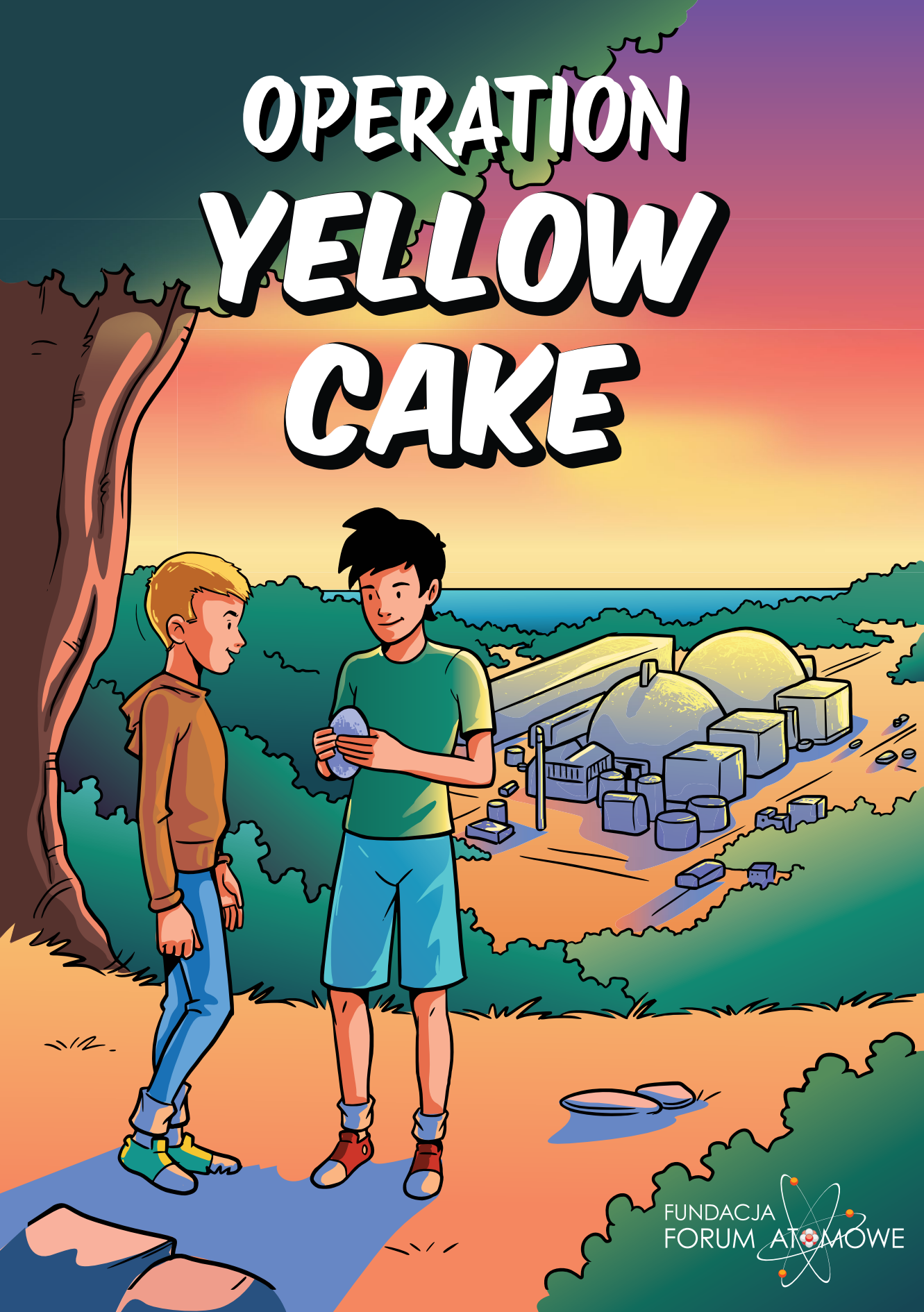
OPERATION YELLOW CAKE



FUNDACJA FORUM ATOMOWE

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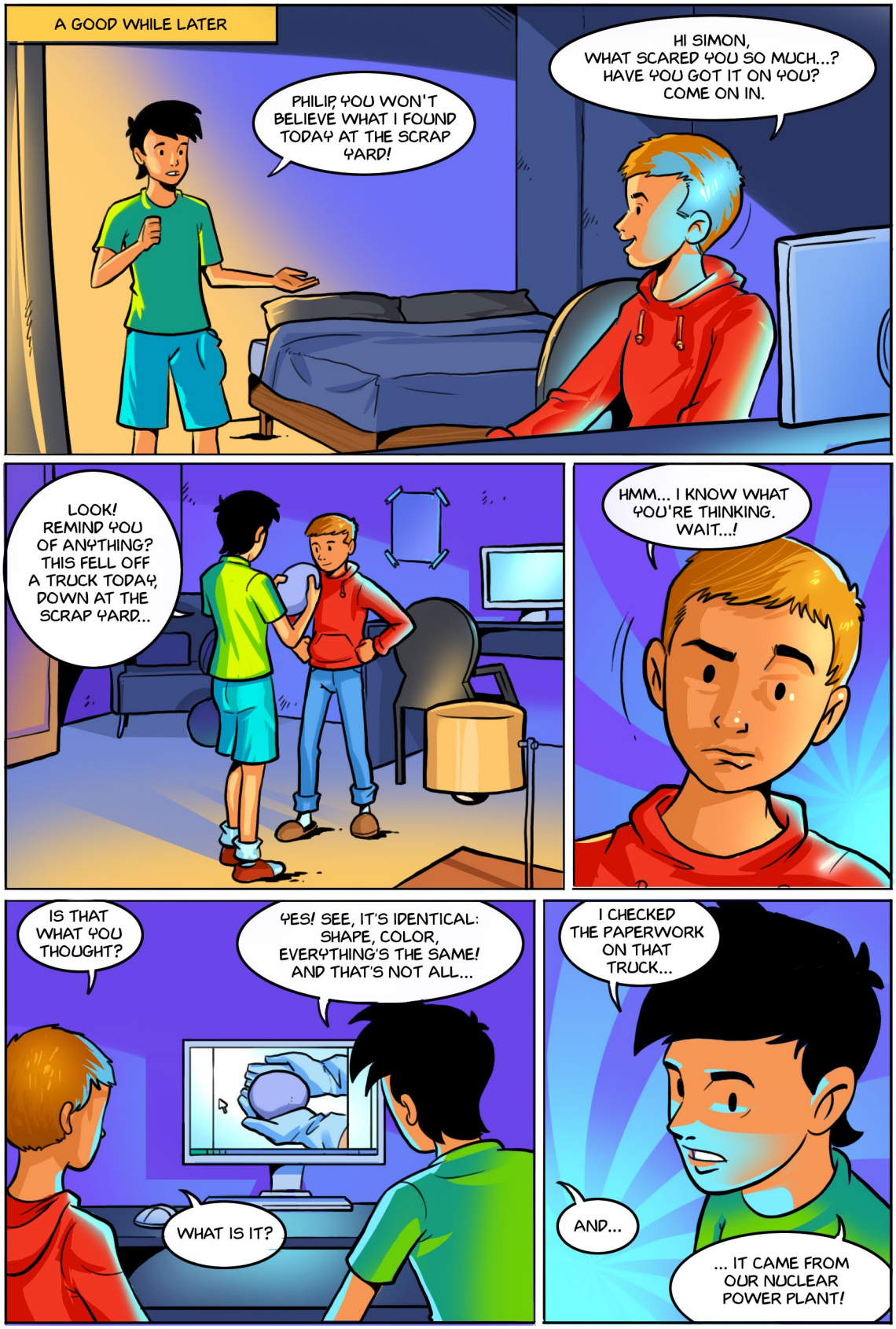
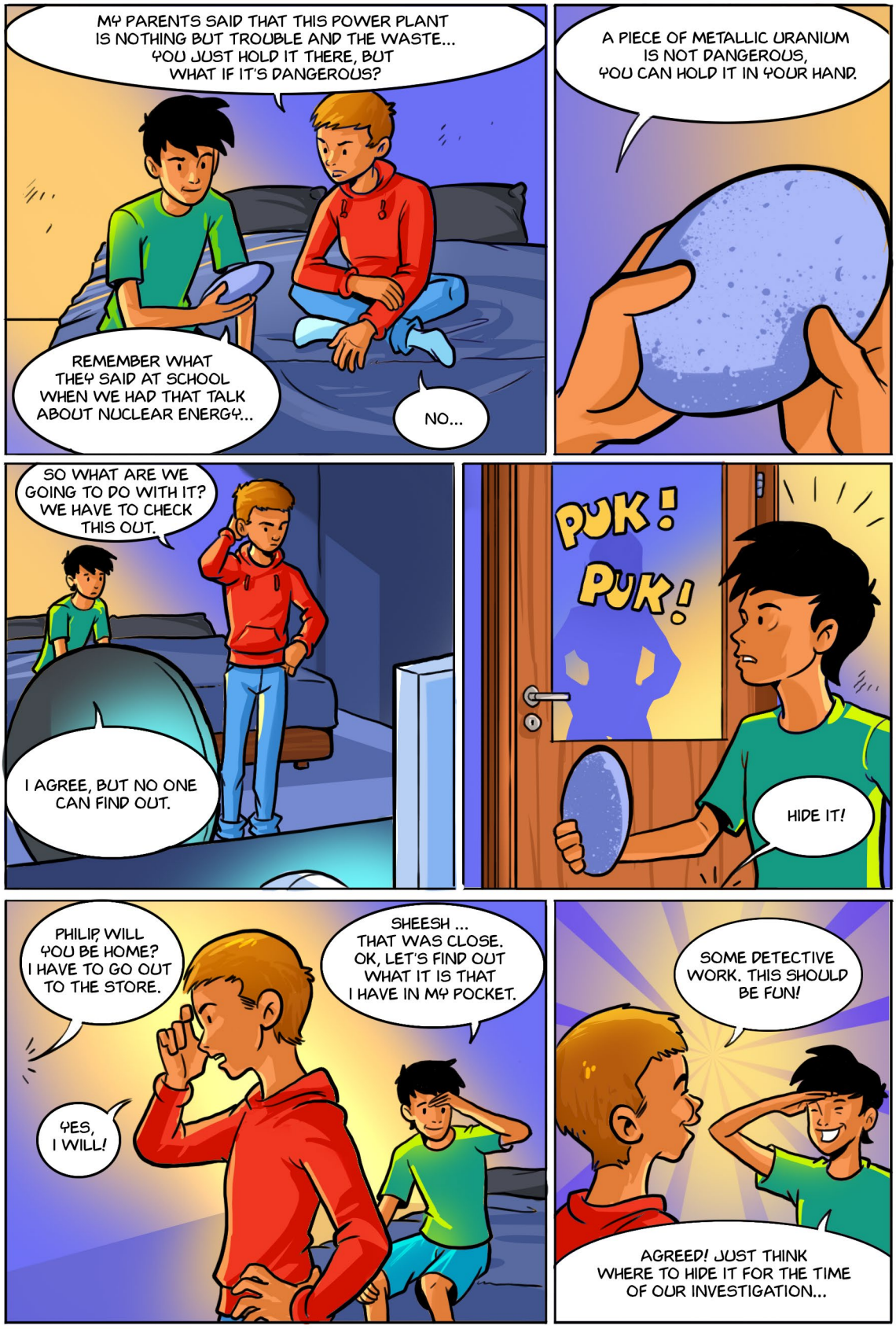
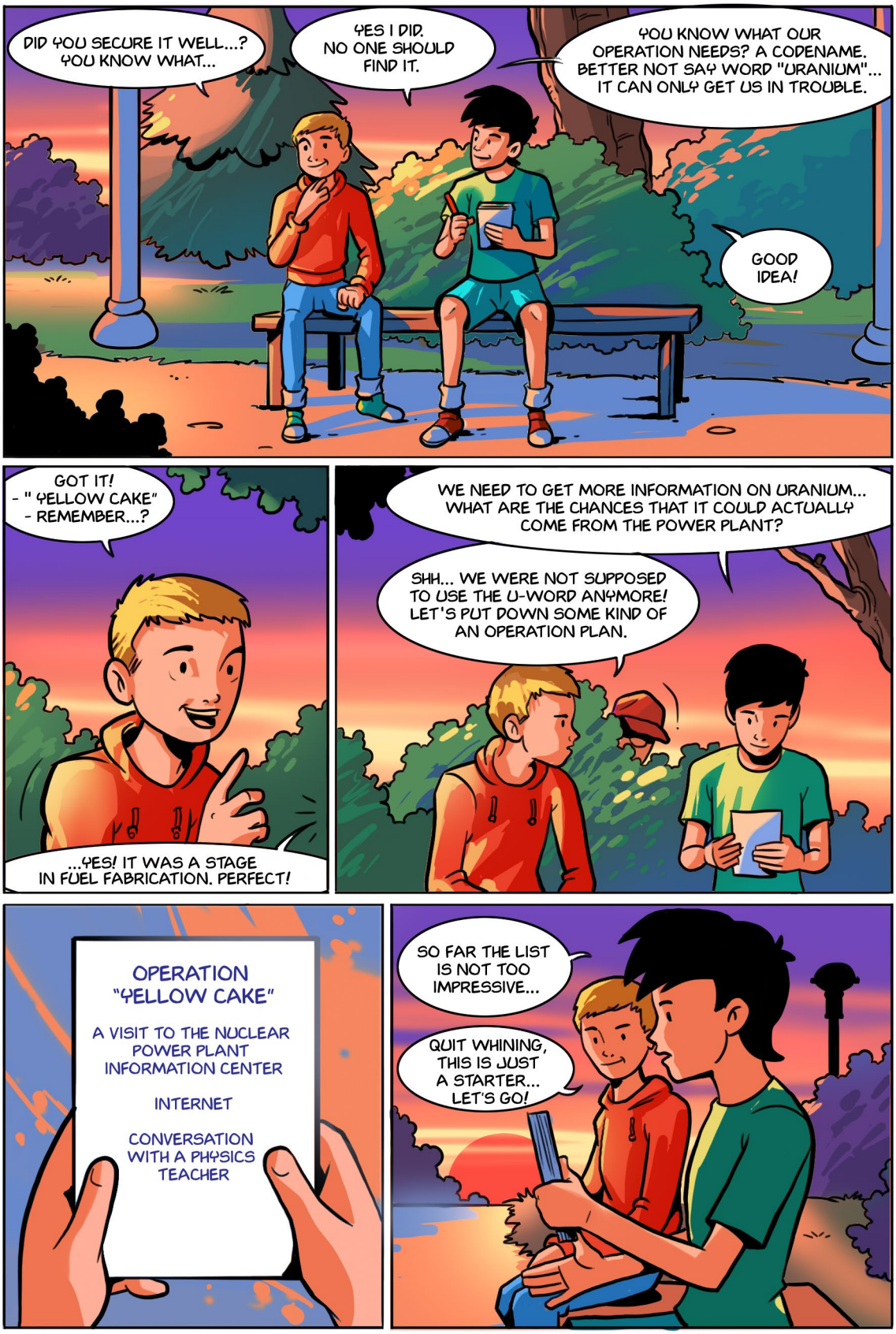
and construction of the first Polish nuclear power plant.


A TYPICAL SATURDAY AFTERNOON AT THE TOWN OF CHESTNUT MANOR, ANOTHER REGULAR WORK DAY AT THE "ZIBI'S SCRAP YARD", OR IS IT ... ?
ZIBI'S SCRAP YARD
SIMON, UNLOAD THAT LAST TRUCK.
WHAT IS THAT... ? WHAT WORRIES ME IS THAT THE TRUCK MAY COME FROM THAT NUCLEAR POWER PLANT.
NO WAY ... URANIUM? BUT WHAT IS IT DOING HERE? AT THE SCRAP YARD?
I HOPE NO ONE CAN SEE ME...
I HAVE TO SHOW IT TO PHILIP, HE WOULD KNOW WHAT IT IS... I GUESS IT'S NOT A BIG DEAL IF I GET OFF WORK A LITTLE EARLY.

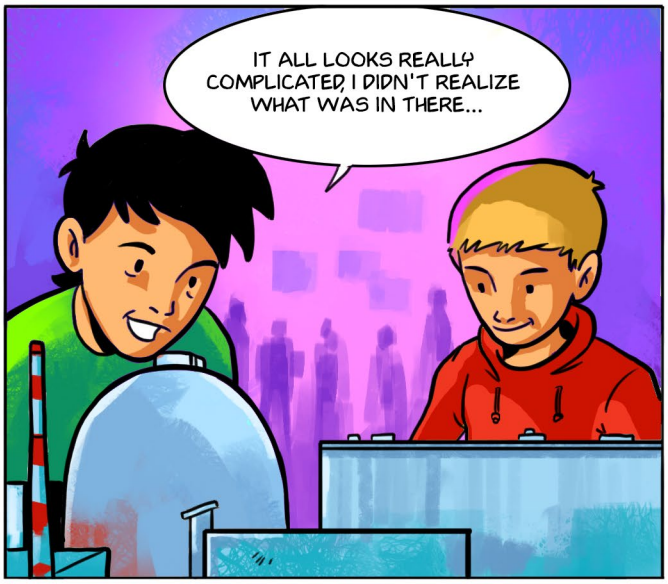

A GOOD WHILE LATER
PHILIP, YOU WON'T BELIEVE WHAT I FOUND TODAY AT THE SCRAP YARD!
HI SIMON, WHAT SCARED YOU SO MUCH...? HAVE YOU GOT IT ON YOU? COME ON IN.
LOOK! REMIND YOU OF ANYTHING? THIS FELL OFF A TRUCK TODAY, DOWN AT THE SCRAP YARD...
HMM... I KNOW WHAT YOU'RE THINKING. WAIT...!
IS THAT WHAT YOU THOUGHT?
YES! SEE, IT'S IDENTICAL: SHAPE, COLOR, EVERYTHING'S THE SAME! AND THAT'S NOT ALL...
WHAT IS IT?
I CHECKED THE PAPERWORK ON THAT TRUCK...
AND...
... IT CAME FROM OUR NUCLEAR POWER PLANT!

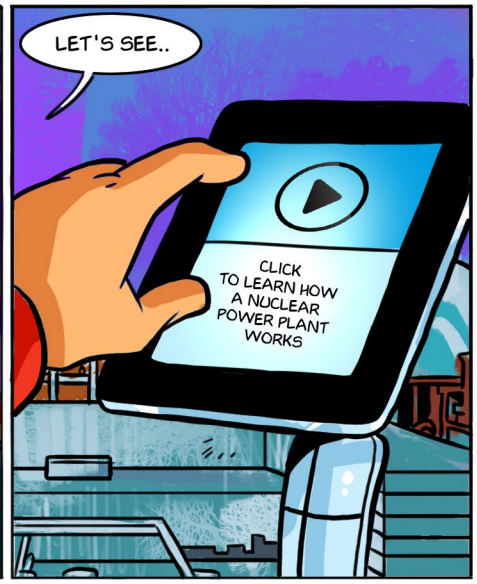


PUK! PUK! = KNOCK! KNOCK!


DID YOU SECURE IT WELL...? YOU KNOW WHAT...
YES I DID. NO ONE SHOULD FIND IT.
YOU KNOW WHAT OUR OPERATION NEEDS? A CODENAME. BETTER NOT SAY WORD "URANIUM"... IT CAN ONLY GET US IN TROUBLE.
GOOD IDEA!
GOT IT! - " YELLOW CAKE" - REMEMBER...?
...YES! IT WAS A STAGE IN FUEL FABRICATION. PERFECT!
WE NEED TO GET MORE INFORMATION ON URANIUM... WHAT ARE THE CHANCES THAT IT COULD ACTUALLY COME FROM THE POWER PLANT?
SHH... WE WERE NOT SUPPOSED TO USE THE U-WORD ANYMORE! LET'S PUT DOWN SOME KIND OF AN OPERATION PLAN.
OPERATION "YELLOW CAKE"
A VISIT TO THE NUCLEAR POWER PLANT INFORMATION CENTER
INTERNET
CONVERSATION WITH A PHYSICS TEACHER
SO FAR THE LIST IS NOT TOO IMPRESSIVE...
QUIT WHINING, THIS IS JUST A STARTER... LET'S GO!


MEANWHILE, ON MONDAY AFTER SCHOOL.
INFORMATION CENTRE
HAVE YOU EVER BEEN HERE?
NO, BUT THIS IS THE BEST PLACE TO GET SOME INFORMATION... LET'S GO!
INFORMATION CENTRE
HELLO, BOYS!
GOOD AFTERNOON, CAN WE VISIT THE CENTER ON OUR OWN?
OF COURSE, COME ON IN. WE ARE CLOSING AT SIX, SO YOU STILL HAVE TWO HOURS.
WOW! AMAZING! LOOK AT THE MOCKUP!
GREAT, COME ON, LET'S FIND SOME CLUES HERE TO SOLVE OUR PUZZLE.





REACTOR

FUEL ASSEMBLY

FUEL ROD

FUEL PELLET

THERE IS A VERY LARGE AMOUNT OF ENERGY IN THE ATOMIC NUCLEUS. IT IS THIS ENERGY THAT WE USE IN A NUCLEAR REACTOR. TO RELEASE IT, THE NUCLEUS OF AN ATOM OF A HEAVY ELEMENT, SUCH AS URANIUM, MUST BE SPLIT IN TWO WHEN IT IS HIT BY ACCELERATED NEUTRONS. THIS PHENOMENON IS CALLED FISSION. AS A RESULT OF THIS REACTION, GAMMA RADIATION AND NEW NEUTRONS ARE EMITTED, WHICH IN TURN CAUSE FURTHER FISSION, AND A VERY LARGE AMOUNT OF ENERGY IS RELEASED.

FISSION

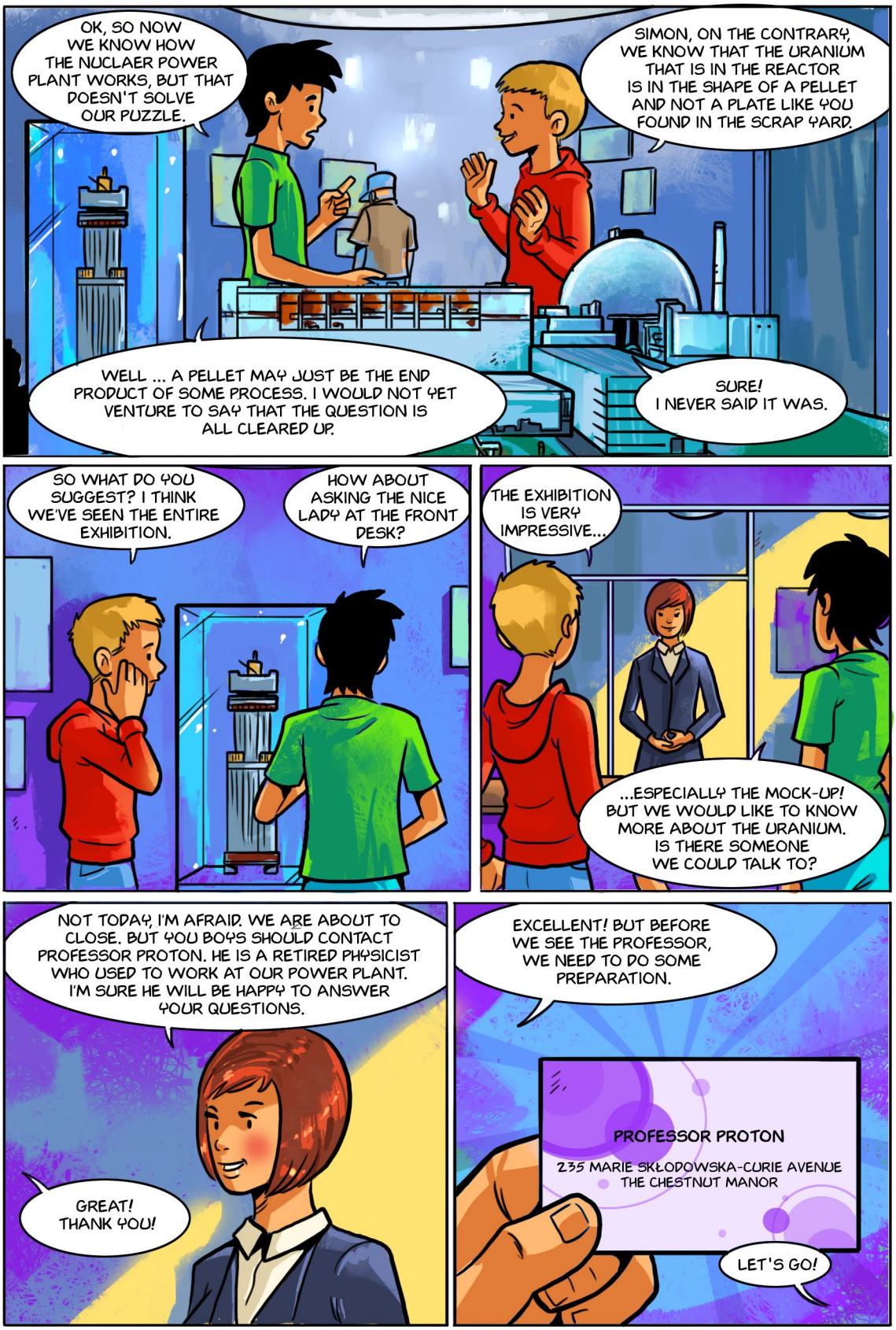
THE WAY A NUCLEAR POWER PLANT WORKS IS VERY SIMPLE. IN THE BUILDING WHERE THE REACTOR IS LOCATED, FUEL ASSEMBLIES ARE PLACED IN ITS CORE (1), WITH URANIUM PELLETS INSIDE (2). THIS IS WHERE THE FISSION CHAIN REACTION OCCURS. A GREAT DEAL OF HEAT IS EMITTED DURING THIS PROCESS. THE FUEL RODS ARE COOLED BY WATER, WHICH GETS HOT AND TURNS TO STEAM. THE STEAM TRAVELS THROUGH A PIPELINE (3) AND DRIVES A TURBINE (4) CONNECTED TO AN ELECTRIC GENERATOR (5).

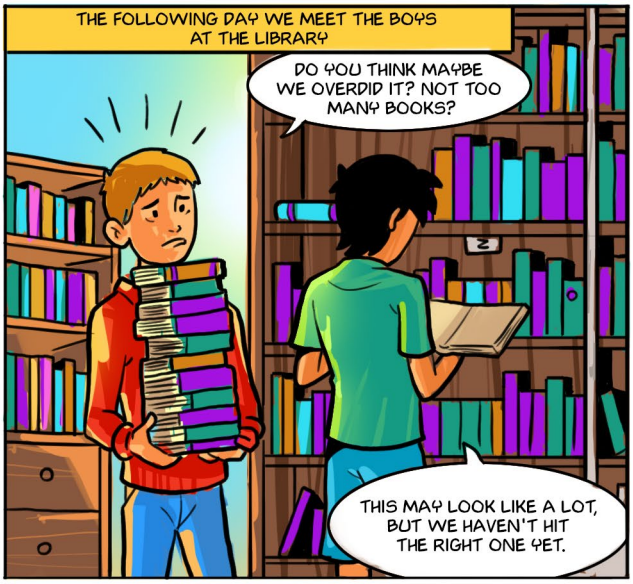
(3) (4) (5) (2) (1) (6)

THE STEAM IS THEN CONDENSED AGAIN. THIS IS WHY WE NEED ACCESS TO COLD WATER FROM THE OCEAN, THE SEA, A RIVER OR A LAKE (6). THIS CONDENSED WATER GOES BACK INTO THE REACTOR AND THE PROCESS REPEATS.

HOW DOES IT WORK - A NUCLEAR POWER PLANT

check the dictionary at the end of the book →element →uranium


OK, SO NOW WE KNOW HOW THE NUCLAER POWER PLANT WORKS, BUT THAT DOESN'T SOLVE OUR PUZZLE.
SIMON, ON THE CONTRARY, WE KNOW THAT THE URANIUM THAT IS IN THE REACTOR IS IN THE SHAPE OF A PELLET AND NOT A PLATE LIKE YOU FOUND IN THE SCRAP YARD.
WELL ... A PELLET MAY JUST BE THE END PRODUCT OF SOME PROCESS. I WOULD NOT YET VENTURE TO SAY THAT THE QUESTION IS ALL CLEARED UP.
SURE! I NEVER SAID IT WAS.
SO WHAT DO YOU SUGGEST? I THINK WE'VE SEEN THE ENTIRE EXHIBITION.
HOW ABOUT ASKING THE NICE LADY AT THE FRONT DESK?
THE EXHIBITION IS VERY IMPRESSIVE...
...ESPECIALLY THE MOCK-UP! BUT WE WOULD LIKE TO KNOW MORE ABOUT THE URANIUM. IS THERE SOMEONE WE COULD TALK TO?
NOT TODAY, I'M AFRAID. WE ARE ABOUT TO CLOSE. BUT YOU BOYS SHOULD CONTACT PROFESSOR PROTON. HE IS A RETIRED PHYSICIST WHO USED TO WORK AT OUR POWER PLANT. I'M SURE HE WILL BE HAPPY TO ANSWER YOUR QUESTIONS.
GREAT! THANK YOU!
EXCELLENT! BUT BEFORE WE SEE THE PROFESSOR, WE NEED TO DO SOME PREPARATION.
PROFESSOR PROTON
235 MARIE SKŁODOWSKA-CURIE AVENUE
THE CHESTNUT MANOR
LET'S GO!



A WHILE LATER AT SIMON'S

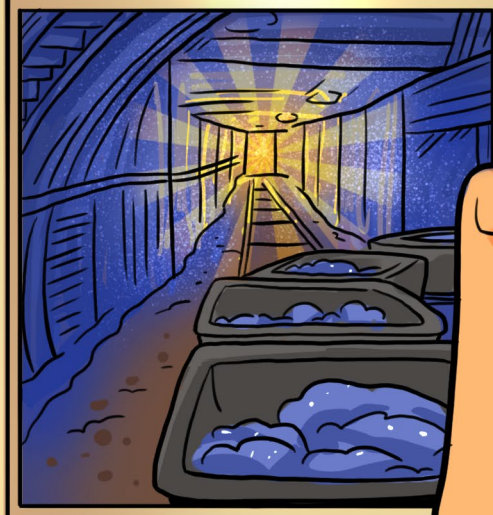
WHERE DO WE GET URANIUM?

URANIUM, LIKE HARD COAL, IS MINED FROM UNDERGROUND TUNNELS (GALLERIES) OR, WHEN IT IS NOT AS DEEP UNDERGROUND, LIKE LIGNITE, THE TOP LAYER OF EARTH IS REMOVED AND URANIUM IS BROUGHT UP FROM THE PIT. ONE TON OF ORE CONTAINS ABOUT 1 KILOGRAM OF URANIUM.

HOWEVER, URANIUM IN THIS FORM IS NOT USEFUL FOR THE PLANT. THE URANIUM MINE IS JUST THE BEGINNING OF THE JOURNEY. THE ORE IS PROCESSED AND GOES THROUGH VARIOUS TRANSFORMATIONS BEFORE IT IS USED TO MAKE FUEL, WHICH THEN NEEDS TO BE TRANSPORTED TO THE NUCLEAR REACTOR.

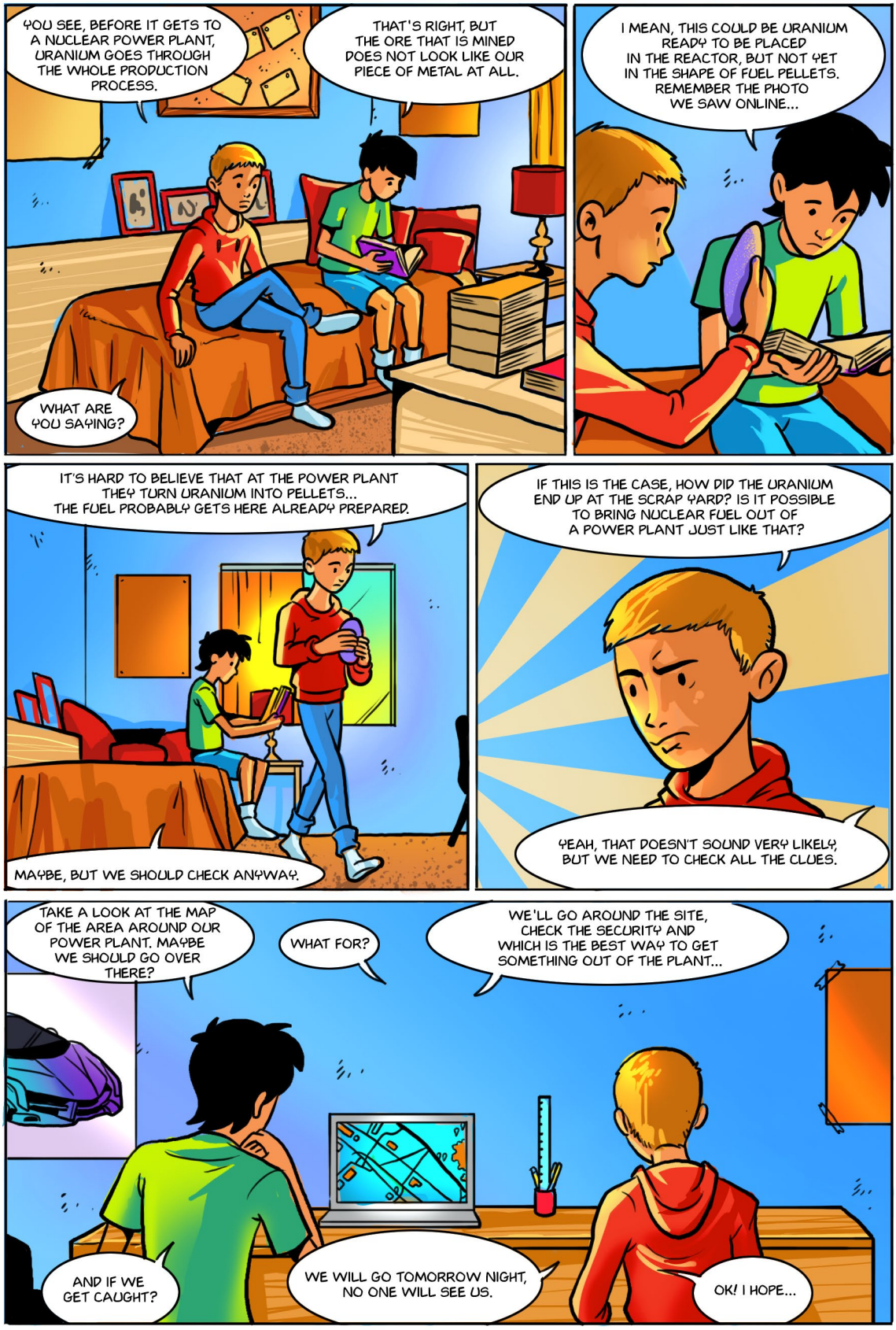
COOL!

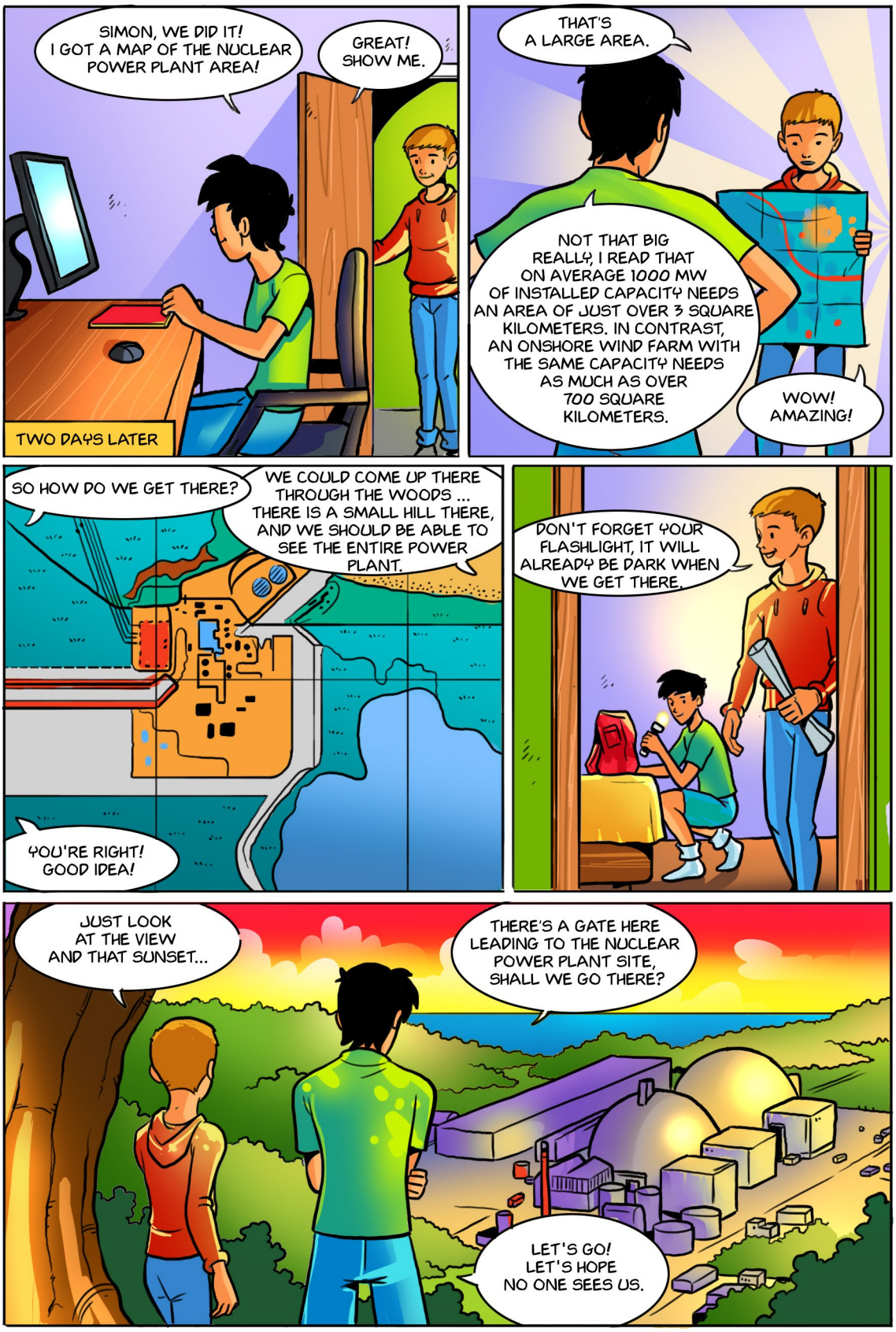
WE USED TO HAVE URANIUM MINES HERE IN POLAND. TWO OF THEM, NOW CLOSED - IN KLETNO AND KOWARY - ARE OPEN TO VISITORS!



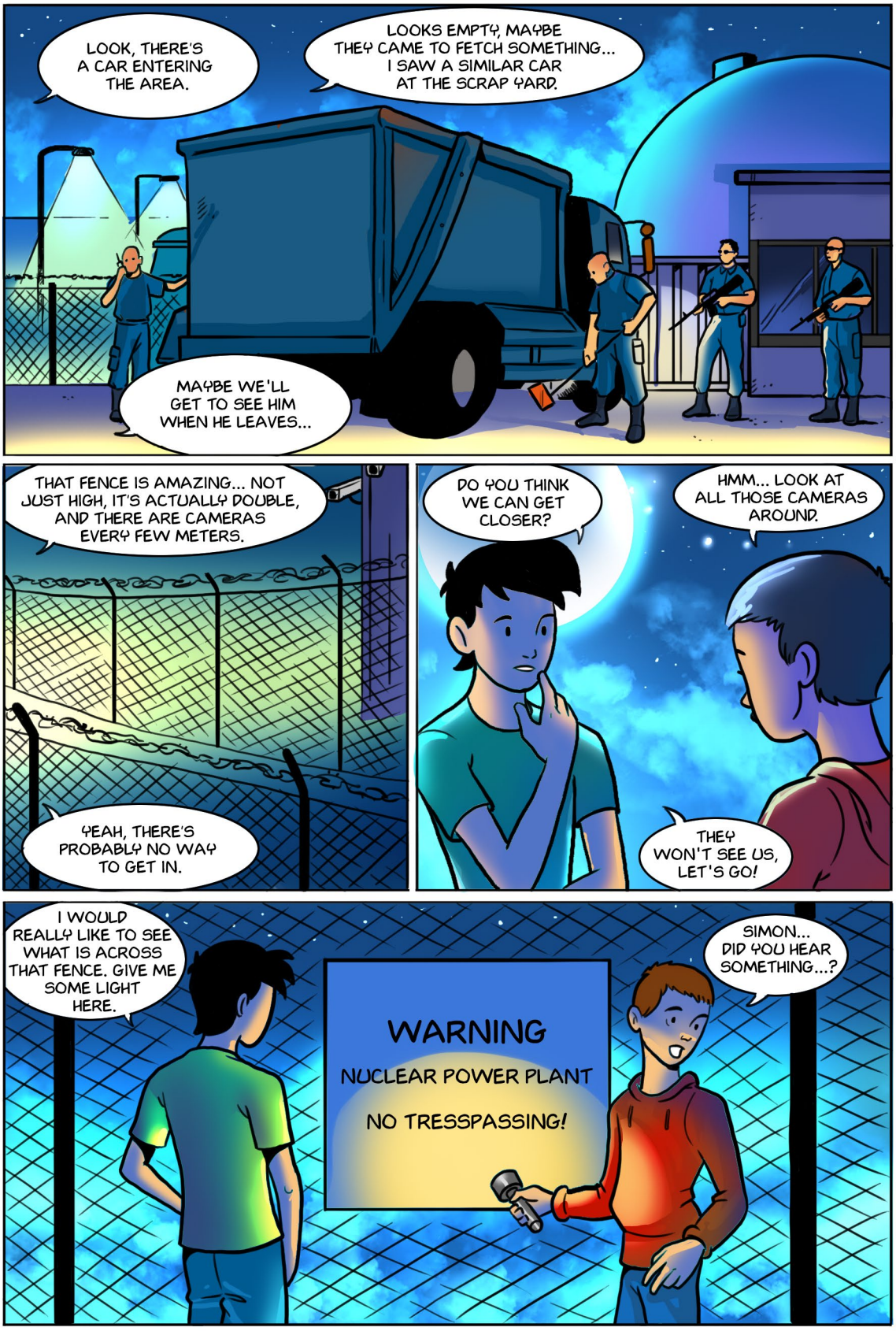
THE INITIAL STAGE IN PRODUCTION OF NUCLEAR FUEL IS THE "YELLOW CAKE".

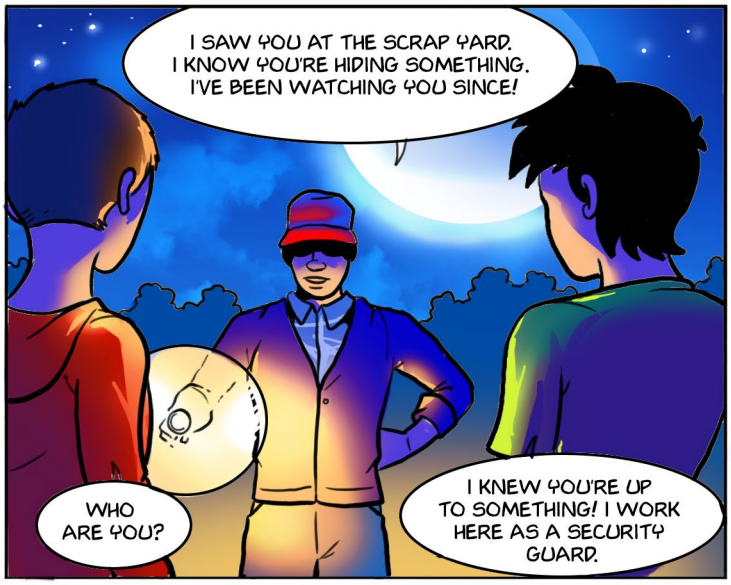
AFTER MINING, URANIUM ORE IS CRUSHED, GROUND AND PURIFIED WITH CHEMICAL SOLUTIONS, THEN WASHED, FILTERED AND SINTERED IN FURNACES. THE RESULTING "YELLOW CAKE" CONCENTRATE THEN UNDERGOES FURTHER CHEMICAL PROCESSING.


YOU SEE, BEFORE IT GETS TO A NUCLEAR POWER PLANT, URANIUM GOES THROUGH THE WHOLE PRODUCTION PROCESS.
THAT'S RIGHT, BUT THE ORE THAT IS MINED DOES NOT LOOK LIKE OUR PIECE OF METAL AT ALL.
WHAT ARE YOU SAYING?
I MEAN, THIS COULD BE URANIUM READY TO BE PLACED IN THE REACTOR, BUT NOT YET IN THE SHAPE OF FUEL PELLETS. REMEMBER THE PHOTO WE SAW ONLINE...
IT'S HARD TO BELIEVE THAT AT THE POWER PLANT THEY TURN URANIUM INTO PELLETS... THE FUEL PROBABLY GETS HERE ALREADY PREPARED.
MAYBE, BUT WE SHOULD CHECK ANYWAY.
IF THIS IS THE CASE, HOW DID THE URANIUM END UP AT THE SCRAP YARD? IS IT POSSIBLE TO BRING NUCLEAR FUEL OUT OF A POWER PLANT JUST LIKE THAT?
YEAH, THAT DOESN'T SOUND VERY LIKELY, BUT WE NEED TO CHECK ALL THE CLUES.
TAKE A LOOK AT THE MAP OF THE AREA AROUND OUR POWER PLANT. MAYBE WE SHOULD GO OVER THERE?
WHAT FOR?
WE'LL GO AROUND THE SITE, CHECK THE SECURITY AND WHICH IS THE BEST WAY TO GET SOMETHING OUT OF THE PLANT...
AND IF WE GET CAUGHT?
WE WILL GO TOMORROW NIGHT, NO ONE WILL SEE US.
OK! I HOPE...



check the dictionary at the end of the book →**power** →**MW**$_E$


LOOK, THERE'S A CAR ENTERING THE AREA.
LOOKS EMPTY, MAYBE THEY CAME TO FETCH SOMETHING... I SAW A SIMILAR CAR AT THE SCRAP YARD.
MAYBE WE'LL GET TO SEE HIM WHEN HE LEAVES...
THAT FENCE IS AMAZING... NOT JUST HIGH, IT'S ACTUALLY DOUBLE, AND THERE ARE CAMERAS EVERY FEW METERS.
YEAH, THERE'S PROBABLY NO WAY TO GET IN.
DO YOU THINK WE CAN GET CLOSER?
HMM... LOOK AT ALL THOSE CAMERAS AROUND.
THEY WON'T SEE US, LET'S GO!
I WOULD REALLY LIKE TO SEE WHAT IS ACROSS THAT FENCE. GIVE ME SOME LIGHT HERE.
WARNING
NUCLEAR POWER PLANT
NO TRESSPASSING!
SIMON... DID YOU HEAR SOMETHING...?



IT IS NOT POSSIBLE TO BREAK INTO THE POWER PLANT!

DESIGNERS OF A NUCLEAR POWER PLANT PUT SAFEGUARDS IN PLACE AGAINST A POSSIBLE ATTACK, FOR EXAMPLE AN ARMORED VEHICLE FILLED WITH EXPLOSIVES TO DESTROY PHYSICAL BARRIERS, OR A SIMILAR ATTACK FROM THE AIR OR SEA.

THE NPP IS SECURED WITH:

- PHYSICAL BARRIERS,
- A SPECIAL FENCE, ILLUMINATED AT NIGHT. THE NPP AREA MUST BE UNDER CONSTANT CONTROL OF OBSERVATION AND RECORDING EQUIPMENT,
- ALARM SYSTEMS, WHICH MUST BE EQUIPPED WITH AN INDEPENDENT POWER SUPPLY,
- RESTRICTIONS ON ACCESS TO THE NPP SITE (POSSIBLE ONLY FOR THOSE WITH SPECIAL ZONAL AUTHORIZATION - AN INDIVIDUAL PERMIT IS REQUIRED FOR EACH PART OF THE CLOSED AREA),
- CONTROL OF OBJECTS BROUGHT IN AND OUT USING, FOR EXAMPLE, METAL DETECTORS, RADIATION DETECTORS,
- ACCESS TO PROTECTED AREAS RESTRICTED TO SELECTED PERSONNEL ONLY,
- RADIATION DETECTORS, MOTION DETECTORS AND OTHER SENSORS THAT ACTIVATE THE CENTRAL ALARM SYSTEM,
- 24-HOUR SECURITY OF THE FACILITY, THE SECURITY SERVICE SHOULD BE ARMED AND PREPARED FOR RAPID INTERVENTION,
- MINIMUM NUMBER OF ENTRANCES TO THE PROTECTED AREA.

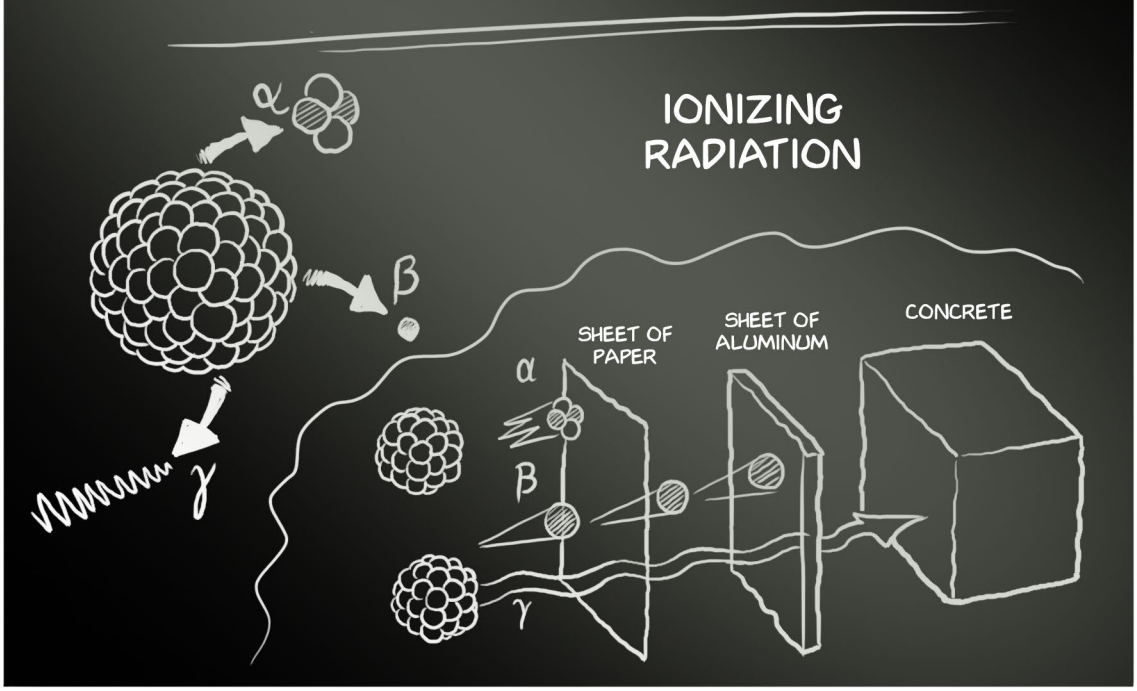
check the dictionary at the end of the book →**radioactive**

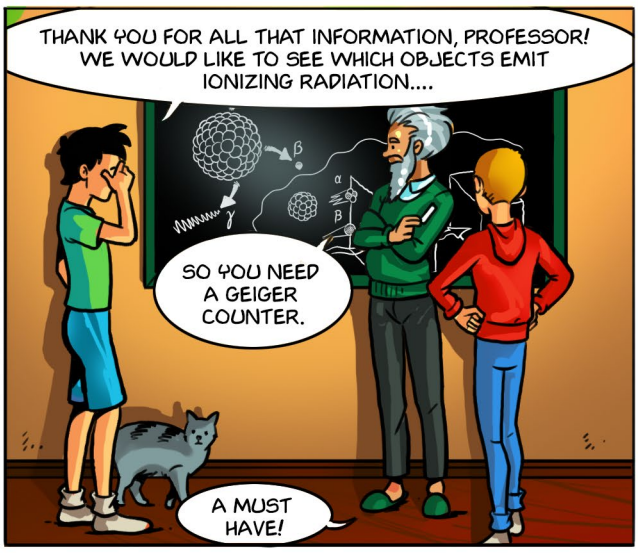
THERE ARE MANY TYPES OF RADIATION WE ENCOUNTER EVERY DAY. THERE ARE RADIO WAVES, WHICH ALLOW US TO WATCH TV, MICROWAVES THAT YOU USE IN YOUR OVENS TO HEAT FOOD, OR VISIBLE LIGHT, SENT OUT BY LIGHT BULBS.

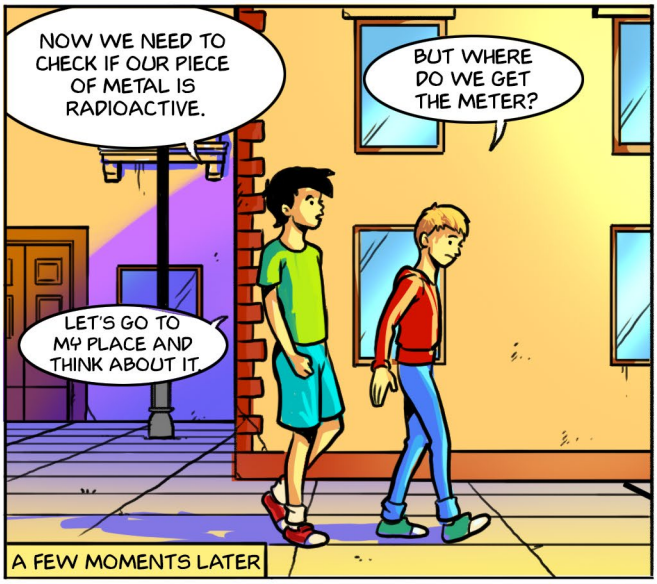
A SPECIAL TYPE OF RADIATION IS CALLED IONIZING RADIATION. IT IS FORMED IN ATOMIC NUCLEI WHEN AN ATOM OF ONE ELEMENT IS TRANSFORMED INTO ANOTHER. THIS PHENOMENON IS CALLED RADIOACTIVITY.

THE THREE MOST COMMON TYPES OF IONIZING RADIATION HAVE SPECIAL NAMES: ALPHA (α) - I.E. THE NUCLEUS OF THE HELIUM ATOM, IT CAN'T FLY TOO FAR EVEN IN AIR, AND IN ORDER TO PROTECT OURSELVES FROM IT ALL WE NEED IS A SHEET OF PAPER, BETA (β) - I.E. ELECTRONS, IN THIS CASE WE CAN USE A THIN SHEET OF ALUMINUM AS A SHIELD, AND GAMMA (γ) - WHICH EASILY PENETRATES MOST MATERIALS, SO IT REQUIRES SPECIAL SHIELDING, SUCH AS A THICK LAYER OF CONCRETE.

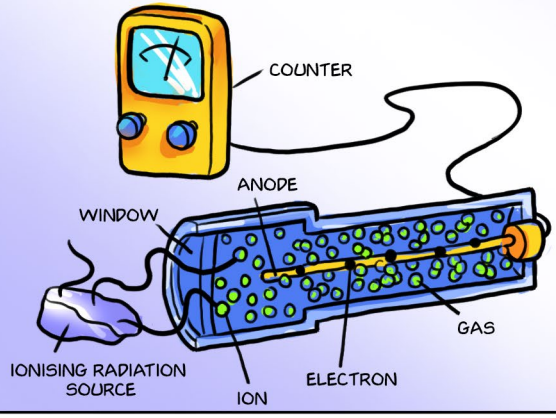
IONIZING RADIATION ACCOMPANIES US EVERY DAY, IN FACT, EVERYTHING AROUND US RADIATES. PLANTS AND ANIMALS, FRUITS AND VEGETABLES, THE SUN, THE EARTH, OUR HOMES, EVEN WE OURSELVES. HUMANS HAVE BEEN LIVING SURROUNDED BY RADIATION FOR CENTURIES, AND THEY ARE WELL PREPARED FOR IT.





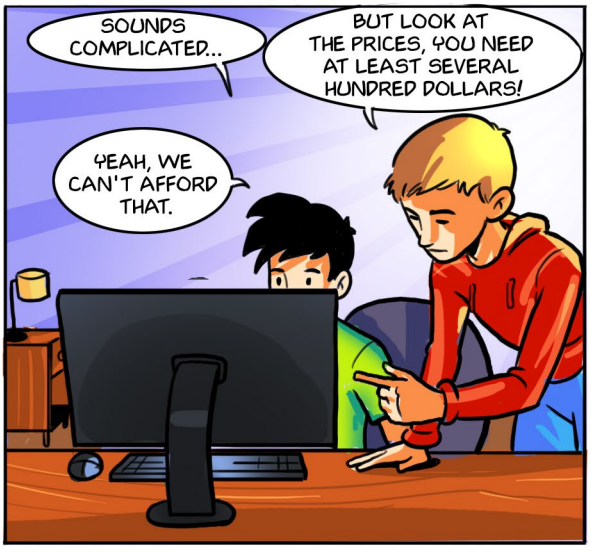


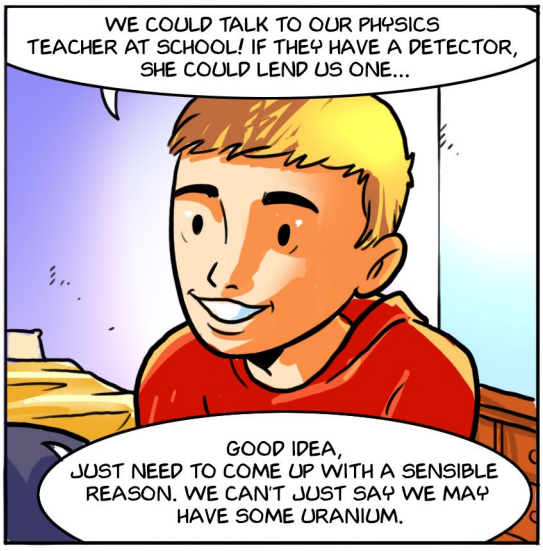
HOW A GEIGER COUNTER WORKS



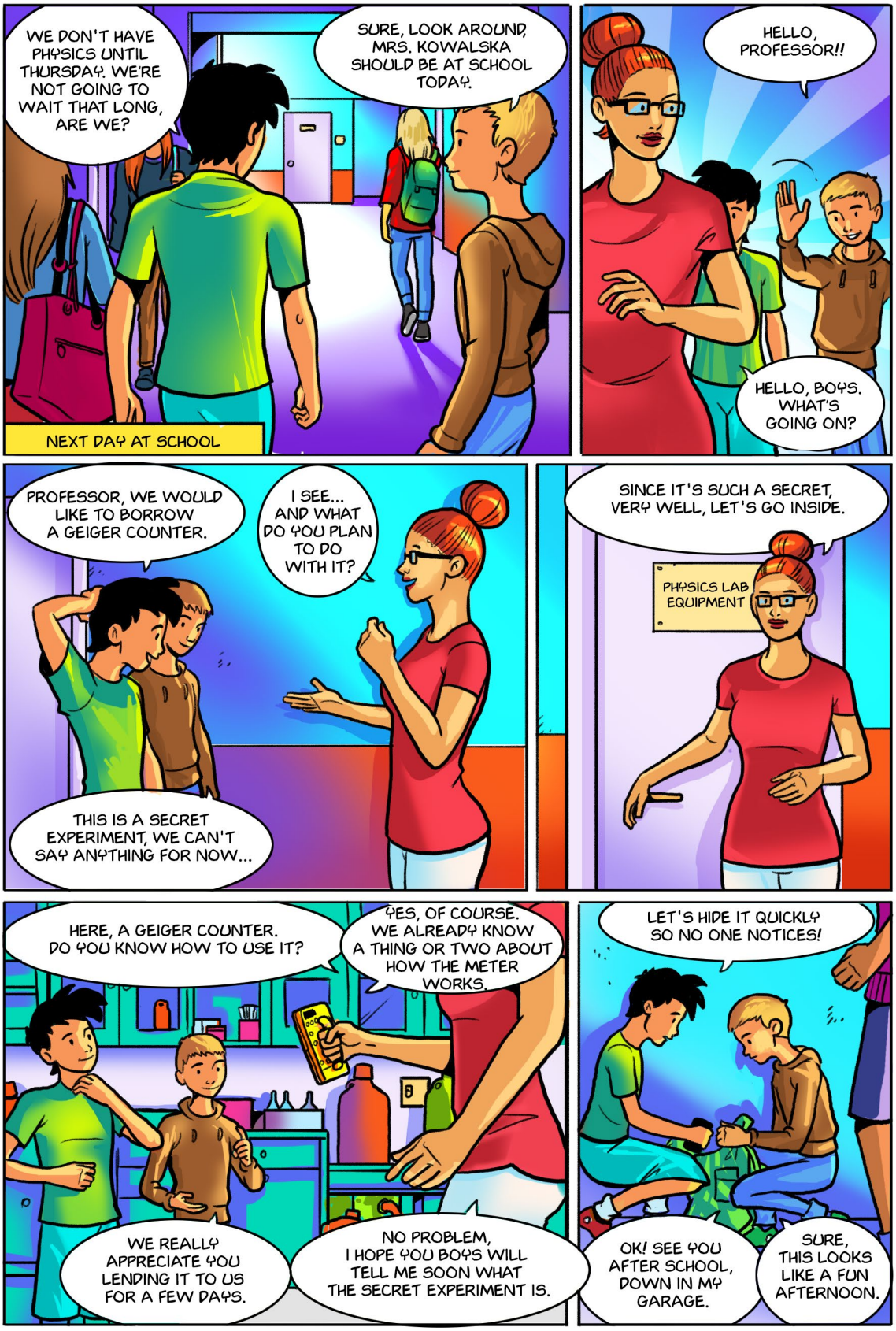
THE GEIGER COUNTER IS A FAIRLY SIMPLE DEVICE. IT CONSISTS OF A METAL TUBE ENCLOSED BY INSULATORS AT BOTH ENDS, WITH A THIN TUNGSTEN WIRE INSIDE. THE TUBE IS FILLED WITH GAS (SUCH AS AIR, ARGON OR NEON) AT LOW PRESSURE WITH ADDITIONAL VAPORS OF ORGANIC COMPOUNDS, SUCH AS ALCOHOL.

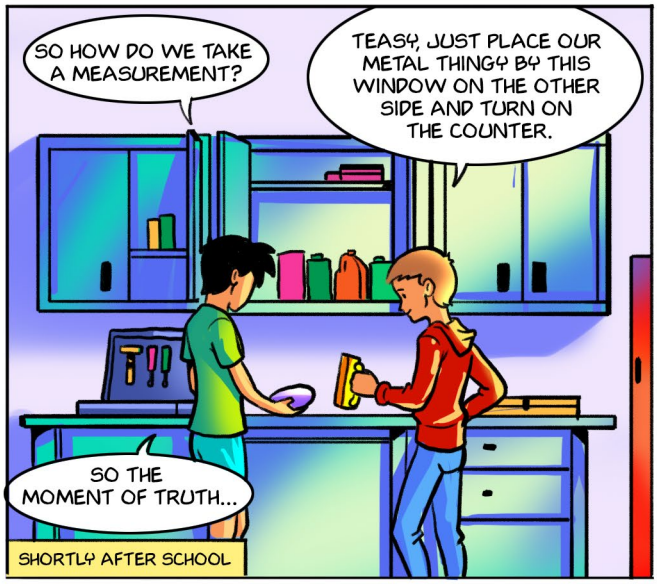
A HIGH VOLTAGE OF SEVERAL HUNDRED VOLTS IS APPLIED BETWEEN THE WIRE AND THE TUBE. IF IONIZING RADIATION ENTERS THE TUBE, IT CAUSES IONIZATION OF THE GAS (ELECTRONS ARE KNOCKED OUT OF THE ATOMS OF THE GAS). THE GENERATED CASCADE OF CHARGE (ELECTRONS) REACHES THE WIRE AND DISCHARGES A STRONG ELECTRIC PULSE, WHICH IS THEN AMPLIFIED AND RECORDED. THE NUMBER OF RECORDED PULSES IS PROPORTIONAL TO THE NUMBER OF PARTICLES THAT ENTERED THE COUNTER.

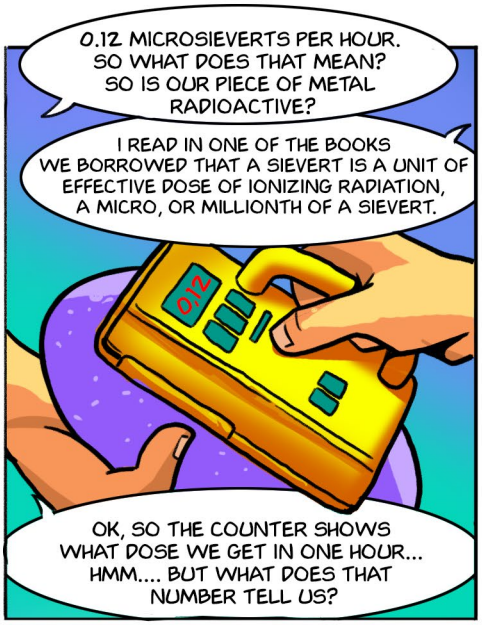


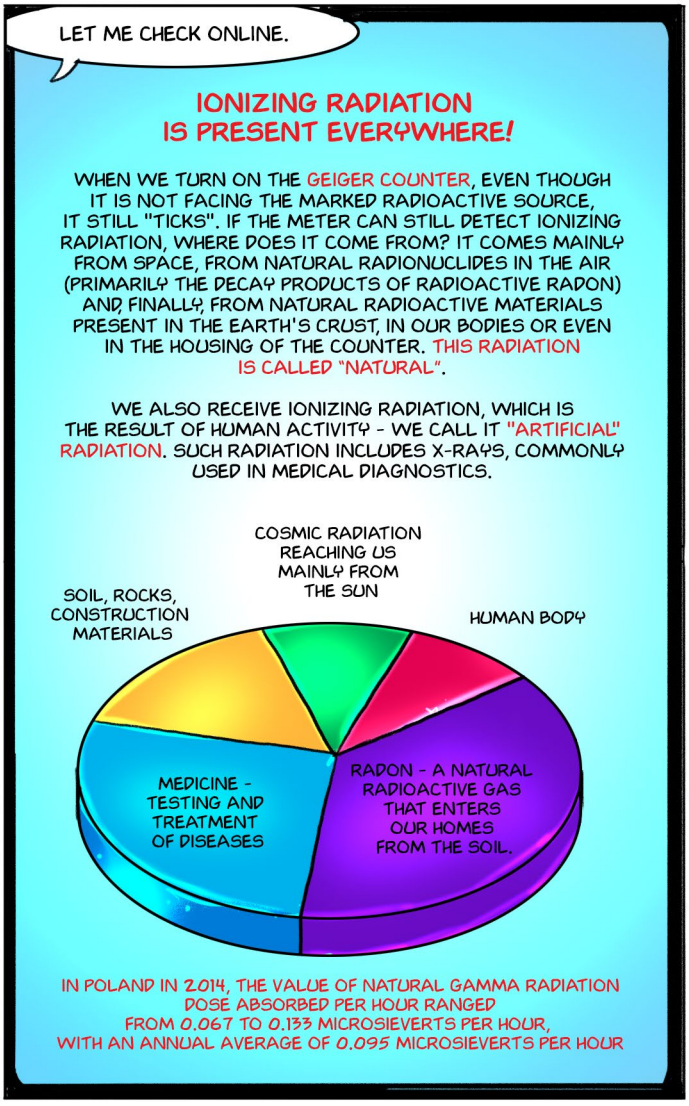


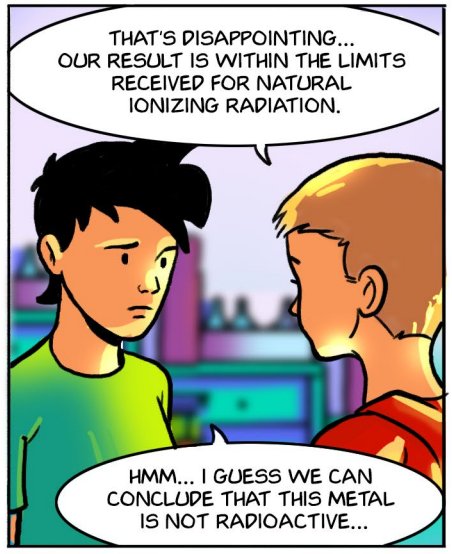
check the dictionary at the end of the book →**ionization** →**electric current**

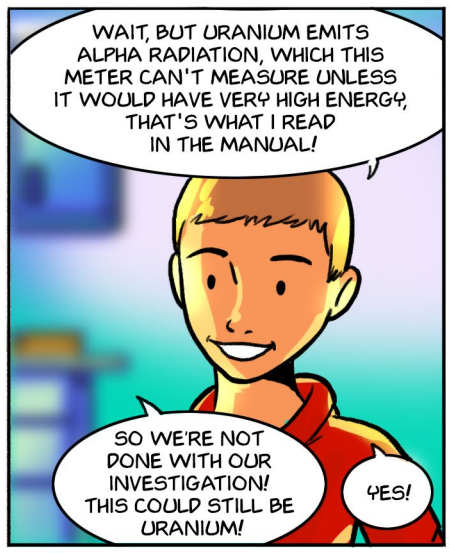

WE DON'T HAVE PHYSICS UNTIL THURSDAY. WE'RE NOT GOING TO WAIT THAT LONG, ARE WE?
SURE, LOOK AROUND, MRS. KOWALSKA SHOULD BE AT SCHOOL TODAY.
NEXT DAY AT SCHOOL
HELLO, PROFESSOR!!
HELLO, BOYS. WHAT'S GOING ON?
PROFESSOR, WE WOULD LIKE TO BORROW A GEIGER COUNTER.
I SEE... AND WHAT DO YOU PLAN TO DO WITH IT?
THIS IS A SECRET EXPERIMENT, WE CAN'T SAY ANYTHING FOR NOW...
SINCE IT'S SUCH A SECRET, VERY WELL, LET'S GO INSIDE.
PHYSICS LAB EQUIPMENT
HERE, A GEIGER COUNTER. DO YOU KNOW HOW TO USE IT?
YES, OF COURSE. WE ALREADY KNOW A THING OR TWO ABOUT HOW THE METER WORKS.
WE REALLY APPRECIATE YOU LENDING IT TO US FOR A FEW DAYS.
NO PROBLEM, I HOPE YOU BOYS WILL TELL ME SOON WHAT THE SECRET EXPERIMENT IS.
LET'S HIDE IT QUICKLY SO NO ONE NOTICES!
OK! SEE YOU AFTER SCHOOL, DOWN IN MY GARAGE.
SURE, THIS LOOKS LIKE A FUN AFTERNOON.



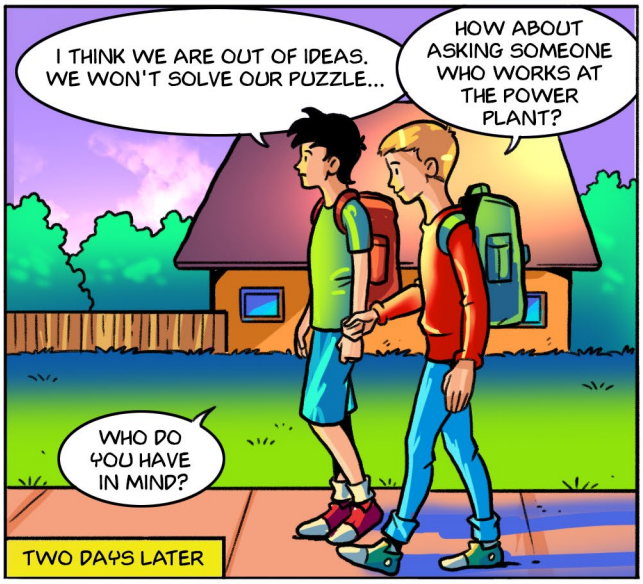


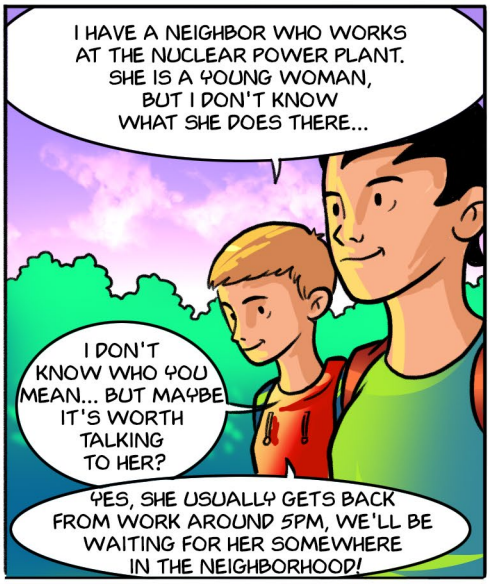


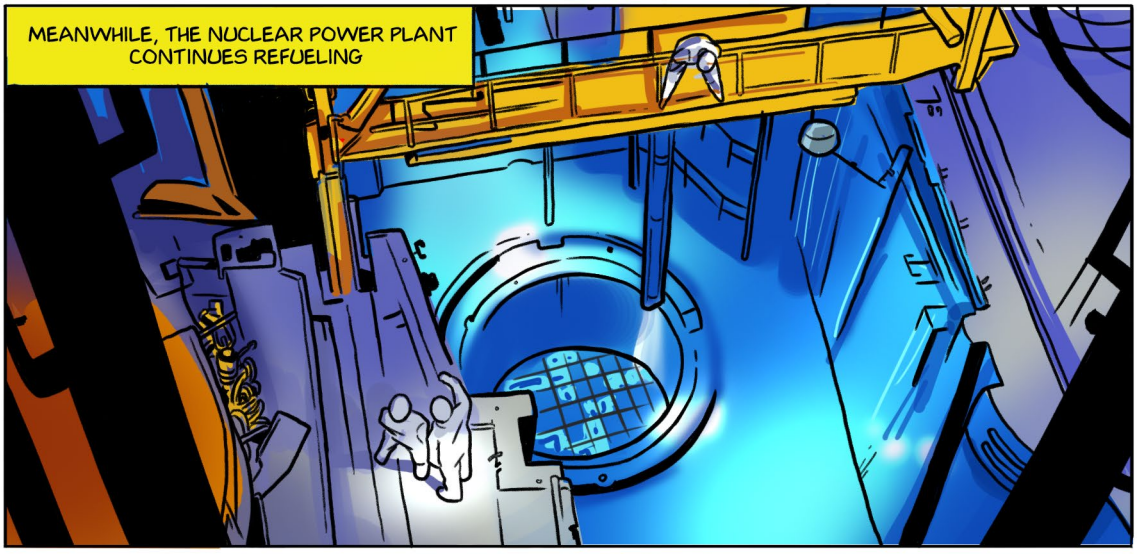




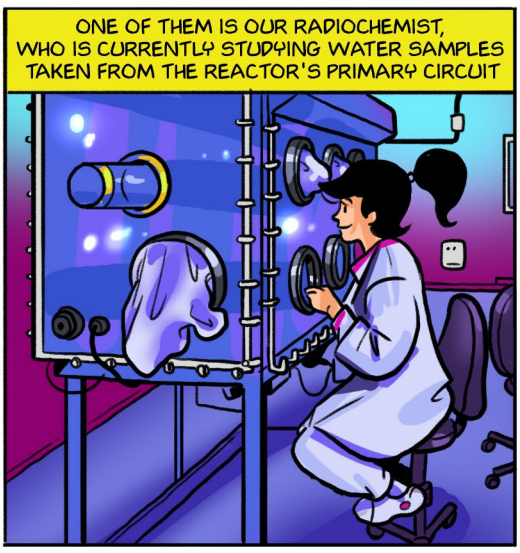
check the dictionary at the end of the book→**radionuclide** →**radon** →**sivert**

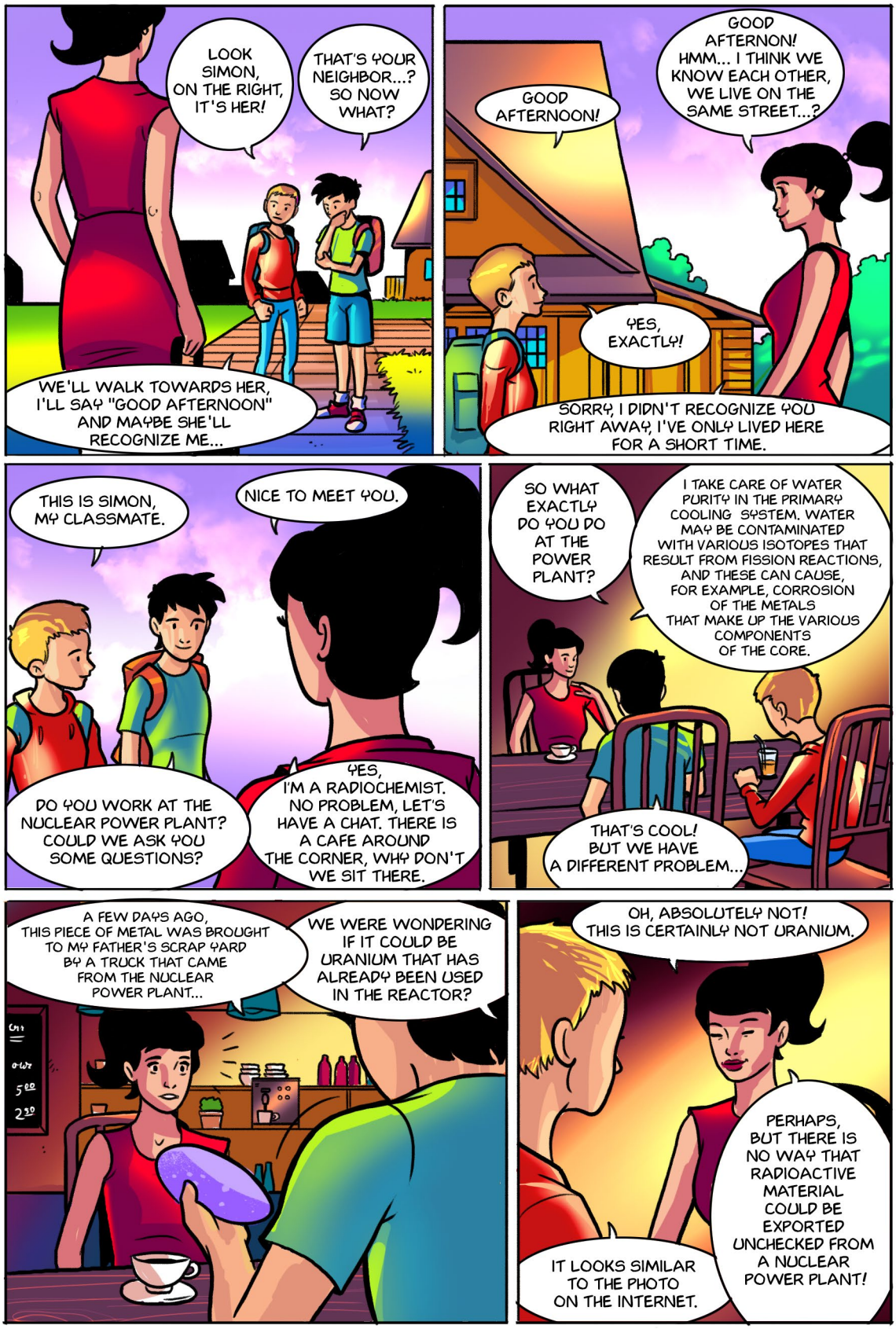

I THINK WE ARE OUT OF IDEAS. WE WON'T SOLVE OUR PUZZLE...
HOW ABOUT ASKING SOMEONE WHO WORKS AT THE POWER PLANT?
WHO DO YOU HAVE IN MIND?
TWO DAYS LATER


I HAVE A NEIGHBOR WHO WORKS AT THE NUCLEAR POWER PLANT. SHE IS A YOUNG WOMAN, BUT I DON'T KNOW WHAT SHE DOES THERE...
I DON'T KNOW WHO YOU MEAN... BUT MAYBE IT'S WORTH TALKING TO HER?
YES, SHE USUALLY GETS BACK FROM WORK AROUND 5PM, WE'LL BE WAITING FOR HER SOMEWHERE IN THE NEIGHBORHOOD!

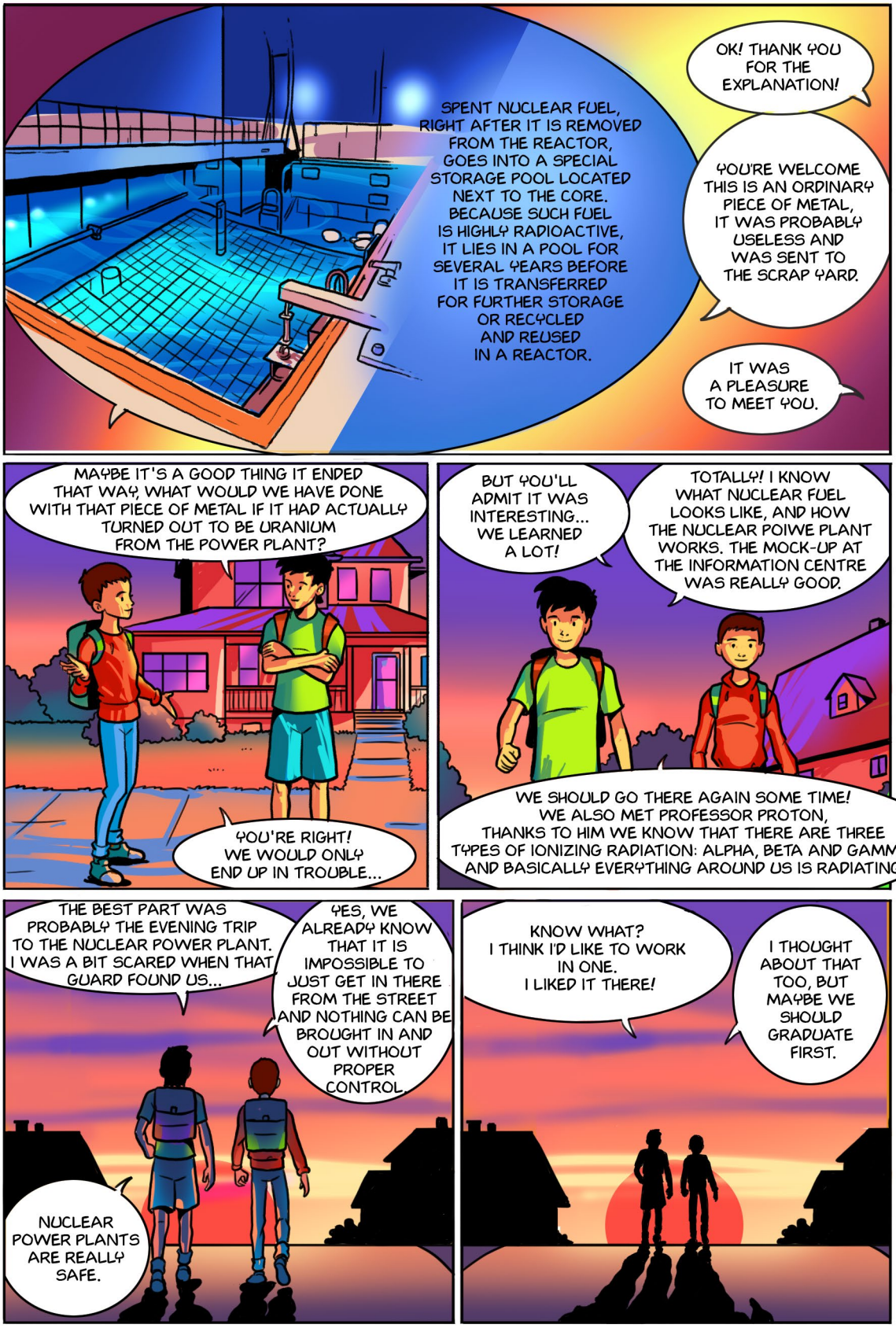

MEANWHILE, THE NUCLEAR POWER PLANT CONTINUES REFUELING


A TYPICAL NUCLEAR POWER PLANT OF 1000 MWe CAPACITY EMPLOYS AROUND 800 PEOPLE. AMONG THEM ARE PHYSICISTS, CHEMISTS AND NUCLEAR ENGINEERS, MECHANICAL AND ELECTRICAL ENGINEERS, REACTOR CONTROL OPERATORS, RADIATION PROTECTION AND RADIOACTIVE WASTE MANAGEMENT TECHNICIANS, IT SPECIALISTS, ADMINISTRATIVE AND SECURITY PERSONNEL, FIREFIGHTERS. YOU TOO, DEAR READER, MAY ONE DAY WORK AT A NUCLEAR POWER PLANT?


ONE OF THEM IS OUR RADIOCHEMIST, WHO IS CURRENTLY STUDYING WATER SAMPLES TAKEN FROM THE REACTOR'S PRIMARY CIRCUIT



check the dictionary at the end of the book →**radiochemist**


SPENT NUCLEAR FUEL, RIGHT AFTER IT IS REMOVED FROM THE REACTOR, GOES INTO A SPECIAL STORAGE POOL LOCATED NEXT TO THE CORE. BECAUSE SUCH FUEL IS HIGHLY RADIOACTIVE, IT LIES IN A POOL FOR SEVERAL YEARS BEFORE IT IS TRANSFERRED FOR FURTHER STORAGE OR RECYCLED AND REUSED IN A REACTOR.
OK! THANK YOU FOR THE EXPLANATION!
YOU'RE WELCOME THIS IS AN ORDINARY PIECE OF METAL, IT WAS PROBABLY USELESS AND WAS SENT TO THE SCRAP YARD.
IT WAS A PLEASURE TO MEET YOU.
MAYBE IT'S A GOOD THING IT ENDED THAT WAY, WHAT WOULD WE HAVE DONE WITH THAT PIECE OF METAL IF IT HAD ACTUALLY TURNED OUT TO BE URANIUM FROM THE POWER PLANT?
YOU'RE RIGHT! WE WOULD ONLY END UP IN TROUBLE...
BUT YOU'LL ADMIT IT WAS INTERESTING... WE LEARNED A LOT!
TOTALLY! I KNOW WHAT NUCLEAR FUEL LOOKS LIKE, AND HOW THE NUCLEAR POIWE PLANT WORKS. THE MOCK-UP AT THE INFORMATION CENTRE WAS REALLY GOOD.
WE SHOULD GO THERE AGAIN SOME TIME! WE ALSO MET PROFESSOR PROTON, THANKS TO HIM WE KNOW THAT THERE ARE THREE TYPES OF IONIZING RADIATION: ALPHA, BETA AND GAMMA, AND BASICALLY EVERYTHING AROUND US IS RADIATING.
THE BEST PART WAS PROBABLY THE EVENING TRIP TO THE NUCLEAR POWER PLANT. I WAS A BIT SCARED WHEN THAT GUARD FOUND US...
YES, WE ALREADY KNOW THAT IT IS IMPOSSIBLE TO JUST GET IN THERE FROM THE STREET AND NOTHING CAN BE BROUGHT IN AND OUT WITHOUT PROPER CONTROL.
NUCLEAR POWER PLANTS ARE REALLY SAFE.
KNOW WHAT? I THINK I'D LIKE TO WORK IN ONE. I LIKED IT THERE!
I THOUGHT ABOUT THAT TOO, BUT MAYBE WE SHOULD GRADUATE FIRST.

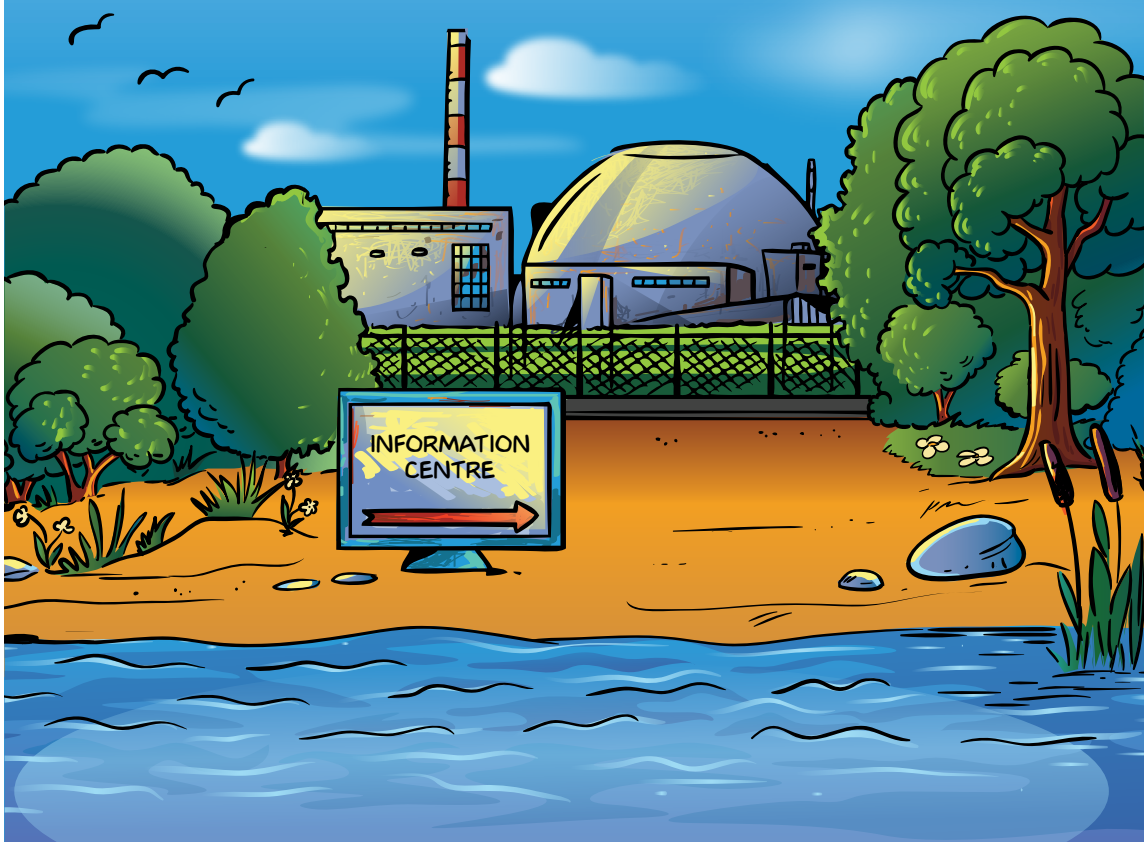
Learn a secret about nuclear power

Write the first letter of the first line in the blank space in the box at the bottom. Then discover the rule and choose the appropriate next letter, writing it in the blanks. This will help you uncover a secret.

N E U H I C O D L K E I E A B R E R E Z N O
P E T R A S G M Y A K I N S I L C A L E S E
V A W J N T A O R N A D A S S I A T H F A
E M E F L O W I R A T I O H A E N S E J N Y
E V Q I F S R I O A S N I B M O E R A N S T

N _____ _____ __ _____ ___ _____

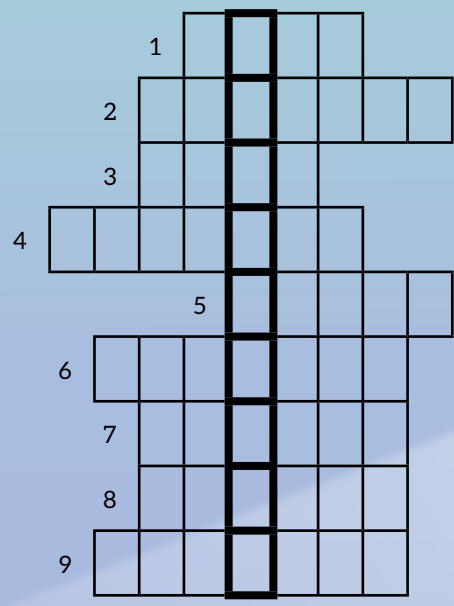
___ ___ _____

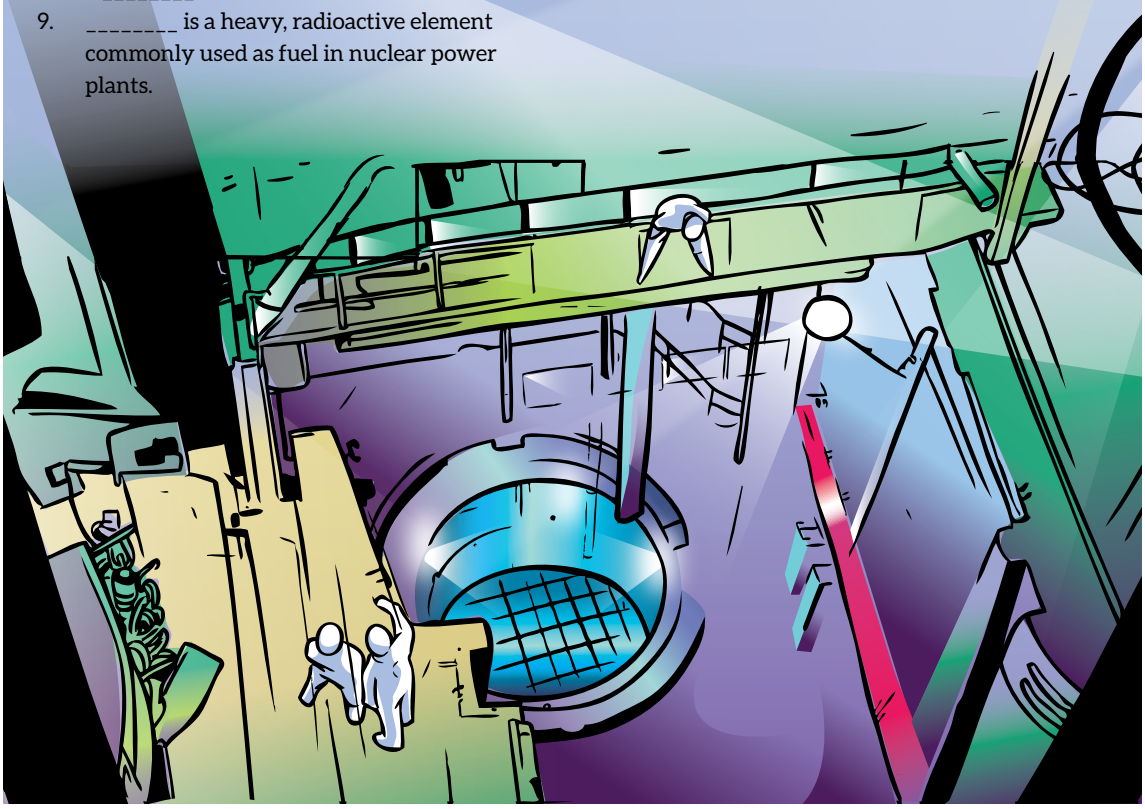


Check if you are an expert in nuclear energy?

Complete the sentences with the missing words and enter them in the crossword puzzle fields.

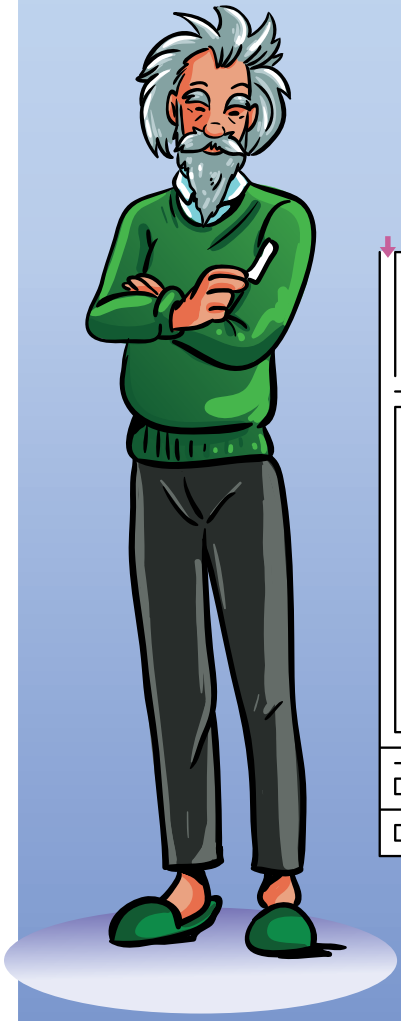
1. _____ radiation is commonly used in medical diagnostics (like looking at bones).
2. In a nuclear _____, a controlled fission chain reaction takes place.
3. Fuel _____ containing uranium pellets are placed in the reactor core.
4. The process of splitting a heavy atomic nucleus (like uranium) into smaller parts is called nuclear _____.
5. _____ radiation consists of Helium atom nuclei (two protons and two neutrons).
6. To start fission, the nucleus of a heavy atom is often hit by an accelerated _____.
7. A popular handheld device used to detect ionizing radiation is the _____ counter.
8. A particle found in the nucleus of an atom that has a positive electric charge is called a _____.
9. _____ is a heavy, radioactive element commonly used as fuel in nuclear power plants.

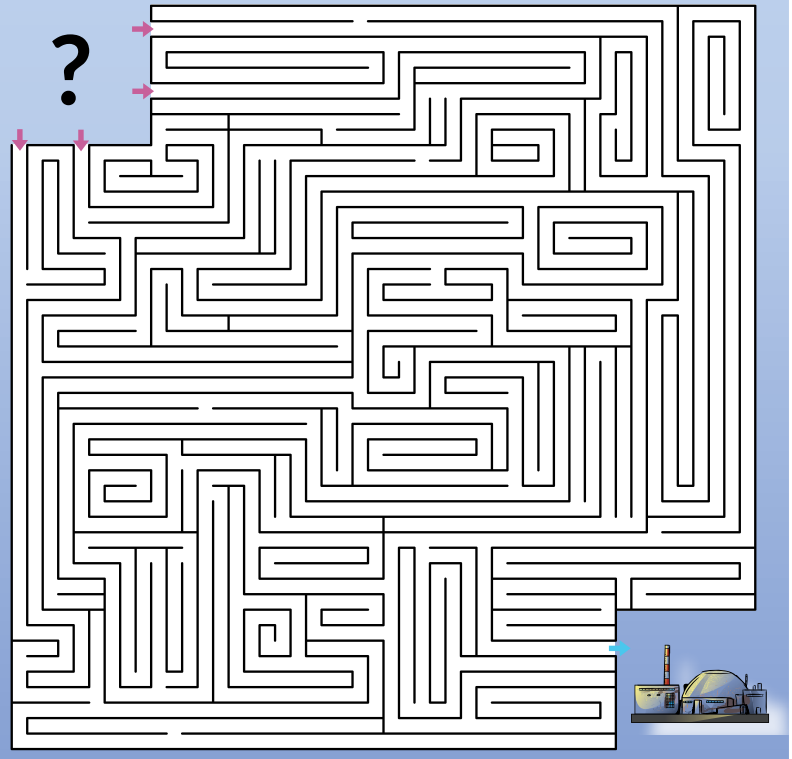




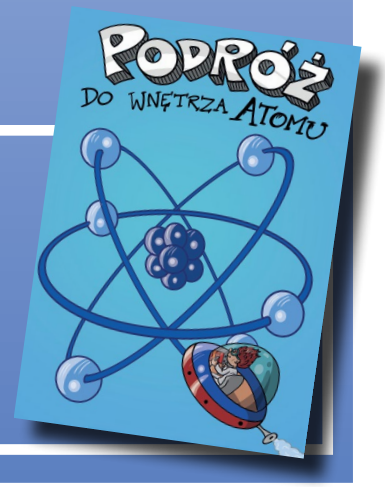
More than 440 nuclear reactors are operating in 30 countries!

Help Professor Proton reach his workplace - the nuclear power plant.



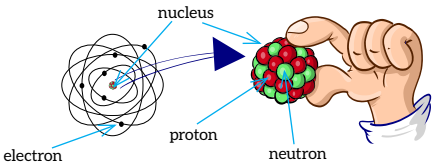


Want to know more? Check out our illustrated book: „Journey to the Center of the Atom”!



Glossary of terms used in the comic book

atomic nucleus (nuclide) — is located in the center of each atom, concentrating virtually all of its mass. It is made up of neutrons and protons, and depending on the number of neutrons and protons in the atomic nucleus, we have different elements, such as hydrogen, oxygen, carbon or uranium.



electric current — the flow of electrons through a conductor, such as a wire. When many electrons flow in a unit of time, we call that high current. The flow of charges is made possible by the fact that both ends of the wire are applied an electric voltage measured in volts.

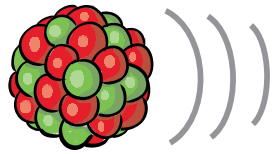
electric megawatt (MW_E) — for a large energy source, such as a power plant, we use a unit of power a million times larger than a watt (W), or megawatts (one million watts), marked as - MW. In a nuclear power plant, the energy released in the fission process is converted into heat. We are able to convert some of this thermal energy into electricity, and the power of the facility that performs this process is given in units of MW_E (megawatts electric).

element — everything around us is composed of the simplest materials, or elements. You can't change one element into another by simple methods. In everyday life we encounter elements such as gold, copper, iron, aluminum and many others.

ionization — the process of knocking one or more electrons out of an atom. Atoms which lost electrons are called ions.

power — if we consume energy in a certain period of time, the rate of this process is called power. If we transfer a lot of energy in a very short time, we say that the energy source has a lot of power. The unit of power is the watt (W), and every appliance or bulb includes a notice how much power it has (consumes or emits energy). A typical household incandescent bulb is 40-100 watts.

radioactive — atoms of some elements release energy by emitting various types of radiation. An atom like that (or the substance or material in which such atoms are found) is called radioactive.



radiochemist — a chemist who specializes in the study of radioactive substances.

radionuclide — an atomic nucleus (nuclide) that undergoes radioactive transformations, emitting ionizing radiation in the process.

radon — a radioactive gas that does not react chemically with anything and is heavier than air, so it accumulates in basements, tunnels or mines.

sivert (Sv), milisievert (mSv) — a unit used to determine the effects of ionizing radiation on the human body.

uranium — an element (silvery-white metal) naturally occurring on Earth, which, like coal, is mined. It was discovered by a German chemist named Martin Klaproth in 1789. Uranium is used as fuel in nuclear power.

SOLUTIONS

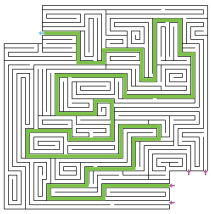
THE SECRET OF NUCLEAR ENERGY

NEUTRON
PETRASGMYAKINSILCALESE
VAWJNTAORNADASSIATHFA
EMEFLOWIRATIOHAENSEJNY
EVQIFSRIOASNIBMOERANST

CROSSWORD

1. XRAY 2. REACTOR 3. RODS
4. FISSION 5. ALPHA 6. NEUTRON
7. GEIGER 8. PROTON 9. URANIUM

HELP PROF. PROTON FIND HIS WAY



POLSKIE ELEKTROWNIE JĄDROWE

Polskie Elektrownie Jądrowe sp. z o.o. is a company responsible, among other things, for the development of the investment process, and acting as the investor in the project to build nuclear power plants with a total capacity of 6 to 9 GWe based on safe, proven, large-scale, generation III(+) pressurized water reactors (PWR), and potentially, their future operation.

The Company also supports the government administration in activities aimed at the execution of the Polish Nuclear Power Program, and the performance of the Intergovernmental Agreement between the Republic of Poland and the United States of America on cooperation towards the development of a civil nuclear power program and the civil nuclear power sector in the Republic of Poland.

More information:
www.ppej.pl

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The FORUM ATOMOWE Foundation was established with the idea of broadly understood informational and educational activities in the field of peaceful use of nuclear energy, promotion of physics and related sciences, as well as the idea of developing nuclear energy in Poland.

The FORUM ATOMOWE Foundation is a team of active and ambitious people, specialists in their fields, including nuclear physics, radiological protection, energy.

The Foundation run several interesting and valuable projects - the largest - „Atomic Bus - Mobile Laboratory", as well as „Meetings with Atomic Energy", „School Radon Map of Poland", knowledge competitions for primary and secondary school students, the popular science portal energiajadrowa.pl and the nuclear energy knowledge portal nukleo.pl.

The Foundation's volunteers remain convinced that only through reliable, comprehensive information and education, as well as broad direct participation of society in public debates, it is possible to obtain full support for the construction of a nuclear power plant in Poland and in other countries that take up a similar challenge.

More information:
www.forumatomowe.org

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