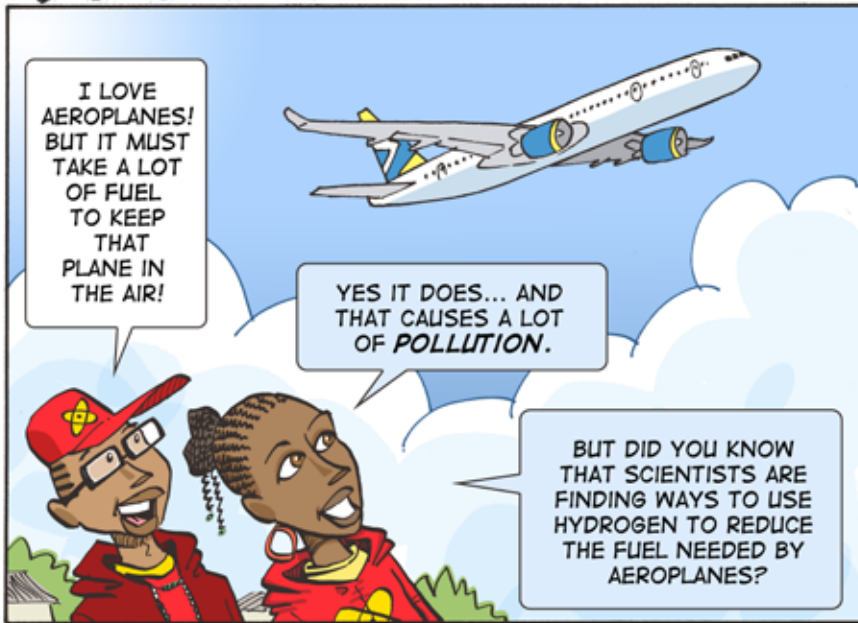




## CLEAN ENERGY FROM HYDROGEN



### ACTIVITY: ENERGY FOR A PAPER PLANE

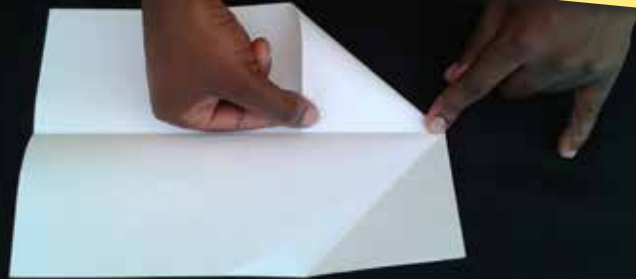


**1** FOLD YOUR PAPER TO CREATE A PAPER AEROPLANE ... LIKE THIS:

YOU WILL NEED:

- A SHEET OF PAPER FOR EACH MEMBER
- SOME ELASTIC BANDS
- PAPER CLIPS
- A STAPLER

**a** FOLD A SHEET OF PAPER ALONG ITS LENGTH. THEN FOLD IN TWO CORNERS TO THE CENTRE FOLD.



**b** FOLD THE TWO ANGLED SIDES IN TO MEET ALONG THE CENTRE FOLD.



**c** FOLD THE TWO SIDES CLOSED, THEN FOLD ONE SIDE OUT TO LIE ALONG THE CENTRE LINE.



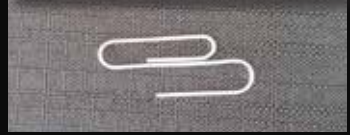
**d** TURN THE PAPER OVER AND FOLD THE OTHER SIDE OUT IN THE SAME WAY.



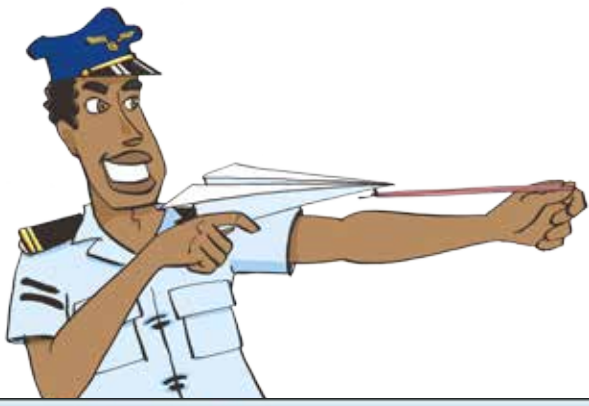
**e** MAKE SURE ALL THE FOLDED EDGES ARE SHARP. THEN BEND THE WINGS UP TO LIE FLAT.



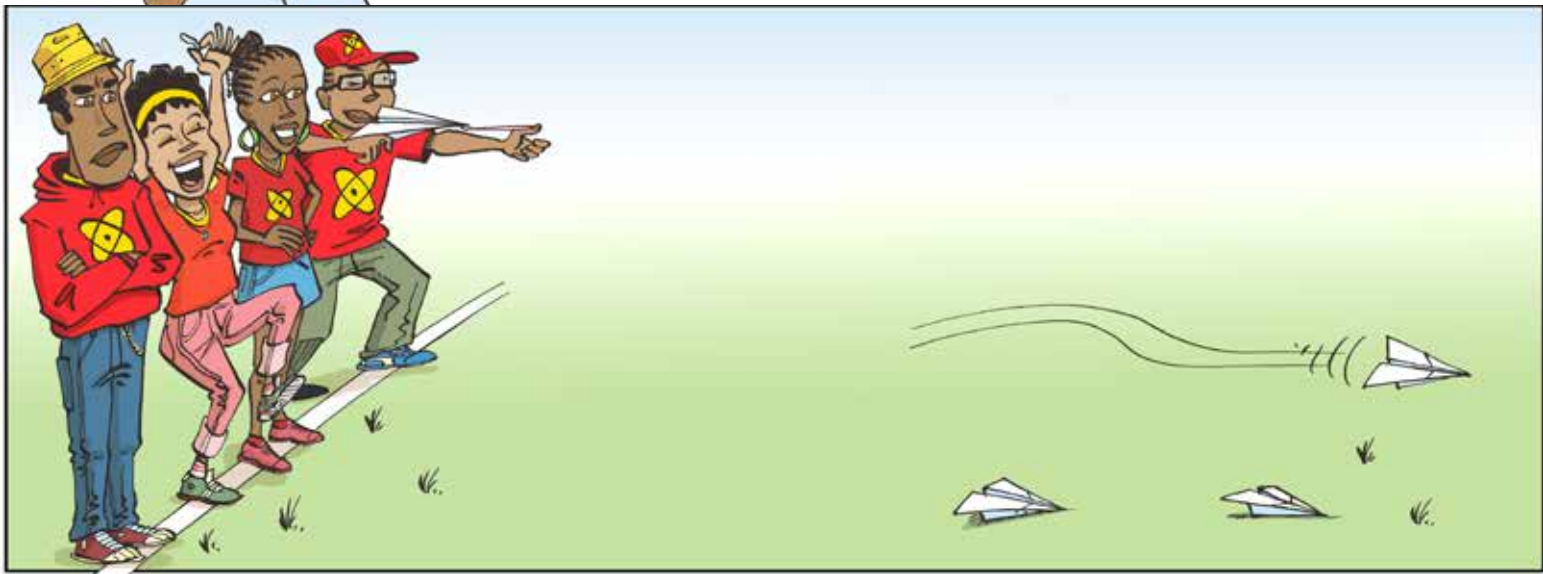
**2** BEND A METAL PAPER CLIP LIKE THIS.



**3** STAPLE THE PAPER CLIP ONTO THE KEEL OF YOUR PLANE.



**4** JOIN 2 OR 3 RUBBER BANDS TOGETHER. USE THEM TO LAUNCH YOUR PLANE OUTSIDE!



## WHAT'S HAPPENING HERE?

### ENERGY SOURCES

WHEN YOU STRETCHED THE ELASTIC BANDS YOU **STORED ENERGY** IN THEM. WHEN YOU LAUNCHED YOUR PAPER PLANE THIS STORED ENERGY OPERATED AS AN ENERGY SOURCE.

REAL PLANES USE LOTS OF ENERGY. **HYDROGEN FUEL CELLS** ARE A **CLEAN** ENERGY SOURCE. IF THEY ARE USED TO SUPPLY SOME OF THE ENERGY, THEN PLANES WILL USE LESS FOSSIL FUEL. THE USE OF FOSSIL FUEL ADDS TO GLOBAL WARMING.



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# HYDROGEN FOR CLEANER ENERGY

TO PROVIDE ENOUGH ENERGY FOR THE FUTURE, AND TO PROTECT OUR ENVIRONMENT, WE MUST USE LESS FOSSIL FUELS AND MORE RENEWABLE ENERGY SOURCES.

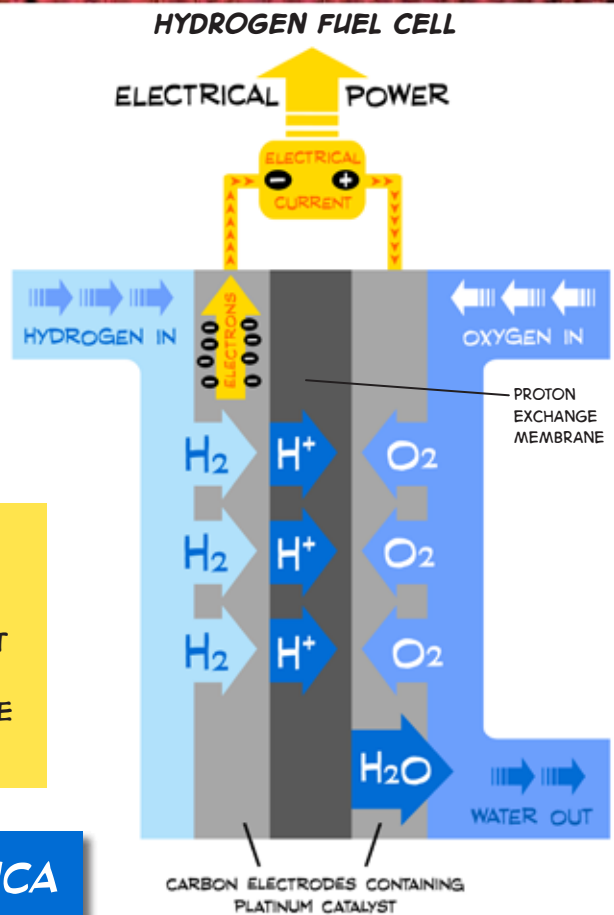
**HYDROGEN FUEL CELLS** ARE AN EXCITING EXAMPLE OF A **RENEWABLE** ENERGY SOURCE: **OXYGEN** AND **HYDROGEN** COMBINE TO FORM **WATER**, AND RELEASE ENERGY:

HYDROGEN + OXYGEN → WATER + ENERGY



IN A HYDROGEN FUEL CELL (HFC), THE CHEMICAL ENERGY OF HYDROGEN AND OXYGEN, IN THE PRESENCE OF A **CATALYST**, PLATINUM, IS TRANSFORMED INTO ELECTRICITY, HEAT AND WATER. THE ONLY BY-PRODUCT IS WATER, SO THIS IS A VERY CLEAN, **ENVIRONMENTALLY FRIENDLY** SOURCE OF ENERGY.

A **CATALYST** SPEEDS UP A CHEMICAL REACTION, BUT DOESN'T GET USED UP IN THE REACTION.



## HYDROGEN TECHNOLOGY IN SOUTH AFRICA



SOUTH AFRICA IS DOING RESEARCH TO DEVELOP HFCS (HYDROGEN FUEL CELLS). ONE EXCITING RESEARCH PROJECT IS BEING DONE WITH THE AIRCRAFT COMPANY AIRBUS, WORKING WITH THE DEPARTMENT OF SCIENCE AND TECHNOLOGY (DST) AND THE NATIONAL AEROSPACE CENTRE.

HFCS ARE NOT POWERFUL ENOUGH TO FLY AN AEROPLANE, BUT THEY COULD PROVIDE THE ENERGY FOR OTHER FUNCTIONS IN AIRCRAFT. THIS WILL REDUCE THE USE OF FOSSIL FUEL.

### PUZZLE YOUR MIND!!!

CAN YOU UNSCRAMBLE EACH OF THE FOLLOWING LETTER GROUPS TO FORM WORDS THAT APPEAR IN THIS SCIENCE SPAZA WORKSHEET?

1. R-A-L-A-N-P-O-E-E
2. E-F-L-U
3. N-B-A-R-L-W-E-E-E
4. V-N-O-E-M-R-I-N-E-N-T
5. S-L-F-I-S-O
6. D-E-G-H-N-O-R-Y
7. L-I-T-P-O-U-L-O-N
8. E-A-C-C-L-I-M-H

1	A									N
2				E						
3				W						
4	E					R				
5				O						L
6				D					N	
7				L				T		N
8	C								C	

FIND A VERTICAL WORD WHICH IS THE NAME OF AN ELEMENT USED IN HYDROGEN FUEL CELLS.

Knowledge is NCAH!



## CAREERS:

- AERONAUTICAL ENGINEER
- CHEMICAL ENGINEER
- MATERIALS SCIENTIST
- ELECTRICAL ENGINEER



## CURRICULUM LINKS

- GRADE 7: **ENERGY & CHANGE** (SOURCES OF ENERGY)
- GRADE 10: **CHEMICAL CHANGE** (SYNTHESIS REACTIONS)
- GRADE 11: **CHEMICAL SYSTEMS** (EXPLOITING THE LITHOSPHERE)
- GRADE 11: **CHEMICAL CHANGE** (ENERGY IN CHEMICAL REACTIONS)

## THINK ABOUT THIS ...

### 1. HOW CLEAN IS ENERGY FROM HYDROGEN?

TO MAKE HFCS WE NEED HYDROGEN. TO PRODUCE THE HYDROGEN, WE NEED TO USE SOME ENERGY. WHERE DO YOU THINK THAT ENERGY COMES FROM?

### 2. WHAT SHOULD SA DO WITH ITS PLATINUM?

SOUTH AFRICA HAS MORE THAN 75% OF THE WORLD'S KNOWN **PLATINUM** RESERVES. PLATINUM IS ESSENTIAL AS A CATALYST IN FUEL CELLS. SHOULD SOUTH AFRICA EXPORT PLATINUM? HOW CAN WE USE IT TO BENEFIT THE COUNTRY?

## GIVE US YOUR FEEDBACK

1. WHAT IS THE NAME OF THE **ELEMENT** YOU FOUND IN THE PUZZLE?
2. WHY IS THIS ELEMENT IMPORTANT IN SOUTH AFRICA'S HYDROGEN FUEL CELL INDUSTRY?

Send your answers and the name of your club to our Whatsapp or SMS number **076 173 7130**; email us at **info@sciencespaza.org**; Facebook us at **ScienceSpaza** or contact us through our website **www.sciencespaza.org**

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A new chapter has been opened in the quest to make commercial air transport more environmentally and economically sustainable. An agreement has been reached by Airbus and South Africa's National Aerospace Centre to jointly fund research by Hydrogen South Africa (HySA) into the application of fuel cells on airliners.

**HySA** | Public Awareness  
Hydrogen South Africa

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