

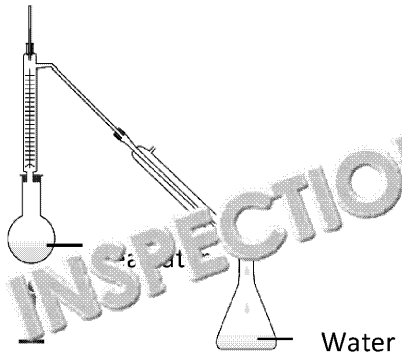
107. Water co… classed a…

What is t… of water…

[1 dm^3 =…

A 0.09…
B 0.9 …
C 9 m…
D 90 m…

108. The diagram below shows the apparatus that could be used to obtain water from seawater.



Obtaining water from seawater

Which of the following statements correctly describes the procedure?

A The thermometer should record 100 °C. ☐

B The method works because water has a higher boiling point than the salts dissolved in seawater. ☐

C Eventually the flask containing seawater would be completely empty. ☐

D The process involves condensation followed by evaporation. ☐

109. This question is about sewage treatment carried out in treatment plants in most countries.

Which of the following statements about sewage treatment is correct?

A The water is first screened to remove bacteria. ☐

B Only water from toilets is treated at sewage works. ☐

C Anaerobic digestion of sewage occurs at a sewage works. ☐

D Chlorine is added to the water to remove smells. ☐

110. **(Higher t**

Copper is
Phytomi

Which of

A Phyt
extr

B Phyt
low

C Phyt

D Biol

111. 60 kg of

Which of

[1 tonne

A 0.0

B 0.04

C 0.4

D 4 %

112. Which of
during th

Life-cycle

A ensu

B try t

C try t
man

D dete

113. The following table represents data from a life-cycle assessment for the disposal of 1000 biodegradable plastic bags.

	Burning to produce electricity	Landfill
Mass of carbon dioxide produced in kg	2.5	1.
Mass of sulfur dioxide produced in kg		0.03

Which of the following s[illegible]nts is correct?

Burning [illegible]stic[illegible]gs compared to putting 3000 bags in landfill would pr[illegible]

A 0.50 kg more carbon dioxide ☐
B 500 kg more carbon dioxide ☐
C 0.05 kg more sulfur dioxide ☐
D 90 kg less sulfur dioxide ☐

114. Recycling certain materials is becoming more and more important.

Which of the following substances is not recycled?

A paper ☐
B aluminium ☐
C metal ores ☐
D poly(propene) ☐

115. (Chemistry only)

Rusting is a chemical process [illegible] P[illegible]tain billions of pounds every year. Which of the fo[illegible] [illegible]tements about rusting is correct?

A Gre[illegible]y i[illegible] objects will slow down the rate of the rust[illegible]ss. ☐
B Iron would rust faster in contact with magnesium. ☐
C Iron would rust in the presence of water which contained no air. ☐
D Painting a rusty object will completely stop the rusting process. ☐

116. (Chemist

The diag[illegible]
gas in th[illegible]
volume [illegible]

The follo[illegible]

original [illegible]

final volu[illegible]

Which of[illegible]
after rus[illegible]

A 7.5 [illegible]
B 8.1 [illegible]
C 81.2
D 81.3

117. (Chemist

The corr[illegible]

Which of[illegible]

A Stee[illegible]
B Cor[illegible]
C All [illegible]
D Onc[illegible]

118. Most metals in everyday use are alloys.

Which of the following statements about alloys is true?

A Alloys are compounds of metals. ☐
B Brass is an alloy of iron. ☐
C Iron containing high amounts of carbon is strong but brittle. ☐
D Aluminium alloys are light but corrode easily. ☐

119. The proportion of gold in gold alloys is measured in carats. The percentage of gold in a gold ring is directly proportional to the number of carats.

A ring made of pure gold is said to be 24 carat.

What is the percentage of gold in a 10-carat gold ring?

A 2.4 % ☐
B 10 % ☐
C 41.7 % ☐
D 58.3 % ☐

120. The special properties of ceramics, polymers and composites make them extremely useful in everyday life.

Which of the following statements is correct about these substances?

A Wood is a composite material. ☐
B Clay ceramics are made from recycled glass. ☐
C Thermosetting polymers do not melt when heated. ☐
D Poly(ethene) is made on an industrial scale in only one form. ☐

121. (Chemistry only)

The Haber process is used to make ammonia.

Which of the following statements is correct about this process?

A The industrial process uses hydrogen obtained from natural gas. ☐
B The Haber process is carried out in an open system. ☐
C The Haber process uses a copper catalyst to speed up the reaction. ☐
D The Haber process is carried out at about 200 °C. ☐

122. (Chemis

The grap
is affecte

Which o
in the Ha

A Hab
poss
B Hab
reas
C Hab
easy
D Ever
dep

123. Which o

A The
B Onc
am
C Nitr
D Unr
proc

124. When Fritz Haber first made ammonia in the laboratory he could make 125 cm^3 of the gas per hour.

How many cm^3 of ammonia could the process make in one whole week?

Give your answer in standard form.

A 10.5×10^3 cm^3 ☐
B 1.05×10^4 cm^3 ☐
C 21×10^3 cm^3 ☐
D 2.1×10^4 cm^3 ☐

125. NPK fert[illegible] wit[illegible]used in agriculture. These fertilisers are mixtures of compou[illegible]ning the three elements vital to plant growth.

Which of the following mixtures of compounds could provide these three elements?

A ammonium nitrate and sodium chloride ☐
B sodium nitrate and ammonium phosphate ☐
C calcium phosphate and potassium chloride ☐
D potassium nitrate and sodium phosphate ☐

126. Which of the following statements about the manufacture and use of fertilisers is true?

A The compounds in fertilisers are not usually water soluble. ☐
B NPK fertilisers are made in one simple process. ☐
C Ammonium nitrate used in some fertilisers is made by reacting ammonia with nitric acid. ☐
D Ammonium phosphate used in fertilisers is made by reacting nitric acid with phosphate[illegible] ☐