

Write your name here

Surname

Other names

**Pearson Edexcel
International GCSE**

Centre Number

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Candidate Number

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Chemistry

Unit: 4CH0

Paper: 2C

Wednesday 13 June 2018 – Morning

Time: 1 hour

Paper Reference

4CH0/2C

You must have:

Calculator, ruler

Total Marks

Instructions

- Use **black** ink or ball-point pen.
- **Fill in the boxes** at the top of this page with your name, centre number and candidate number.
- Answer **all** questions.
- Answer the questions in the spaces provided – *there may be more space than you need.*
- Show all the steps in any calculations and state the units.
- Some questions must be answered with a cross in a box ☒. If you change your mind about an answer, put a line through the box ☒ and then mark your new answer with a cross ☒.

Information

- The total mark for this paper is 60.
- The marks for **each** question are shown in brackets – *use this as a guide as to how much time to spend on each question.*

Advice

- Read each question carefully before you start to answer it.
- Write your answers neatly and in good English.
- Try to answer every question.
- Check your answers if you have time at the end.

Turn over ►

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THE PERIODIC TABLE

Period 1 2 3 4 5 6 7 0

Group

4	He	Helium	2
---	----	--------	---

1	H	Hydrogen	1
---	---	----------	---

7	Li	Lithium	3	9	Be	Beryllium	4	20	Ne	Neon	10
23	Na	Sodium	11	24	Mg	Magnesium	12	31	P	Phosphorus	15
39	K	Potassium	19	40	Ca	Calcium	20	70	Ga	Gallium	31
86	Rb	Rubidium	37	88	Sr	Strontium	38	115	In	Indium	49
133	Cs	Caesium	55	137	Ba	Barium	56	204	Tl	Thallium	81
223	Fr	Francium	87	226	Ra	Radium	88	207	Pb	Lead	82
227	Ac	Actinium	89	232	Th	Thorium	90	208	Po	Polonium	84
45	Sc	Scandium	21	46	Ti	Titanium	22	56	Fe	Iron	26
89	Y	Yttrium	39	90	Zr	Zirconium	40	101	Ru	Ruthenium	44
139	La	Lanthanum	57	140	Ce	Cerium	58	112	Cd	Cadmium	48
179	Hf	Hafnium	72	180	Ta	Tantalum	73	195	Pt	Platinum	78
181	Ta	Tantalum	73	182	W	Tungsten	74	197	Au	Gold	79
186	Re	Rhenium	75	188	Os	Osmium	76	198	Ir	Iridium	77
210	Po	Polonium	84	211	At	Astatine	85	209	Bi	Bismuth	83
222	Rn	Radon	86	223	Fr	Francium	87	224	Ra	Radium	88
238	U	Uranium	92	239	Np	Neptunium	93	240	Pu	Plutonium	94
244	Pu	Plutonium	94	245	Am	Americium	95	246	Cm	Curium	96
254	Cf	Californium	98	255	Bk	Berkelium	99	256	Cf	Californium	98
262	Lr	Lutetium	71	263	Hf	Hafnium	72	264	Lu	Lutetium	71
267	Lr	Lutetium	71	268	Hf	Hafnium	72	269	Lu	Lutetium	71
270	Lr	Lutetium	71	271	Hf	Hafnium	72	272	Lu	Lutetium	71
287	Lr	Lutetium	71	288	Hf	Hafnium	72	289	Lu	Lutetium	71
293	Lr	Lutetium	71	294	Hf	Hafnium	72	295	Lu	Lutetium	71
304	Lr	Lutetium	71	305	Hf	Hafnium	72	306	Lu	Lutetium	71
315	Lr	Lutetium	71	316	Hf	Hafnium	72	317	Lu	Lutetium	71
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524	Lr	Lutetium	71	525	Hf	Hafnium	72	526	Lu	Lutetium	71
535	Lr	Lutetium	71	536	Hf	Hafnium	72	537	Lu	Lutetium	71
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568	Lr	Lutetium	71	569	Hf	Hafnium	72	570	Lu	Lutetium	71
579	Lr	Lutetium	71	580	Hf	Hafnium	72	581	Lu	Lutetium	71
590	Lr	Lutetium	71	591	Hf	Hafnium	72	592	Lu	Lutetium	71
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700	Lr	Lutetium	71	701	Hf	Hafnium	72	702	Lu	Lutetium	71
711	Lr	Lutetium	71	712	Hf	Hafnium	72	713	Lu	Lutetium	71
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777	Lr	Lutetium	71	778	Hf	Hafnium	72	779	Lu	Lutetium	71
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799	Lr	Lutetium	71	800	Hf	Hafnium	72	801	Lu	Lutetium	71
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854	Lr	Lutetium	71	855	Hf	Hafnium	72	856	Lu	Lutetium	71
865	Lr	Lutetium	71	866	Hf	Hafnium	72	867	Lu	Lutetium	71
876	Lr	Lutetium	71	877	Hf	Hafnium	72	878	Lu	Lutetium	71
887	Lr	Lutetium	71	888	Hf	Hafnium	72	889	Lu	Lutetium	71
898	Lr	Lutetium	71	899	Hf	Hafnium	72	900	Lu	Lutetium	71
909	Lr	Lutetium	71	910	Hf	Hafnium	72	911	Lu	Lutetium	71
920	Lr	Lutetium	71	921	Hf	Hafnium	72	922	Lu	Lutetium	71
931	Lr	Lutetium	71	932	Hf	Hafnium	72	933	Lu	Lutetium	71
942	Lr	Lutetium	71	943	Hf	Hafnium	72	944	Lu	Lutetium	71
953	Lr	Lutetium	71	954	Hf	Hafnium	72	955	Lu	Lutetium	71
964	Lr	Lutetium	71	965	Hf	Hafnium	72	966	Lu	Lutetium	71
975	Lr	Lutetium	71	976	Hf	Hafnium	72	977	Lu	Lutetium	71
986	Lr	Lutetium	71	987	Hf	Hafnium	72	988	Lu	Lutetium	71
997	Lr	Lutetium	71	998	Hf	Hafnium	72	999	Lu	Lutetium	71

Key

Relative atomic mass
Symbol
Name
Atomic number

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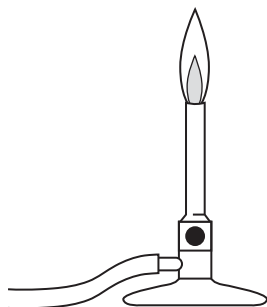
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Answer ALL questions.

1 The diagram shows a Bunsen burner.



(a) The Bunsen burner uses methane as a fuel.

Methane has the formula CH_4

Give the names of the two elements in methane.

(2)

..... and

(b) When methane burns it reacts with a gas in the air.

Give the name of this gas.

(1)

.....

(c) (i) Name the two substances that form when methane burns in plenty of air.

(2)

1

2

(ii) Name the poisonous gas that forms when methane burns in a shortage of air.

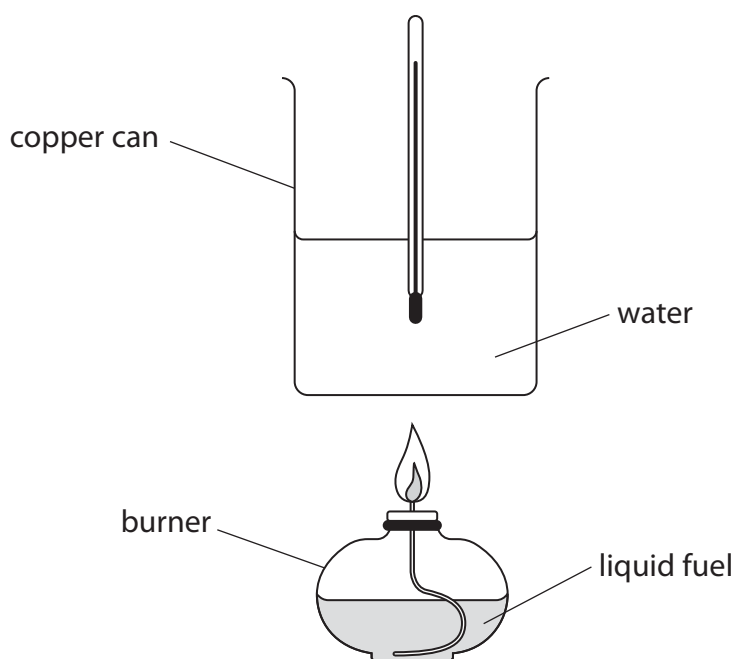
(1)

.....

(Total for Question 1 = 6 marks)



- 2 A student uses this apparatus to investigate the burning of four different liquid fuels, W, X, Y and Z.



The table shows the student's results.

Fuel	Initial temperature in °C	Final temperature in °C	Increase in temperature in °C
W	19.0	31.3	12.3
X	18.4	28.7	
Y	19.5	35.4	
Z	18.7	29.8	

- (a) Complete the table by giving the increase in temperature for fuels X, Y and Z. (1)
- (b) The student uses the same mass of water and burns each fuel for the same period of time. Explain which fuel releases the most heat energy. (2)

.....

.....

.....

.....



(c) What is the name given to reactions that release heat energy?

(1)

- A decomposition
- B endothermic
- C exothermic
- D reduction

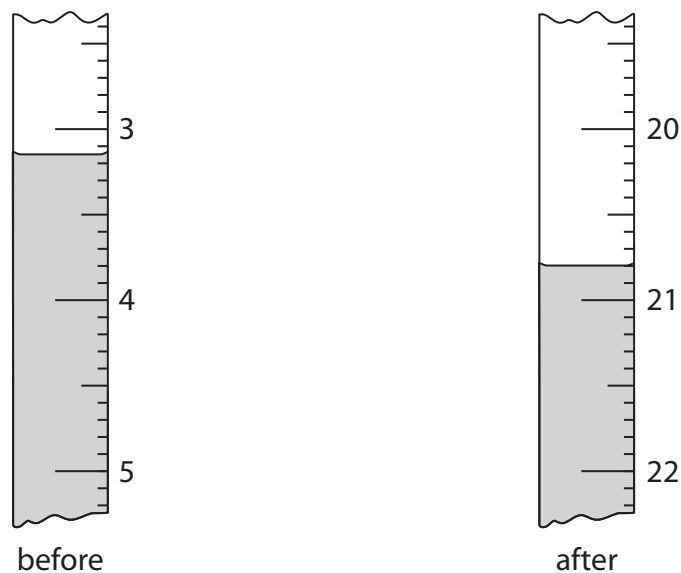
(Total for Question 2 = 4 marks)



3 A student makes an alkali solution by dissolving a small volume of cleaning liquid in deionised water.

He then titrates a sample of this solution with an acid until neutralisation is complete.

(a) The diagram shows the burette readings for his titration.



Use the readings to complete the table, giving all values to the nearest 0.05 cm^3 .

(2)

Burette reading after adding the acid	20.80
Burette reading before adding the acid	
Volume of acid added in cm^3	



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(b) Another student does a titration using a solution of a different cleaning liquid.

The table shows her results.

Burette reading after adding the acid	29.65	28.70	29.25	29.10	28.55
Burette reading before adding the acid	3.40	3.60	3.50	3.80	3.35
Volume of acid added in cm³	26.25	25.10	25.75	25.30	25.20
Concordant results (✓)					

Concordant results are those that differ by 0.20 cm³ or less.

- (i) Place ticks in the table to show which results are concordant. (1)
- (ii) Use the concordant results to calculate the average (mean) volume of acid added. (1)

average volume of acid = cm³

(Total for Question 3 = 4 marks)



4 Bromine, chlorine, fluorine and iodine are elements in Group 7 of the Periodic Table.

(a) Which element is the most reactive?

(1)

- A bromine
- B chlorine
- C fluorine
- D iodine

(b) Which element is a solid at room temperature?

(1)

- A bromine
- B chlorine
- C fluorine
- D iodine

(c) Which element has the darkest colour at room temperature?

(1)

- A bromine
- B chlorine
- C fluorine
- D iodine



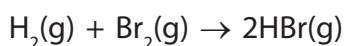
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(d) Bromine reacts with hydrogen to form hydrogen bromide.

The equation for the reaction is



The table shows some average bond energies.

Bond	H—H	Br—Br	H—Br
Average bond energy in kJ/mol	436	193	366

Use the values in the table to calculate the enthalpy change for the reaction between hydrogen and bromine.

(3)

enthalpy change = kJ/mol

(Total for Question 4 = 6 marks)



5 Ethanol can be manufactured by fermentation or by the direct hydration of ethene.

(a) In Brazil, the main source of sugar for fermentation is sugar cane.

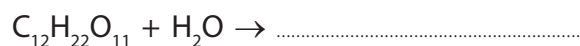
- sugar cane is added to water
- sugar cane contains sucrose ($C_{12}H_{22}O_{11}$) that dissolves in the water
- during the fermentation process the sucrose is broken down into glucose ($C_6H_{12}O_6$)
- this glucose is then converted into ethanol (C_2H_5OH) and carbon dioxide

(i) Name the substance that is added to the sucrose solution to allow fermentation to take place.

(1)

(ii) Complete the equation for the conversion of sucrose into glucose.

(1)



(iii) Write a chemical equation for the conversion of glucose into ethanol and carbon dioxide.

(1)

(iv) Fermentation produces a solution that is a mixture of ethanol and water.

Which of these is the most effective method of obtaining ethanol from this mixture?

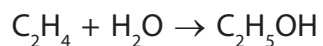
(1)

- A crystallisation
- B filtration
- C fractional distillation
- D simple distillation



(b) In the direct hydration method, ethene reacts with steam.

The equation for the reaction is



(i) Name the catalyst used in this reaction.

(1)

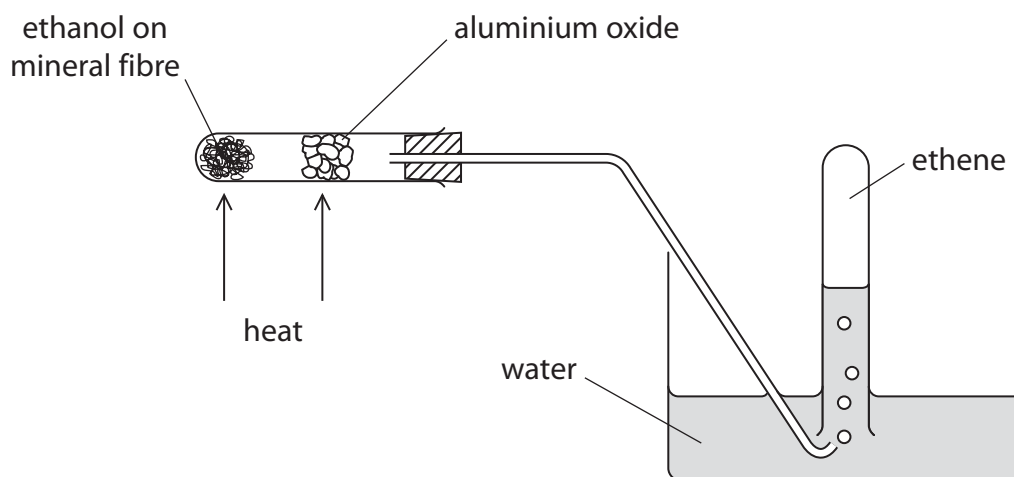
(ii) State the temperature and pressure used in this reaction.

(2)

temperature

pressure

(c) This apparatus is used to convert ethanol into ethene.



(i) Name the type of reaction taking place.

(1)

(ii) State the function of the aluminium oxide in this reaction.

(1)



(d) Ethene belongs to a homologous series of unsaturated hydrocarbons called alkenes.

(i) State what is meant by the term **unsaturated**.

(1)

(ii) State the colour change that is observed when bromine water is shaken with ethene in a test tube.

(2)

from to

(Total for Question 5 = 12 marks)



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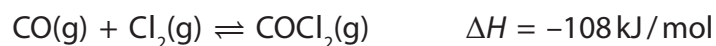
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6 Phosgene (COCl_2) is used in industry to make polymers.

(a) Phosgene is formed when carbon monoxide reacts with chlorine.



- (i) The reaction mixture is kept at temperatures between 50 and 150 °C. If a temperature above 200 °C is used, only a small amount of phosgene is formed.

Suggest why only a small amount of phosgene is formed at temperatures above 200 °C.

(2)

- (ii) Predict how the yield of phosgene will change if the reaction is carried out at a higher pressure.

Give a reason for your answer.

[assume the reaction reaches a position of equilibrium]

(2)

(b) Phosgene reacts with water to form hydrochloric acid and carbon dioxide.

Write a chemical equation for this reaction.

(1)

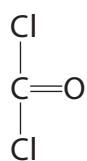


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(c) The diagram shows the displayed formula of phosgene.



Draw a dot and cross diagram to show the arrangement of all the outer electrons in a molecule of phosgene.

(3)

(Total for Question 6 = 8 marks)



- 7 Magnesium carbonate decomposes when heated to form magnesium oxide and carbon dioxide. The equation for the reaction is



A student uses this method to investigate the reaction.

- Step 1 weigh a clean, dry crucible and record the mass
- Step 2 add some magnesium carbonate
- Step 3 reweigh the crucible and contents and record the new mass
- Step 4 heat the crucible and contents for five minutes
- Step 5 allow the crucible and contents to cool and then reweigh
- Step 6 repeat steps 4 and 5 until the mass of the crucible and contents does not change

The student does the experiment four times.

The table shows her results.

	Mass in g			
	Experiment 1	Experiment 2	Experiment 3	Experiment 4
mass of empty crucible	19.20	21.31	19.83	20.45
mass of crucible and magnesium carbonate before heating	23.40	24.94	24.65	26.92
mass of crucible and contents after heating for 5 minutes	22.85	23.21	22.13	24.02
mass of crucible and contents after heating for a total of 10 minutes	21.94	23.04	22.13	23.53
mass of crucible and contents after heating for a total of 15 minutes	21.60	23.04	22.13	23.53

- (a) State why the mass of the crucible and contents decreases during heating.

(1)



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(b) (i) State the reason for Step 6.

(1)

.....
.....

(ii) Explain in which experiment the student should have heated for a fourth period of five minutes.

(2)

.....
.....
.....
.....

(Total for Question 7 = 4 marks)



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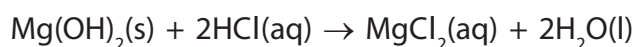
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8 Acid indigestion is caused by having too much hydrochloric acid in the stomach.

A suspension of magnesium hydroxide, Mg(OH)_2 , in water, can be used to cure acid indigestion.

The equation for the reaction between magnesium hydroxide and hydrochloric acid is



A student investigates how much magnesium hydroxide is needed to neutralise 100 cm^3 of hydrochloric acid with a concentration of 0.0968 mol/dm^3 .

He uses 0.29 g of magnesium hydroxide to neutralise the hydrochloric acid.

(a) Calculate the amount, in moles, of HCl in the hydrochloric acid.

(2)

amount of HCl mol

(b) Calculate the amount, in moles, of Mg(OH)_2 used by the student.

$[M_r \text{ of } \text{Mg(OH)}_2 = 58]$

(2)

amount of Mg(OH)_2 mol

(c) Explain whether the student used the right amount of magnesium hydroxide to neutralise the hydrochloric acid.

(2)

.....

.....

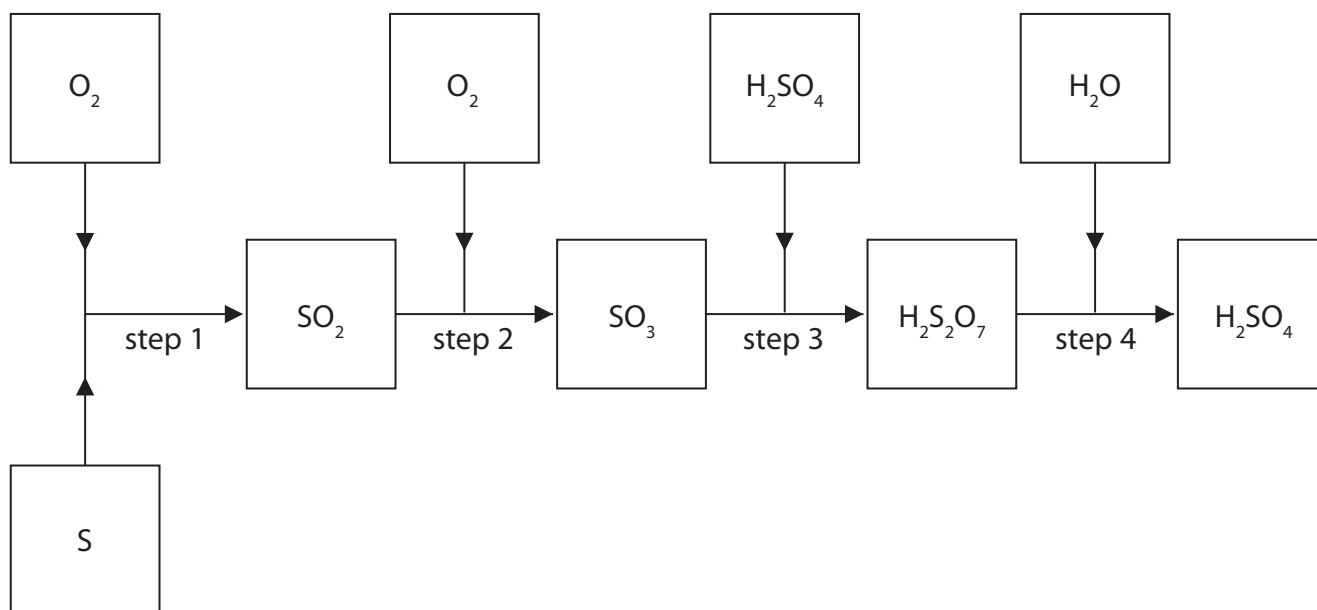
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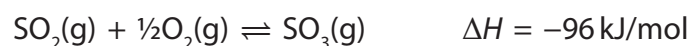
(Total for Question 8 = 6 marks)



9 The flow chart shows the steps in the manufacture of sulfuric acid.



(a) The equation for the reaction in step 2 is



(i) State what the symbols \rightleftharpoons and ΔH represent.

(2)

\rightleftharpoons

ΔH

(ii) Name the catalyst used in step 2.

(1)

(iii) State the temperature and pressure used in the reaction in step 2.

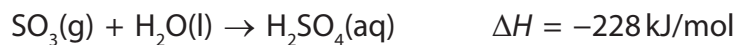
(2)

temperature

pressure



- (b) Sulfur trioxide reacts with water to form sulfuric acid.
This reaction is very exothermic.



- (i) State why the sulfur trioxide is not dissolved in water to form sulfuric acid in step 3. (1)

- (ii) Write chemical equations for the reactions that take place in step 3 and step 4. (2)

step 3.....

step 4.....

- (c) Give two industrial uses for sulfuric acid. (2)

1.....

2.....

(Total for Question 9 = 10 marks)

TOTAL FOR PAPER = 60 MARKS



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