This is a Class 1 exam

Lebanon Evangelical School
for Boys and Girls
Loueizeh - Baabda

Stage Exam 03
FEB2023

Do NOT write in this box. Your MARK will be placed here.

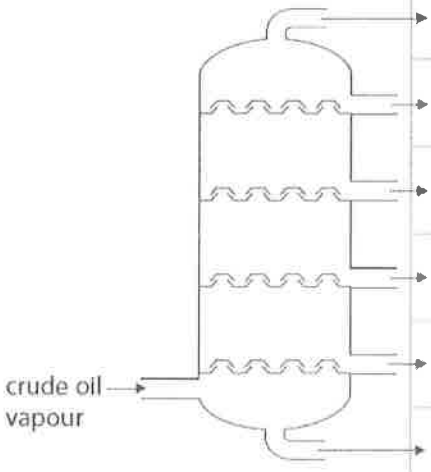
Subject :	Chemistry
Class :	10A
Teacher :	Mrs. Saydeh Nasrallah
Duration :	1 hour

Your name :		*Time taken to complete exam*
Your Class :		
Exam Room :		
How many sheets, including cover sheet :		

- Do not open this paper until the teacher in charge instructs you to do so.
- The most important thing to remember in taking an exam is NEVER PANIC.
- If you are caught cheating in this exam, you will be awarded zero for ALL exams that are taken on this day.

Answer ALL questions.

1. The diagram shows the separation of crude oil into fractions.



Fraction	Typical number of carbon atoms per molecule
A	1 – 4
B	5 – 10
C	11 – 16
D	17 – 20
E	21 – 30
F	more than 30

(a) What is the name of this method of separation?

(1)

.....

(b) Complete the table by giving the correct fraction, A, B, C, D, E or F, for each description. You may use each letter once, more than once or not at all.

(3)

Fraction	Description
	contains only gases
	is the most viscous
	contains bitumen

(c) State the relationship between the number of carbon atoms per molecule and the boiling point of the fraction.

(1)

.....

.....

(Total for Question 1 = 5 marks)

2. (a) Explain what is meant by the term **isomerism**.

(2)

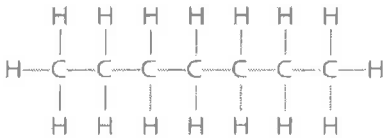
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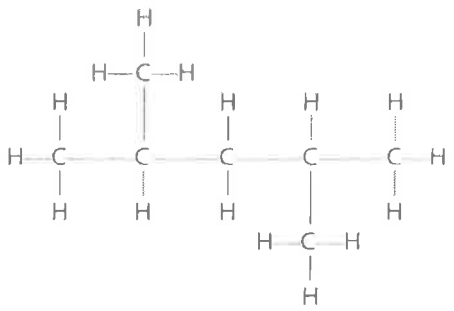
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(b) The displayed formula of heptane (C_7H_{16}) is

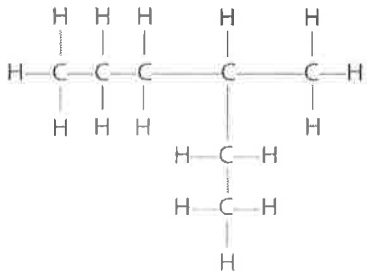


Which one of the displayed formulae below does **not** represent an isomer of heptane?
Place a cross ☒ in the box to indicate your answer.

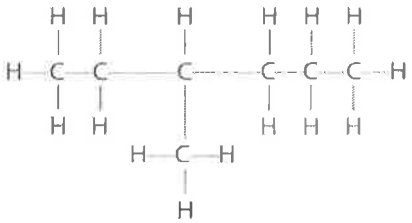
(1)



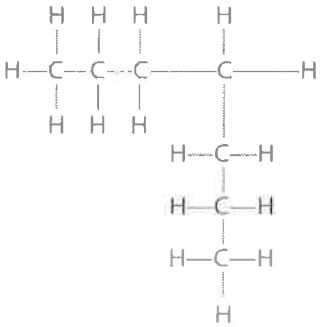
A ☐



B ☐



C ☐



D ☐

(c) Heptane belongs to a homologous series of compounds called alkanes.
The general formula of the alkanes is C_nH_{2n+2}

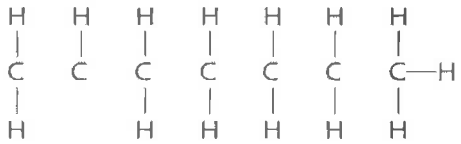
(i) Heptene belongs to a homologous series of compounds called alkenes.
Give the general formula of the alkenes.

(1)

.....

(ii) Complete the following diagram to show the structural formula of heptene (C_7H_{14}) by inserting lines to represent the covalent bonds between the carbon atoms.

(2)



(d) When heptene is added to bromine water, and the mixture is shaken, a reaction occurs.

State the type of reaction and give the colour of the bromine water before and after the reaction with heptene.

(3)

Type of reaction .....

Colour before .....

Colour after .....

(e) Explain, in terms of the bonds present, why heptane is described as saturated and heptene as unsaturated.

(2)

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.....

.....

.....

(Total for Question 2 = 11 marks)

3. The table gives information about barium salts.

Barium salt	Formula	Solubility in water	Toxic (poisonous)
barium chloride		soluble	yes
barium nitrate	$Ba(NO_3)_2$	soluble	yes
barium carbonate		insoluble	no
barium sulfate	$BaSO_4$	insoluble	no

(a) Complete the table by giving the formula of barium chloride and of barium carbonate.

(2)

(b) The human stomach contains hydrochloric acid.
Suggest why barium carbonate may cause poisoning when it enters the stomach.

(2)

.....

.....

.....

.....

(c) Before patients have stomach X-rays they are given a barium salt to swallow.
Which salt in the table is safe to use?

(1)

.....

(d) A student accidentally swallowed a small amount of barium hydroxide solution, which is poisonous.

Suggest a reason why a solution of magnesium sulfate could be given to the student to swallow as a first aid treatment.
Write an equation for the reaction that takes place.

(3)

Reason

.....

.....

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Equation

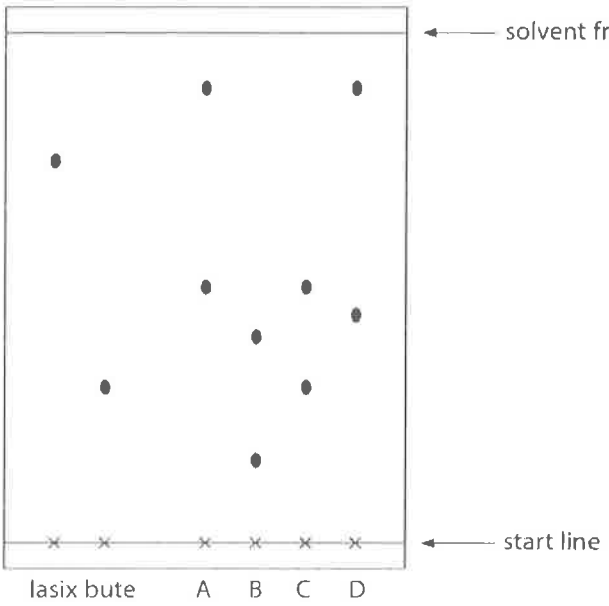
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(Total for Question 3 = 8 marks)

4. Illegal drugs are sometimes used to affect the performance of race horses.
These drugs can be detected in horse urine using chromatography.

- a concentrated sample of urine from each horse is spotted onto the start line of a sheet of chromatography paper
- known illegal drugs are also spotted onto the same paper
- ethanol is used as the solvent

The chromatogram shows urine samples, A, B, C and D, and the two illegal drugs lasix and bute.



(a) Explain which urine sample contains an illegal drug.

(2)

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(b) What is the meaning of the term **solvent**?

(1)

.....

.....

(c) The results for known drugs are given as R_f values.

$$R_f \text{ value} = \frac{\text{distance travelled by the drug}}{\text{distance travelled by the solvent}}$$

Calculate the R_f value for lasix.

(2)

R_f value for lasix = ...

(d) Suggest how the solubility of the drug in the solvent affects the distance travelled by the substance.

(1)

.....

.....

(Total for Question 4 = 6 marks)

5. Solutions of lead(II) nitrate and sodium chloride react together to form a precipitate of lead(II) chloride.
The equation for the reaction is

$$Pb(NO_3)_2(.....) + 2NaCl(.....) \rightarrow PbCl_2(.....) + 2NaNO_3(.....)$$

(a) Complete the above equation by adding the missing state symbols.

(1)

A student carries out a series of experiments to find how much precipitate is formed when different volumes of lead(II) nitrate are added.
She uses this method.

- place $15\,cm^3$ of sodium chloride solution into a boiling tube
- add $2.0\,cm^3$ of lead(II) nitrate solution
- allow the precipitate to settle
- measure the height of the precipitate
- repeat the experiment using different volumes of lead(II) nitrate solution

The table shows the student's results.

Volume in cm^3 of lead(II) nitrate added	Height of precipitate in cm
2.0	0.6
4.0	1.2
6.0	1.8
8.0	2.1
10.0	2.5
12.0	2.1
14.0	2.1

(b) Suggest why the height of the precipitate eventually stops increasing as more lead(II) nitrate solution is added.

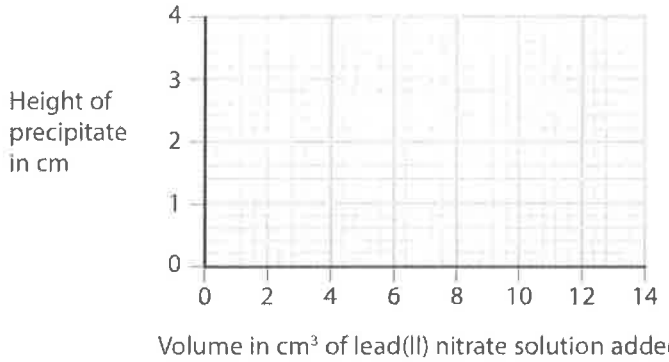
(1)

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(c)(i) Plot the student's results on the grid.
Draw a straight line of best fit through the origin and the first three points, and another straight line of best fit through the last four points.
Make sure that the two lines cross.

(4)



(ii) Draw a circle on the grid around the point that represents the anomalous result.

(1)

(iii) Which statement is a possible explanation for this anomalous result?

(1)

☐ **A** the precipitate was not allowed to settle before its height was measured
☐ **B** only $1\,cm^3$ of sodium chloride solution was added instead of $2\,cm^3$
☐ **C** $20\,cm^3$ of lead(II) nitrate solution was used
☐ **D** the reaction was carried out at a higher temperature

(iv) Why should the graph line pass through the origin?

(1)

.....

.....

(v) Use your graph to estimate the volume of lead(II) nitrate solution that would be required to react completely with $15\,cm^3$ of the sodium chloride solution.

(1)

volume = ... cm^3

(Total for Question 5 = 10 marks)

6. (a) A student uses the following method to prepare a sample of hydrated zinc nitrate crystals.

step 1 put $25 cm^3$ of dilute nitric acid into a beaker

step 2 add zinc carbonate until it is in excess

step 3 separate the dilute solution of zinc nitrate from the mixture

The student then obtains crystals from the dilute solution of zinc nitrate.

(i) How would the student know when she has added an excess of zinc carbonate?

(1)

.....

(ii) Name the separation method used in **step 3**.

(1)

.....

(iii) The student wants to obtain a pure, dry sample of hydrated zinc nitrate crystals from the dilute solution.
One method is to leave the solution so that all the water evaporates.
Describe another method, involving crystallisation, that the student could use.

(3)

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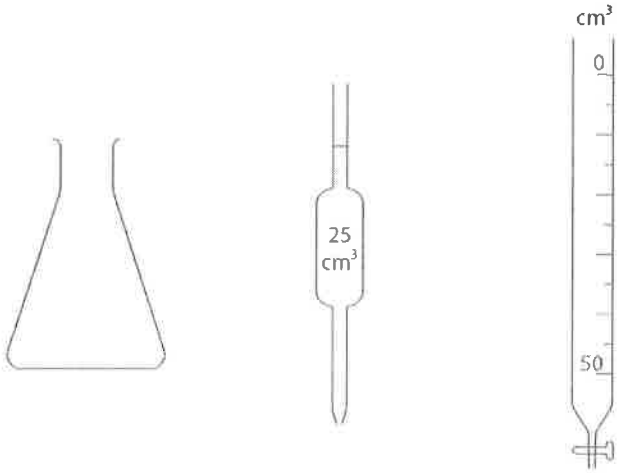
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(b) Another student does a titration to find the concentration of a solution of dilute sulfuric acid. The student uses these solutions and the apparatus shown below.

- dilute sulfuric acid
- potassium hydroxide solution of concentration $0.240\,mol/dm^3$
- methyl orange indicator



The student wants to find the volume of sulfuric acid needed to neutralise $25.0\,cm^3$ of the potassium hydroxide solution. Describe how the student should do this titration. Assume that all pieces of apparatus are clean and dry.

(5)

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(Total for Question 6 = 10 marks)

TOTAL FOR PAPER = 50 MARKS

The Periodic Table of the Elements

1	2											3	4	5	6	7	0
							1 **H** hydrogen 1										4 **He** helium 2
7 **Li** lithium 3	9 **Be** beryllium 4											11 **B** boron 5	12 **C** carbon 6	14 **N** nitrogen 7	16 **O** oxygen 8	19 **F** fluorine 9	20 **Ne** neon 10
23 **Na** sodium 11	24 **Mg** magnesium 12											27 **Al** aluminium 13	28 **Si** silicon 14	31 **P** phosphorus 15	32 **S** sulfur 16	35.5 **Cl** chlorine 17	40 **Ar** argon 18
39 **K** potassium 19	40 **Ca** calcium 20	45 **Sc** scandium 21	48 **Ti** titanium 22	51 **V** vanadium 23	52 **Cr** chromium 24	55 **Mn** manganese 25	56 **Fe** iron 26	59 **Co** cobalt 27	59 **Ni** nickel 28	63.5 **Cu** copper 29	65 **Zn** zinc 30	70 **Ga** gallium 31	73 **Ge** germanium 32	75 **As** arsenic 33	79 **Se** selenium 34	80 **Br** bromine 35	84 **Kr** krypton 36
85 **Rb** rubidium 37	88 **Sr** strontium 38	89 **Y** yttrium 39	91 **Zr** zirconium 40	93 **Nb** niobium 41	96 **Mo** molybdenum 42	[98] **Tc** technetium 43	101 **Ru** ruthenium 44	103 **Rh** rhodium 45	106 **Pd** palladium 46	108 **Ag** silver 47	112 **Cd** cadmium 48	115 **In** indium 49	119 **Sn** tin 50	122 **Sb** antimony 51	128 **Te** tellurium 52	127 **I** iodine 53	131 **Xe** xenon 54
133 **Cs** caesium 55	137 **Ba** barium 56	139 **La*** lanthanum 57	178 **Hf** hafnium 72	181 **Ta** tantalum 73	184 **W** tungsten 74	186 **Re** rhenium 75	190 **Os** osmium 76	192 **Ir** iridium 77	195 **Pt** platinum 78	197 **Au** gold 79	201 **Hg** mercury 80	204 **Tl** thallium 81	207 **Pb** lead 82	209 **Bi** bismuth 83	[209] **Po** polonium 84	[210] **At** astatine 85	[222] **Rn** radon 86
[223] **Fr** francium 87	[226] **Ra** radium 88	[227] **Ac*** actinium 89	[261] **Rf** rutherfordium 104	[262] **Db** dubnium 105	[266] **Sg** seaborgium 106	[264] **Bh** bohrium 107	[277] **Hs** hassium 108	[268] **Mt** meitnerium 109	[271] **Ds** darmstadtium 110	[272] **Rg** roentgenium 111	Elements with atomic numbers 112–116 have been reported but not fully authenticated						

Key

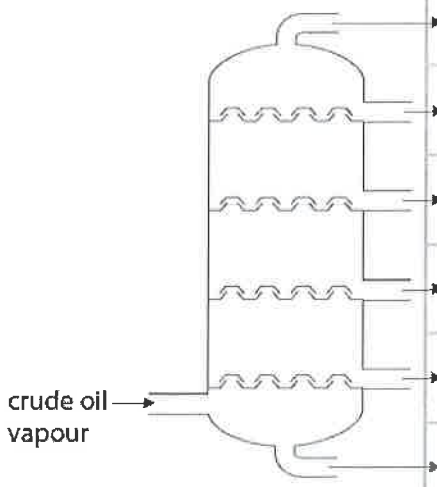
relative atomic mass
atomic symbol
name
atomic (proton) number

**** The lanthanoids (atomic numbers 58–71) and the actinoids (atomic numbers 90–103) have been omitted.***

The relative atomic masses of copper and chlorine have not been rounded to the nearest whole number.

Answer ALL questions.

1. The diagram shows the separation of crude oil into fractions.



Fraction	Typical number of carbon atoms per molecule
A	1 – 4
B	5 – 10
C	11 – 16
D	17 – 20
E	21 – 30
F	more than 30

(a) What is the name of this method of separation?

fractional distillation (1)

(1)

(b) Complete the table by giving the correct fraction, A, B, C, D, E or F, for each description. You may use each letter once, more than once or not at all.

(3)

Fraction	Description
A	contains only gases
F	is the most viscous
F	contains bitumen

(c) State the relationship between the number of carbon atoms per molecule and the boiling point of the fraction.

There is a positive correlation between the number of carbon atoms and the Tb (1)

(1)

(Total for Question 1 = 5 marks)

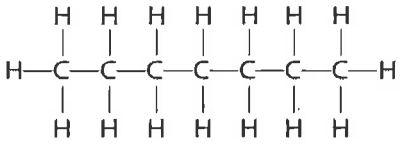
2. (a) Explain what is meant by the term **isomerism**.

(2)

The fact that 2 compounds have the same molecular formula but different structural formula

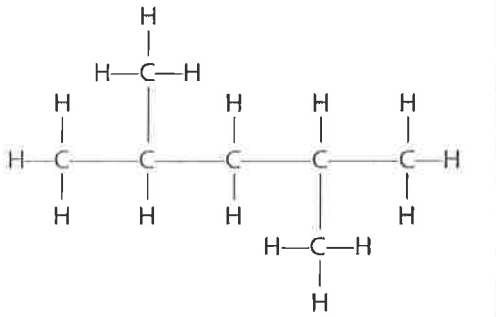
(2)

(b) The displayed formula of heptane (C_7H_{16}) is

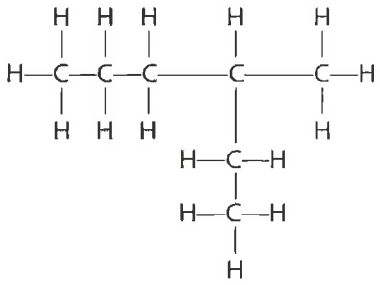


Which one of the displayed formulae below does **not** represent an isomer of heptane?
Place a cross ☒ in the box to indicate your answer.

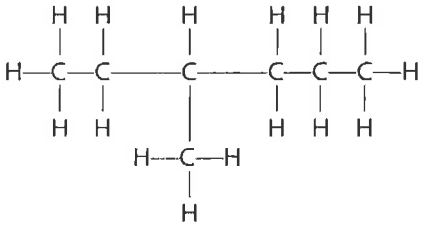
(1)



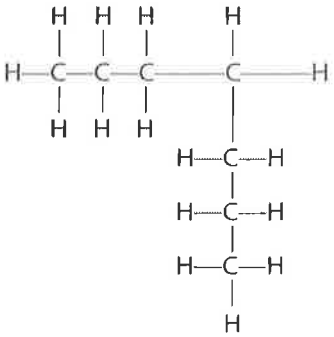
A ☐



B ☐



C ☐



D ☒

(1)

(c) Heptane belongs to a homologous series of compounds called alkanes.
The general formula of the alkanes is C_nH_{2n+2}

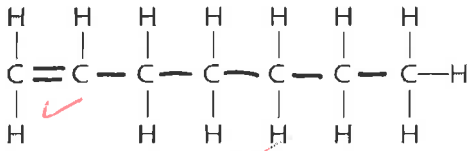
(i) Heptene belongs to a homologous series of compounds called alkenes.
Give the general formula of the alkenes.

(1)

C_nH_{2n} ✓ (1)

(ii) Complete the following diagram to show the structural formula of heptene (C_7H_{14}) by inserting lines to represent the covalent bonds between the carbon atoms.

(2)



(2)

(d) When heptene is added to bromine water, and the mixture is shaken, a reaction occurs.

State the type of reaction and give the colour of the bromine water before and after the reaction with heptene.

(3)

Type of reaction addition ✓ (1)

Colour before orange ✓ (1)

Colour after colourless ✓ (1)

(e) Explain, in terms of the bonds present, why heptane is described as saturated and heptene as unsaturated.

(2)

All carbon atoms are singly bonded with neighbouring carbon atoms, in heptane ✓ (1)
While in heptene, one pair of carbon atoms are double bonded ✓ (1)

(Total for Question 2 = 11 marks)

3. The table gives information about barium salts.

Barium salt	Formula	Solubility in water	Toxic (poisonous)
barium chloride	$BaCl_2$ (1)	soluble	yes
barium nitrate	$Ba(NO_3)_2$	soluble	yes
barium carbonate	$BaCO_3$ (1)	insoluble	no
barium sulfate	$BaSO_4$	insoluble	no

(a) Complete the table by giving the formula of barium chloride and of barium carbonate.

(2)

(b) The human stomach contains hydrochloric acid.
Suggest why barium carbonate may cause poisoning when it enters the stomach.

(2)

Soluble $BaCl_2$ (1) is produced when $BaCO_3$ reacts with the HCl in the stomach. Thus it's absorbed by the body & causes poisonning. (1)

(c) Before patients have stomach X-rays they are given a barium salt to swallow.
Which salt in the table is safe to use?

(1)

$BaSO_4$ (1)

(d) A student accidentally swallowed a small amount of barium hydroxide solution, which is poisonous.

Suggest a reason why a solution of magnesium sulfate could be given to the student to swallow as a first aid treatment.
Write an equation for the reaction that takes place.

(3)

Reason

2 products are formed ; $Mg(OH)_2$ used to ease to stomach ache (1) and $BaSO_4$ which is not assimilated by the body. (1)

Equation

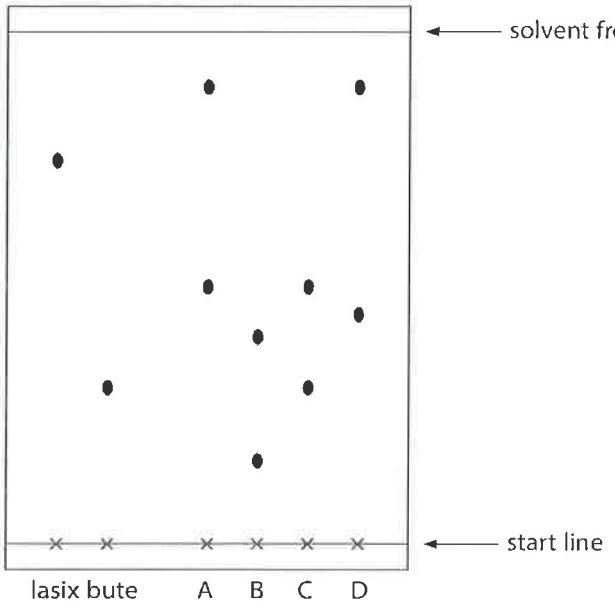
$MgSO_4 + Ba(OH)_2 \longrightarrow BaSO_{4\,(s)} + Mg(OH)_2$ (1)

(Total for Question 3 = 8 marks)

4. Illegal drugs are sometimes used to affect the performance of race horses.
These drugs can be detected in horse urine using chromatography.

- a concentrated sample of urine from each horse is spotted onto the start line of a sheet of chromatography paper
- known illegal drugs are also spotted onto the same paper
- ethanol is used as the solvent

The chromatogram shows urine samples, A, B, C and D, and the two illegal drugs lasix and bute.



(a) Explain which urine sample contains an illegal drug.

(2)

Urine sample C shows a spot, which is at the same height as the spot caused by the illegal drug "bute" 2

(b) What is the meaning of the term **solvent**?

(1)

A substance that dissolves other substances. 1

(c) The results for known drugs are given as R_f values.

$$R_f \text{ value} = \frac{\text{distance travelled by the drug}}{\text{distance travelled by the solvent}}$$

Calculate the R_f value for lasix.

(2)

$R_f(\text{lasix}) = \frac{5.2}{6.8}$ (1)

R_f value for lasix = 0.76 (1)

(d) Suggest how the solubility of the drug in the solvent affects the distance travelled by the substance.

(1)

The more soluble it is, the longer the travelled distance is. (1)

(Total for Question 4 = 6 marks)

5. Solutions of lead(II) nitrate and sodium chloride react together to form a precipitate of lead(II) chloride.
The equation for the reaction is

$$Pb(NO_3)_2(aq.) + 2NaCl(aq) \rightarrow PbCl_2(s..) + 2NaNO_3(aq)$$ (1)

(a) Complete the above equation by adding the missing state symbols.

(1)

A student carries out a series of experiments to find how much precipitate is formed when different volumes of lead(II) nitrate are added.
She uses this method.

- place $15\,cm^3$ of sodium chloride solution into a boiling tube
- add $2.0\,cm^3$ of lead(II) nitrate solution
- allow the precipitate to settle
- measure the height of the precipitate
- repeat the experiment using different volumes of lead(II) nitrate solution

The table shows the student's results.

Volume in cm^3 of lead(II) nitrate added	Height of precipitate in cm
2.0	0.6
4.0	1.2
6.0	1.8
8.0	2.1
10.0	2.5
12.0	2.1
14.0	2.1

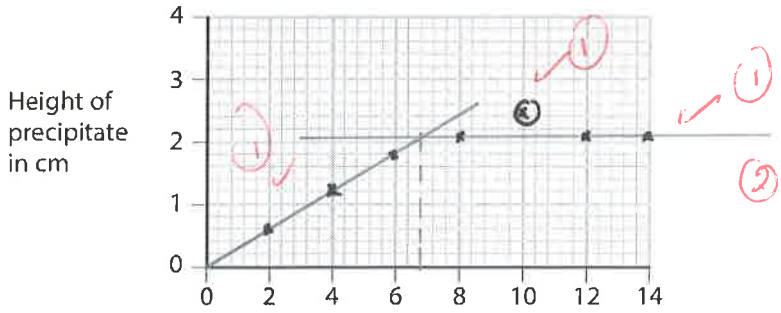
(b) Suggest why the height of the precipitate eventually stops increasing as more lead(II) nitrate solution is added.

(1)

The reaction had stopped, as all of NaCl present were used up. (1)

(c)(i) Plot the student's results on the grid.
Draw a straight line of best fit through the origin and the first three points, and another straight line of best fit through the last four points.
Make sure that the two lines cross.

(4)



(ii) Draw a circle on the grid around the point that represents the anomalous result.

(1)

(iii) Which statement is a possible explanation for this anomalous result?

(1)

- ☒ **A** the precipitate was not allowed to settle before its height was measured
- ☐ **B** only $1\,cm^3$ of sodium chloride solution was added instead of $2\,cm^3$
- ☐ **C** $20\,cm^3$ of lead(II) nitrate solution was used
- ☐ **D** the reaction was carried out at a higher temperature

(iv) Why should the graph line pass through the origin?

(1)

No precipitate would form without the addition of lead (II) nitrate

(v) Use your graph to estimate the volume of lead(II) nitrate solution that would be required to react completely with $15\,cm^3$ of the sodium chloride solution.

(1)

volume = 6.8 cm^3

(Total for Question 5 = 10 marks)

6. (a) A student uses the following method to prepare a sample of hydrated zinc nitrate crystals.

step 1 put $25 cm^3$ of dilute nitric acid into a beaker

step 2 add zinc carbonate until it is in excess

step 3 separate the dilute solution of zinc nitrate from the mixture

The student then obtains crystals from the dilute solution of zinc nitrate.

(i) How would the student know when she has added an excess of zinc carbonate?

(1)

A residue will be seen. ✓ (1)

(ii) Name the separation method used in **step 3**.

(1)

Filtration ✓ (1)

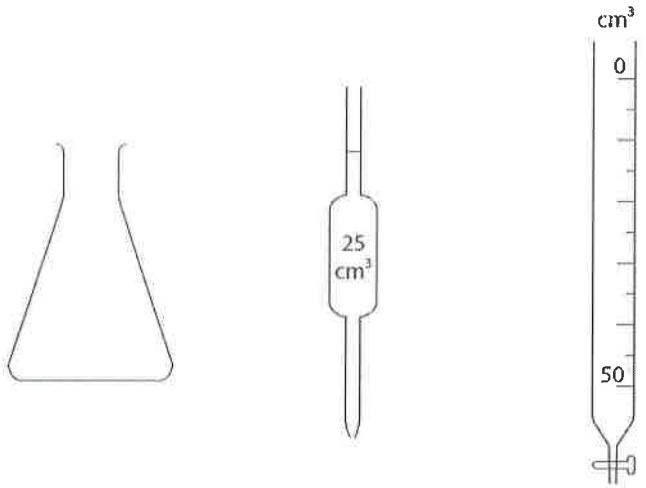
(iii) The student wants to obtain a pure, dry sample of hydrated zinc nitrate crystals from the dilute solution.
One method is to leave the solution so that all the water evaporates.
Describe another method, involving crystallisation, that the student could use.

(3)

Heat the dilute solution using bunsen burner ✓ (1)
Using a glass rod, dipped in the solution, check whether point of crystallisation is reached ✓
If tiny crystals are seen on the glass rod, remove the source of heat and transfer the solution into a large basin ✓ (1)
Cool and allow to evaporate
Filter the mixture to collect the hydrated crystals on filter paper. ✓
Dab the crystals with dry filter paper. ✓ (1)

(b) Another student does a titration to find the concentration of a solution of dilute sulfuric acid.
The student uses these solutions and the apparatus shown below.

- dilute sulfuric acid
- potassium hydroxide solution of concentration $0.240\,mol/dm^3$
- methyl orange indicator



The student wants to find the volume of sulfuric acid needed to neutralise $25.0\,cm^3$ of the potassium hydroxide solution. Describe how the student should do this titration.
Assume that all pieces of apparatus are clean and dry.

(5)

- Using a 25 cm^3 volumetric pipette, transfer 25.0 cm^3 of KOH into the erlenmeyer, where is put a magnet bar, and place the erlenmeyer on the magnetic stirrer
- Fill the burette with sulfuric acid solution, and adjust the volume at "0"
- Add few drops of methyl orange to the sample of KOH in the erlenmeyer, and the solution would turn yellow
- While the burette is placed vertically over the erlenmeyer and the stirrer is on at a low speed, we start adding

H_2SO_4 drop by drop until a persistent orange colour appears in the erlenmeyer. ✓

- ~~Record the~~ Stop adding H_2SO_4 and record the final reading off the burette. ✓

(Total for Question 6 = 10 marks)

TOTAL FOR PAPER = 50 MARKS

The Periodic Table of the Elements

1	2											3	4	5	6	7	0
							1 **H** hydrogen 1										4 **He** helium 2
7 **Li** lithium 3	9 **Be** beryllium 4											11 **B** boron 5	12 **C** carbon 6	14 **N** nitrogen 7	16 **O** oxygen 8	19 **F** fluorine 9	20 **Ne** neon 10
23 **Na** sodium 11	24 **Mg** magnesium 12											27 **Al** aluminium 13	28 **Si** silicon 14	31 **P** phosphorus 15	32 **S** sulfur 16	35.5 **Cl** chlorine 17	40 **Ar** argon 18
39 **K** potassium 19	40 **Ca** calcium 20	45 **Sc** scandium 21	48 **Ti** titanium 22	51 **V** vanadium 23	52 **Cr** chromium 24	55 **Mn** manganese 25	56 **Fe** iron 26	59 **Co** cobalt 27	59 **Ni** nickel 28	63.5 **Cu** copper 29	65 **Zn** zinc 30	70 **Ga** gallium 31	73 **Ge** germanium 32	75 **As** arsenic 33	79 **Se** selenium 34	80 **Br** bromine 35	84 **Kr** krypton 36
85 **Rb** rubidium 37	88 **Sr** strontium 38	89 **Y** yttrium 39	91 **Zr** zirconium 40	93 **Nb** niobium 41	96 **Mo** molybdenum 42	[98] **Tc** technetium 43	101 **Ru** ruthenium 44	103 **Rh** rhodium 45	106 **Pd** palladium 46	108 **Ag** silver 47	112 **Cd** cadmium 48	115 **In** indium 49	119 **Sn** tin 50	122 **Sb** antimony 51	128 **Te** tellurium 52	127 **I** iodine 53	131 **Xe** xenon 54
133 **Cs** caesium 55	137 **Ba** barium 56	139 **La*** lanthanum 57	178 **Hf** hafnium 72	181 **Ta** tantalum 73	184 **W** tungsten 74	186 **Re** rhenium 75	190 **Os** osmium 76	192 **Ir** iridium 77	195 **Pt** platinum 78	197 **Au** gold 79	201 **Hg** mercury 80	204 **Tl** thallium 81	207 **Pb** lead 82	209 **Bi** bismuth 83	[209] **Po** polonium 84	[210] **At** astatine 85	[222] **Rn** radon 86
[223] **Fr** francium 87	[226] **Ra** radium 88	[227] **Ac*** actinium 89	[261] **Rf** rutherfordium 104	[262] **Db** dubnium 105	[266] **Sg** seaborgium 106	[264] **Bh** bohrium 107	[277] **Hs** hassium 108	[268] **Mt** meitnerium 109	[271] **Ds** darmstadtium 110	[272] **Rg** roentgenium 111	Elements with atomic numbers 112–116 have been reported but not fully authenticated						

Key

relative atomic mass
atomic symbol
name
atomic (proton) number

** The lanthanoids (atomic numbers 58–71) and the actinoids (atomic numbers 90–103) have been omitted.*

The relative atomic masses of copper and chlorine have not been rounded to the nearest whole number.