

1.9 TECH CONNECT: DETECTING COUNTERFEIT CANADIAN CURRENCY

TECH CONNECT 1.9 QUESTIONS

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Understanding Concepts

1. Canadian Journey series \$5 and \$10 dollar bills contain blue and white fibres that fluoresce when placed under UV light. \$20, \$50, and \$100 dollar bills have planchettes coated with ink that fluoresces under UV light. The blue and white fibres and the ink on the planchettes are composed of molecules whose electrons enter the excited state when exposed to UV light. When they return to the ground state, these electrons emit their excess energy in the form of fluorescent light.
2. Some security features on Canadian currency include planchettes and fluorescent fibres.
3. Smaller denominations of Canadian currency are just as likely to be counterfeited as larger ones because some counterfeiters believe that merchants are not as meticulous in checking smaller denominations of currency as they are in checking larger denominations of currency, possibly making the exchange of counterfeit smaller-denomination currency easier.
4. The detection of counterfeit notes can be considered qualitative analysis because the “quality” of the note is being assessed in order to ascertain whether it is counterfeit. A comparison is being made between a given note and the characteristics of an authentic note.

Making Connections

5. Student answers will vary. Some of the security features are raised printing (intaglio), a serial number, fluorescent areas (if a UV light source is available), and an optical security device (OSD). The OSD on the \$20 bill is on the front of the banknote, in the top left-hand corner. Other qualities that distinguish genuine currency from counterfeit currency are the paper and microprinting. Currency paper is special stock paper that is not easily reproduced. The words “Bank of Canada” are printed in small letters in specific areas on a \$20 bill.
6. If retailers are passed a note that they suspect is counterfeit, they should retain the note, if possible, record its details, obtain a description of the passer, including license plate, if possible, call the local police, and surrender the note to the police, requesting a receipt.

1.10 EXPLORE AN ISSUE: MRI CLINICS

Understanding the Issue

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1. Magnetic resonance imaging (MRI) uses magnets and radio waves to produce diagnostic images. The human body contains billions of hydrogen atoms that each have one proton in their nucleus. The protons spin on their axes, similar to a spinning top. When subjected to a magnetic field, the proton in each hydrogen atom aligns itself with either the south or north pole of the magnet of the MRI machine. The south and north poles of the magnet coincide with the patient’s head and feet when lying down in the machine. Then the patient is subjected to radio waves. The hydrogen protons absorb radio-wave energy and spin. When the radio-wave energy is no longer applied, the hydrogen nuclei return to their original positions, facing the south or north pole of the magnet, and release the initial radio-wave energy they absorbed. The energy released is detected and a computer transforms the information into an image. MRI is considered a form of spectroscopy because it is based on the absorption and release of energy by atoms. Hydrogen atoms absorb radio wave energy and then release it. The detailed image that is produced is a result of the release of this energy. Light spectroscopy is based on the release of absorbed energy in the form of light.
2. During an MRI scan, the hydrogen atom’s proton nucleus absorbs radio-wave energy.
3. The Ontario government’s solution to the current MRI shortage in the province is to allow the opening of 20 new MRI clinics run by private enterprise. The clinics will provide services covered by OHIP in addition to supplementary services not covered by OHIP, to be paid by the individual.
4. The Ontario government must keep close tabs on private MRI clinics because clients could state that the service they are receiving is supplementary, not medically necessary. They could then jump the queue and receive an MRI at a private clinic, and pay, rather than wait for months for an MRI at a hospital, paid for by the Ontario government.

TAKE A STAND: FAIR ACCESS

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Statement: Ontarians should have the right to choose faster access to MRI and better treatment through personal funding.

Table 1 Arguments that Support and Refute the Statement

Arguments that support the statement	Arguments that refute the statement
<ul style="list-style-type: none"> • People should have a right to spend their money as they desire and not be dictated to by government policy. • Private MRI clinics allow people to be diagnosed more quickly, thus easing the strain on the health care system. People's conditions can deteriorate further by waiting for an MRI for a year or more. • Doctors, nurses, and medical technologists will be enticed to stay in Canada with the option of working in the private sector. Private clinics will help stop the "brain drain" to the U.S. • Government monitoring will ensure that individuals do not jump queues for supplementary services. • Private clinics will alleviate the current stress on the public sector to provide MRIs. 	<ul style="list-style-type: none"> • Individuals with more disposable income will have access to health care facilities faster than individuals with less disposable income. This inequality violates the premise upon which the Canadian Health Act is based: equal access to basic health services. • Serious cases are dealt with in a reasonable time span. OHIP pays for MRI provided in the U.S. if the service cannot be provided in Ontario. • Leaders in health care will be drawn to private clinics as a result of the "profit" generated. This consequence will eventually drain the public sector of the best doctors, nurses, and medical technologists. The public system, used by the majority of Ontarians, will be at a disadvantage. • Government monitoring is not effective. Audits are costly and time-consuming. • Government should consider alleviating the stress on hospitals by buying more up-to-date equipment, opening more public MRI clinics, and funding more programs to train MRI technologists, for whom there is a growing demand.

Student arguments will vary. The above arguments are some examples. The numbering of their points and the writing of position papers will also vary.

1.11 THE FORMATION OF IONIC COMPOUNDS

SECTION 1.11 QUESTIONS

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Understanding Concepts

1. An electrolyte is a compound that, when dissolved in water, produces a solution that conducts electricity. A nonelectrolyte is a compound that, when dissolved in water, produces a solution that does not conduct electricity.
2. Atoms have a tendency to form ions when their outermost shells are not full and they need to gain or lose electrons in order to attain a stable octet structure. Metals have a tendency to lose their valence electrons to attain a full outer shell and become cations, whereas nonmetals tend to gain electrons to fill their outer shells and become anions.
3. Cations and anions form ionic bonds. Metals lose electrons and become cations, whereas nonmetals gain electrons and become anions. The strong electrostatic force of attraction between cations and anions results in the formation of an ionic bond.
4. (a) K^+
 (b) Cs^+
 (c) $:\ddot{I}:$
 (d) $:\ddot{S}i:$