Cambridge Assessment International Education

Cambridge O Level

CHEMISTRY **5070/11**

Paper 1 Multiple Choice **October/November 2021**

1 hour

You must answer on the multiple choice answer sheet.

You will need: Multiple choice answer sheet
Soft clean eraser
Soft pencil (type B or HB is recommended)

INSTRUCTIONS

- There are **forty** questions on this paper. Answer **all** questions.
- For each question there are four possible answers **A**, **B**, **C** and **D**. Choose the **one** you consider correct and record your choice in soft pencil on the multiple choice answer sheet.
- Follow the instructions on the multiple choice answer sheet.
- Write in soft pencil.
- Write your name, centre number and candidate number on the multiple choice answer sheet in the spaces provided unless this has been done for you.
- Do **not** use correction fluid.
- Do **not** write on any bar codes.
- You may use a calculator.

INFORMATION

- The total mark for this paper is 40.
- Each correct answer will score one mark.
- Any rough working should be done on this question paper.
- The Periodic Table is printed in the question paper.

IB21 11_5070_11/5RP
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1 A student makes aqueous copper(II) sulfate. The student adds an excess of copper(II) oxide powder to warm sulfuric acid and stirs the mixture.

Which apparatus should be used to separate aqueous copper(II) sulfate from the excess copper(II) oxide?

A burette

B distillation apparatus

C filter funnel and paper

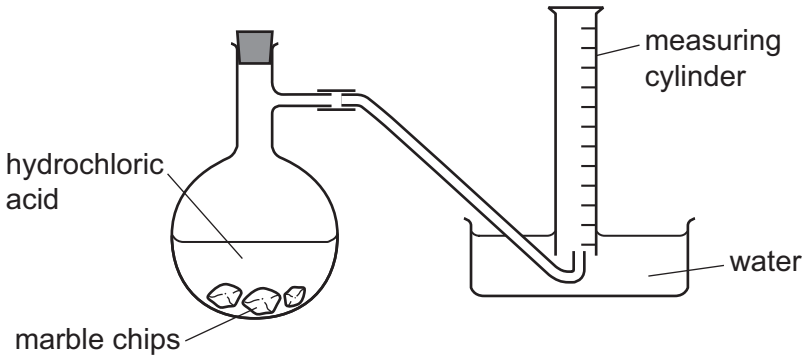
D measuring cylinder

2 A student follows the rate of the reaction between marble chips, $CaCO_3$, and dilute hydrochloric acid.

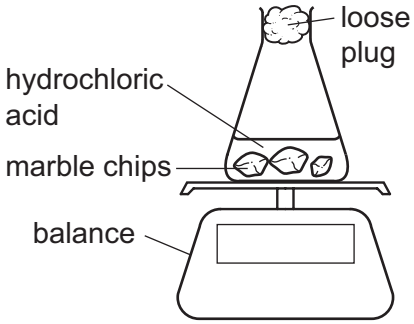
$$CaCO_3 + 2HCl \rightarrow CaCl_2 + CO_2 + H_2O$$

Which diagrams show apparatus that, with a stopwatch, is suitable for this experiment?

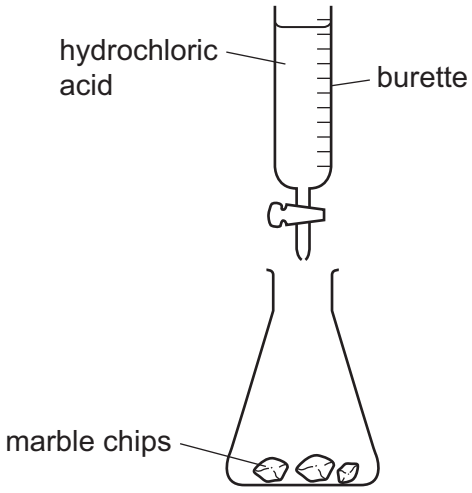
1



2



3



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

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3 A mixture of three liquids is separated by fractional distillation.

Which statements are correct?

1 The mixture boils at constant temperature throughout the separation.

2 The temperature at which the mixture boils increases during the separation.

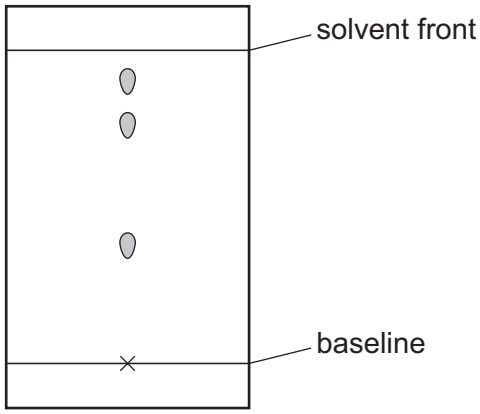
3 The liquid with the highest boiling point is collected first.

4 The liquid with the lowest boiling point is collected first.

A 1 and 3 **B** 1 and 4 **C** 2 and 3 **D** 2 and 4

4 A mixture of four coloured dyes is analysed by chromatography.

The result is shown.



Which change will allow the four dyes to be seen?

A Measure the R_f values of the spots carefully.

B Run the chromatogram for a longer time.

C Run the chromatogram using a different solvent.

D Use a locating agent.

5 A compound X, when heated with an aqueous solution of compound Y, produces a gas that turns red litmus blue.

1 Y could be potassium hydroxide.

2 X is an acid.

3 X could be an ammonium salt.

4 X could be sodium nitrate.

Which statements are correct?

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

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6 An aqueous solution of zinc chloride is tested by adding reagents.

Which observation is correct?

	reagent added to zinc chloride (aq)	observations
A	acidified aqueous barium nitrate	forms a white precipitate
B	aqueous ammonia	forms a white precipitate, soluble in excess of the reagent
C	aqueous sodium hydroxide	forms a white precipitate, insoluble in excess of the reagent
D	powdered copper	forms a grey precipitate

7 The rate of diffusion of carbon dioxide and methane is investigated at two different temperatures, one high and one low.

Which row correctly shows the gas that diffuses faster and the temperature at which diffusion takes place most rapidly?

	gas	temperature
A	carbon dioxide	high
B	carbon dioxide	low
C	methane	high
D	methane	low

8 Which statement about atoms and ions is correct?

A Atoms and ions of the same element must have different numbers of neutrons.

B Isotopes of different elements must have different numbers of neutrons.

C The charge on a positive ion = (nucleon number – number of neutrons – number of electrons).

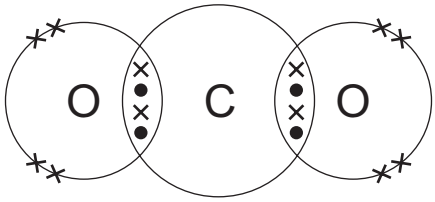
D The number of protons and number of neutrons in an atom must be the same.

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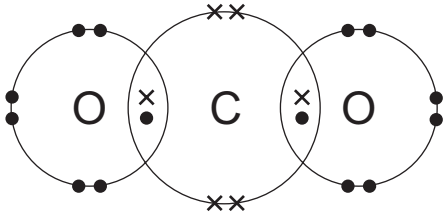
9 The bonding in a molecule of carbon dioxide can be represented by a dot-and-cross diagram.

Which diagram is correct?

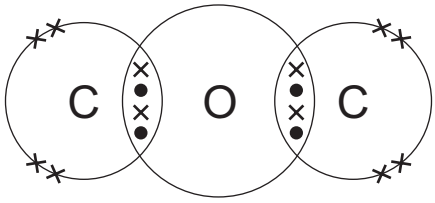
A



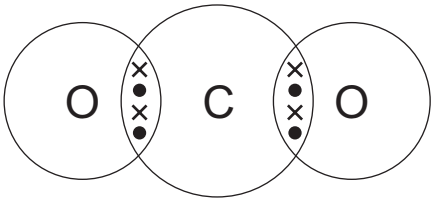
B



C



D



10 Which statement about the structure or bonding of metals is correct?

A A metal lattice consists of negative ions in a ‘sea of electrons’.

B Electrons in a metal move randomly through the lattice.

C Metals are malleable because the ions present are mobile.

D The ions in a metal move when positive and negative electrodes are attached.

11 The relative atomic mass of chlorine is 35.5.

What is the mass of 2.0 mol of chlorine gas?

A 17.75 g **B** 35.5 g **C** 71 g **D** 142 g

12 Methane burns in oxygen.

$$CH_4(g) + 2O_2(g) \rightarrow CO_2(g) + 2H_2O(l)$$

10 cm^3 of methane is reacted with 25 cm^3 of oxygen.

What is the total volume of gas that would be measured after the reaction?

(Assume all volumes of gases are measured at room temperature and pressure.)

A 10 cm^3 **B** 15 cm^3 **C** 30 cm^3 **D** 35 cm^3

13 An aqueous solution is made by dissolving 3.4 g of sodium hydroxide, NaOH, to make 500 cm^3 of solution.

What is the concentration, in mol / dm^3, of this sodium hydroxide solution?

A 0.0068 **B** 0.085 **C** 0.17 **D** 6.8

14 Which statement about electrolysis reactions is correct?

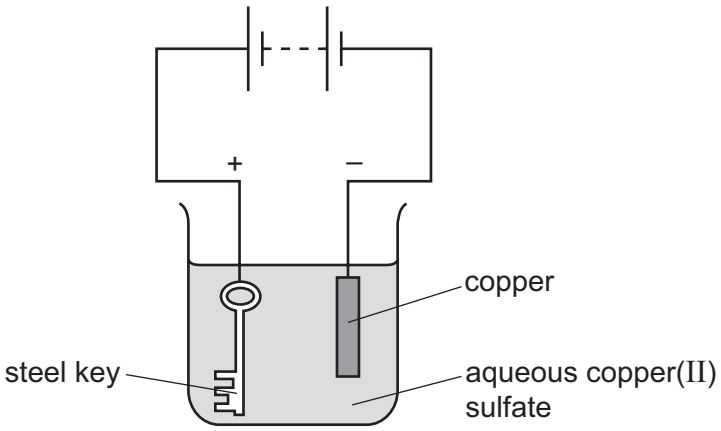
A Bromine is formed at the anode when molten lead bromide is electrolysed.

B Positive ions are discharged at the positive electrode.

C Sodium is formed at the cathode when aqueous sodium chloride is electrolysed.

D Sulfur dioxide is formed as a gas when dilute sulfuric acid is electrolysed.

15 The apparatus shown is set up to plate a steel key with copper.



The key does not get coated with copper.

Which change needs to be made to plate the key?

A Increase the concentration of the aqueous copper(II) sulfate.

B Increase the voltage.

C Replace the solution with dilute sulfuric acid.

D Reverse the electrical connections.

16 Which process is endothermic?

A atoms bonding to form molecules

B the chemical reaction occurring in a fuel cell

C the reaction of carbon dioxide and water to produce glucose and oxygen

D the reaction of methane with oxygen to produce water and carbon dioxide

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17 The reaction of hydrogen with chlorine to form gaseous hydrogen chloride is exothermic.

Which statement is correct?

A The total energy of bond formation is greater than the total energy of bond breaking.

B The total energy of bond breaking is greater than the total energy of bond formation.

C The temperature of the reaction mixture falls during the reaction.

D The temperature of the reaction mixture remains unchanged during the reaction.

18 The equation shows the reaction for the manufacture of ammonia.

$$N_2(g) + 3H_2(g) \rightleftharpoons 2NH_3(g)$$

Which change will decrease the activation energy of the reaction?

A addition of a catalyst

B decrease in temperature

C increase in concentration

D increase in pressure

19 Which statements about oxidation and reduction are correct?

1 Reduction can involve the loss of oxygen.

2 Oxidation can involve the loss of hydrogen.

3 Reduction can involve the loss of electrons.

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

20 Aqueous ammonium nitrite, NH_4NO_2, decomposes when heated.

$$NH_4NO_2(aq) \rightarrow N_2(g) + 2H_2O(l)$$

In this salt, the anion is .....1..... .

The nitrogen atoms in the .....2..... ion are oxidised during the reaction.

Which formulae correctly complete gaps 1 and 2?

	1	2
A	NH_4^+	NH_4^+
B	NH_4^+	NO_2^-
C	NO_2^-	NH_4^+
D	NO_2^-	NO_2^-

21 Elements X and Y react together in a reversible reaction to form XY_2.

$$X + 2Y \rightleftharpoons XY_2$$

1.0 mol of X is mixed with 1.0 mol of Y and the mixture is left to react until an equilibrium position is reached.

Which statements about this reaction are correct?

1 After the equilibrium position has been reached, the reaction stops.

2 At equilibrium there is more than 0.5 mol of X present.

3 At equilibrium there is less than 1.0 mol of XY_2 present.

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

22 Two solutions are prepared.

- Solution P is 0.050 mol / dm^3 hydrochloric acid.
- Solution Q is 0.100 mol / dm^3 butanoic acid.

A 2 cm strip of magnesium ribbon is put into 100 cm^3 of each solution. Fizzing is seen in both solutions but the fizzing is faster in solution P than it is in solution Q.

Which statement helps to explain this observation?

A Magnesium reacts with solution P to form a salt, but does not form a salt with solution Q.

B More particles are dissociated in solution P than are dissociated in solution Q.

C Solution Q contains a stronger acid than solution P.

D The particles are closer together in solution Q than they are in solution P.

23 Which compound can be formed by precipitation?

A $NaCl$ **B** K_2SO_4 **C** $Ca(NO_3)_2$ **D** $PbSO_4$

24 In a neutralisation reaction, which change in particles occurs?

A atoms $\rightarrow$ molecules

B ions $\rightarrow$ molecules

C atoms $\rightarrow$ ions

D ions $\rightarrow$ atoms

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25 In order to decide which would be the better nitrogenous fertiliser, a student calculates the percentage by mass of nitrogen in both ammonium sulfate and ammonium nitrate.

Which row gives the correct results?

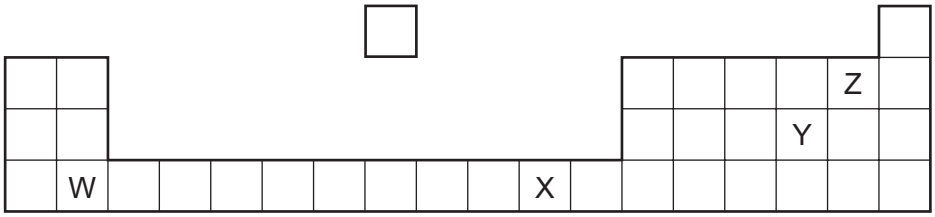
	percentage by mass of nitrogen in ammonium sulfate	percentage by mass of nitrogen in ammonium nitrate
A	10.6	17.5
B	10.6	35.0
C	21.2	35.0
D	21.2	17.5

26 The manufacture of sulfuric acid by the Contact process involves the use of three different raw materials.

How many of these raw materials are elements, how many are compounds and how many are mixtures?

	elements	compounds	mixtures
A	0	3	0
B	1	2	0
C	1	1	1
D	2	0	1

27 The diagram shows part of the Periodic Table.



Which two letters represent elements that can react together to form covalent compounds?

A W and X **B** W and Y **C** X and Y **D** Y and Z

28 Which statement about elements in the Periodic Table is correct?

A Elements at the left-hand side of the Periodic Table are more metallic than those, in the same period, near the right-hand side.

B Elements at the top of a group lose electrons more readily than those, in the same group, that are lower in the Periodic Table.

C Elements in the same group of the Periodic Table have the same number of completed shells of electrons.

D Elements in the same period of the Periodic Table have the same number of electrons in the outer shell.

29 Which statement about the properties of the elements in Group VIII of the Periodic Table, helium to xenon, is correct?

A Argon reacts with iron to form a compound.

B Helium is less dense than air.

C The elements change from gas to solid down the group.

D The elements exist as covalent molecules.

30 Which two statements indicate that metal M may have a proton number between 21 and 30?

1 It conducts electricity.

2 It does not react with water.

3 It forms two basic oxides with formulae MO and M_2O_3.

4 It forms two coloured sulfates.

A 1 and 2 **B** 1 and 4 **C** 2 and 3 **D** 3 and 4

31 Different metals react with water in different ways.

Which statement is correct?

A Calcium does not react with cold water.

B Iron reacts slowly with steam to produce an oxide of iron and hydrogen.

C Magnesium reacts with steam to produce magnesium hydroxide and oxygen.

D Sodium reacts with cold water to produce aqueous sodium oxide and hydrogen.

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32 Metal X is more reactive than zinc but less reactive than sodium.

What would be the best method for obtaining metal X from its ore?

A electrolysis of an aqueous solution of a salt of X

B electrolysis of the molten oxide of X

C heating the oxide of X in hydrogen

D heating the oxide of X with powdered carbon

33 Steel is often galvanised.

Which statements about galvanising are correct?

1 Galvanising makes a steel alloy.

2 Galvanising provides a sacrificial protection against rusting.

3 Galvanising coats a layer of zinc onto steel.

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

34 In the extraction of aluminium from aluminium oxide, the following three reactions take place.

1 $Al^{3+} + 3e^- \rightarrow Al$

2 $2O^{2-} \rightarrow O_2 + 4e^-$

3 $C + O_2 \rightarrow CO_2$

Which reactions take place at the positive electrode?

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

35 The carbon cycle regulates the amount of carbon dioxide in the atmosphere.

Combustion, photosynthesis and respiration are involved in this cycle.

How do these processes affect the amount of carbon dioxide in the atmosphere?

	combustion	photosynthesis	respiration
A	increases	increases	increases
B	increases	decreases	increases
C	decreases	increases	decreases
D	decreases	decreases	decreases

36 Which statement about alkanes is correct?

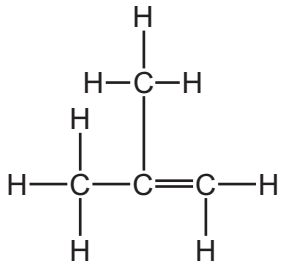
A Alkanes are described as being saturated because they are insoluble in water.

B Alkanes react with chlorine in an addition reaction.

C The alkane containing 10 carbon atoms in each molecule has a higher viscosity than the alkane containing 20 carbon atoms.

D The formula of an alkane with 35 carbon atoms in each molecule is $C_{35}H_{72}$.

37 The structure of compound X is shown.



Four statements are made about compound X.

1 X burns in air to form carbon dioxide and water.

2 X turns bromine water from colourless to brown.

3 X is propene.

4 The number of C–C single bonds is increased by reacting X with hydrogen.

Which statements are correct?

A 1 and 2 **B** 1 and 4 **C** 2 and 3 **D** 3 and 4

38 When ethene reacts with steam to form ethanol, which type of reaction takes place?

A addition

B fermentation

C polymerisation

D reduction

39 Which compound could be a flavouring in a non-alcoholic fruit drink?

A CH_3CH_2OH

B $CH_3CH_2CH_2CH_2COOH$

C $CH_3COOCH_2CH_2CH_2CH_2CH_3$

D $CH_3CH_2CH_2CH_2CH_2OH$

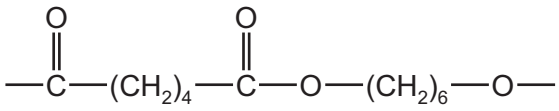
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40 P is a polymer that:

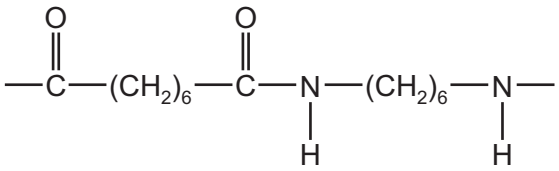
- has six carbon atoms in each of the monomers from which it is formed
- is **not** a polyester
- is formed using condensation polymerisation.

What is the partial structure of P?

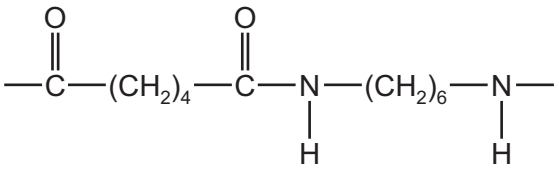
A



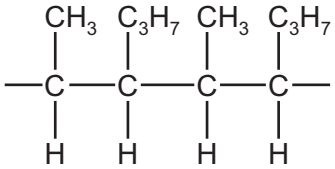
B



C



D



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The Periodic Table of Elements

Group																	
I	II											III	IV	V	VI	VII	VIII
							1 H hydrogen 1										2 He helium 4
3 Li lithium 7	4 Be beryllium 9											5 B boron 11	6 C carbon 12	7 N nitrogen 14	8 O oxygen 16	9 F fluorine 19	10 Ne neon 20
11 Na sodium 23	12 Mg magnesium 24											13 Al aluminium 27	14 Si silicon 28	15 P phosphorus 31	16 S sulfur 32	17 Cl chlorine 35.5	18 Ar argon 40
19 K potassium 39	20 Ca calcium 40	21 Sc scandium 45	22 Ti titanium 48	23 V vanadium 51	24 Cr chromium 52	25 Mn manganese 55	26 Fe iron 56	27 Co cobalt 59	28 Ni nickel 59	29 Cu copper 64	30 Zn zinc 65	31 Ga gallium 70	32 Ge germanium 73	33 As arsenic 75	34 Se selenium 79	35 Br bromine 80	36 Kr krypton 84
37 Rb rubidium 85	38 Sr strontium 88	39 Y yttrium 89	40 Zr zirconium 91	41 Nb niobium 93	42 Mo molybdenum 96	43 Tc technetium –	44 Ru ruthenium 101	45 Rh rhodium 103	46 Pd palladium 106	47 Ag silver 108	48 Cd cadmium 112	49 In indium 115	50 Sn tin 119	51 Sb antimony 122	52 Te tellurium 128	53 I iodine 127	54 Xe xenon 131
55 Cs caesium 133	56 Ba barium 137	57–71 lanthanoids	72 Hf hafnium 178	73 Ta tantalum 181	74 W tungsten 184	75 Re rhenium 186	76 Os osmium 190	77 Ir iridium 192	78 Pt platinum 195	79 Au gold 197	80 Hg mercury 201	81 Tl thallium 204	82 Pb lead 207	83 Bi bismuth 209	84 Po polonium –	85 At astatine –	86 Rn radon –
87 Fr francium –	88 Ra radium –	89–103 actinoids	104 Rf rutherfordium –	105 Db dubnium –	106 Sg seaborgium –	107 Bh bohrium –	108 Hs hassium –	109 Mt meitnerium –	110 Ds darmstadtium –	111 Rg roentgenium –	112 Cn copernicium –		114 Fl flerovium –		116 Lv livermorium –		

Key

atomic number
atomic symbol
name
relative atomic mass

lanthanoids	57 La lanthanum 139	58 Ce cerium 140	59 Pr praseodymium 141	60 Nd neodymium 144	61 Pm promethium –	62 Sm samarium 150	63 Eu europium 152	64 Gd gadolinium 157	65 Tb terbium 159	66 Dy dysprosium 163	67 Ho holmium 165	68 Er erbium 167	69 Tm thulium 169	70 Yb ytterbium 173	71 Lu lutetium 175
actinoids	89 Ac actinium –	90 Th thorium 232	91 Pa protactinium 231	92 U uranium 238	93 Np neptunium –	94 Pu plutonium –	95 Am americium –	96 Cm curium –	97 Bk berkelium –	98 Cf californium –	99 Es einsteinium –	100 Fm fermium –	101 Md mendelevium –	102 No nobelium –	103 Lr lawrencium –

The volume of one mole of any gas is 24 dm^3 at room temperature and pressure (r.t.p.).