CHECK YOUR UNDERSTANDING

Module A

L2:

- What are the top cut ten diamonds by size? Where do most of these famous diamonds originate?

	Diamond Name	Origin
1	Golden Jubilee	Premier Mine, S. Africa
2	Cullinan I	Premier Mine, S. Africa
3	Incomparable	Congo
4	Cullinan II	Premier Mine, S. Africa
5	Spirit of Grisogono	Congo (?)
6	Centenary	Premier Mine, S. Africa
7	Jubilee	Jagersfontein Mine, S. Africa
8	7th DeBeers Diamond	DeBeers Mine, S. Africa
9	The Red Cross	DeBeers Mine, S. Africa
10	Millennium Star	Congo

- Other than its impressive size, what makes the Mogul Emerald Unique? Why do you think it is called the "Mogul Emerald?"
- From where do most of the listed famous emeralds originate? Rubies?

L3:

- How has DeBeers historically had such a strong hold on the diamond market?
- How are diamonds sorted into sights? Who can purchase a sight?

L4:

- Cultures worldwide greatly value gemstones, both historically and symbolically. What are some reasons why they are considered so valuable?
- What are some factors that affect the popularity of gemstones over time?
- What is the CDCC and how does it regulate the authentication of Canadian diamonds? How does this affect retailers? (ie. what sort of information are they required to provide to consumers?)

L5:

- Can you identify the following as a mineral, gemstone, or rock?
    - emerald
    - beryl
    - ruby
    - corundum
    - diamond
    - ice
    - granite
    - concrete
    - cubic zirconia
    - sugar crystal
- Regarding plate tectonics, consider:
    - what happens when two continental plates converge?
    - what happens when two oceanic plates converge?
    - which plate is subducted when a continental and oceanic plate converge? Why?
    - what kind of plate interaction that results in the formation of island arc chains?

L6:

- How abundant is silicon (Si) in the Earth's crust?
- What are some common traits of the native metals that differentiate them from most other minerals?
- What is the difference between a noble metal and a precious metal?
- What is Sterling Silver?

L7:

- Recall in Lesson 2 we learned the Black Prince's Ruby was actually the mineral spinel, not ruby. Now that we know a bit more about minerals, what mineralogical characteristics of these two gemstones could you use to tell them apart?
- What is a solid solution? Can you give an example of a common mineral that displays solid solution in its chemical formula? See if you can find another mineral in your textbook that can exhibit solidsolution substitutions.
- How is chromium incorporated into colourless beryl to produce emerald? Why do we write beryl and emerald with the same chemical formula?

Module B

L8:

- What kind of deposits hosted the majority of historical diamonds from Brazil and the Golconda region of India?
- What happened in 1867 that made diamonds much more readily accessible to consumers?

L9:

- What differentiates Type I from Type II diamond? Why are Type IIa diamonds so rare?
- Which of the following are common crystal habits of rough diamond?
    - octahedral
    - cubic
    - prismatic
    - dodecahedral
- Regarding the physical properties of diamonds:
    - What are some of the diagnostic properties (physical and chemical) of diamonds?
    - Which of these properties might a geologist use to identify a rough diamond in the field?
    - Which of the properties might a gemologist used to distinguish a cut diamond from some of its imitators, like cubic zirconia, glass, moissanite?

L10:

- What rock type are most primary diamond deposits hosted in?
- Why are diamonds only found in regions of very old continental crust?
- Why do you think kimberlites form "carrot-shaped" deposits?
- Try to name three indicator minerals for diamond bearing kimberlites.
- What is unique about the Argyle mine in Australia?
- Do you know which of these techniques are commonly used to explore for diamond in arctic regions?
    - A) aeromagnetic surveys
    - B) panning rivers
    - C) glacial till sampling
    - D) offshore drilling platforms

L11:

- What is often considered the "5th C" that affects the value of a diamond?
- What impact does a country such as the United States have on the success or failure of the Kimberley Process?
- What portion of the global diamond trade does the Kimberley Process attempt to moderate?

L12:

- How do refraction and reflection differ?
- What is the phenomena that produces 'fire' in gemstones, especially diamond?
- Total internal reflection also plays a role in a gemstone's 'fire', how?
- Compare and contrast the causes of asterism and chatoyancy with those of iridescence and labradoresence.
- Why do some minerals (e.g., tanzanite) display pleochroism?
- Knowing what you do about the different colours of corundum, is ruby allochromatic or idiochromatic? Why? What about a star ruby?

L13:

- What is emerald? How does it differ from aquamarine?
- How are emerald and aquamarine similar?
- How does green beryl differ from emerald?

L14:

- Compare the hardness, cleavage, specific gravity, streak, crystal system and refractive index (or indices) of beryl to diamond. *See Below*
- Which Al3+ substitutions in beryl are responsible for the blue colour of aquamarine? Emerald? Red beryl?
- How might beryl be distinguished from quartz in rough samples?
- How do the functions/properties of oil, epoxy and polymers differ for treating emerald? What diagnostic feature is present in some commercial polymers?
- What is the Gota De Aceite effect and why is it desirable?

L15:

- What is the role of hydrothermal fluid in producing metamorphic gem beryl deposits?
- What is the typical parental igneous rock type that can generate magmatic gem beryl deposits?
- In which geological environment do the largest crystals of beryl occur?
- Considering beryl's low density compared to common placer minerals (e.g., gold, diamond) why does it still end up in placer deposits?

L16:

- Why is nearly all gem corundum heat-treated?
- What are “Fancy Sapphires?”

L17:

- What is the chemical formula of corundum?
- Can you explain why corundum can have a wide variety of colours?
- In particular, what gives rise the "Pigeon's Blood Red" and "Cornflower Blue" colours in corundum?
- What minerals are rubies commonly confused with? What about sapphires?
- Compare the hardness, cleavage, specific gravity, crystal system and refractive index (or indices) of corundum to diamond and beryl. (Use your physical properties summary sheet!)

L18:

- How are gem corundum deposits in lamprophyres and alkali basalts similar to diamond deposits?
- Why might xenocrystic corundum be more common than xenocrystic diamond?

L19:

- How is a polarizing microscope different from a normal microscope?
- If you wanted to determine the value of a gemstone's refractive index, which tool(s) would be most useful?
- If you wanted to classify a gemstone on the basis of the specific range of light that it absorbs, which tool would be most useful?
- What differences in the transmittance/absorption graph of alexandrite would you expect as compared to ruby and emerald?

L20:

- Which type of pegmatite tends to be the best for rare metal ore deposits?
- What are some countries that host famous gem-bearing pegmatite localities?
- Why are high volatile concentrations essential in producing gem-bearing pegmatites?
- What happens if the volatile concentrations become too high?
- How might corrosion in a pegmatite affect a faceted gemstone, such as beryl or spodumene?

L21:

- What crystal habit is common for tourmaline? What about colour?
- How can a single tourmaline crystal exhibit “watermelon” colouration?
- Where was Imperial topaz traditionally mined? Where is it mined today?
- What property can make topaz difficult to work with in jewellery?
- What colours are the two main gem varieties of spodumene?

L22:

- Why are jade and lapis lazuli considered rocks and not minerals like most gemstones?
- What is an organic gemstone?

L23:

- What is the origin of the strong play of colours in opal?
- What is the origin of the strong colour change in alexandrite?
- What is the parent mineral for the gem tanzanite? What do you suppose is the origin of the gem's varietal name?
- Although tanzanite is a marvelous gemstone, what do you think one of its major drawbacks is?
- Can you differentiate between the artisanal mining and traditional mining areas for the Merelani Hills area by investigating satellite imagery through Google Maps?

Module C

L24:

- Can you think of some reasons and examples of how gold can be considered an element, a mineral, and a noble metal?

L25:

- List the commonalities and differences between the three main geological settings for lode gold (mesothermal, intrusion-related, epithermal).
- Which of the lode gold deposit types do you think is the most important producer for Canada?
- The most shallow lode gold deposits form at less than 1.5 km depth. What are 2 components of the fluids that create these deposits? Does the depth of the deposit contribute to this? What current geological environment could you find these deposits in?
- A common standard weight that gold grade is reported in is the "ton" (e.g., 1 oz Au per ton). How much volume of rock would be equal to 1 ton if you assumed a denisty of 3.5 g/cm3?

L26:

- What are some differences and commonalities between gold localities in BC and the Canadian Shield?

L27:

- Imagine a timeline showing significant events in the discovery and use of platinum throughout history. Why does platinum have a shorter history than gold?

L28:

- Name the district that is Canada's major supplier PGEs. What is one particularly distinct feature that separates this deposit from other Ni-PGE deposits?

L29:

- In this lesson we read about VMS deposits. What does the acronym 'VMS' stand for? Why are these deposits important in Canada? Draw a picture and label the main components of a VMS deposit.
- Compare and contrast the two general periods of silver mining in Canada.
- Did you know that silver can be used in wound dressings? Describe some other uses of silver that you may personally encounter in your everyday life. Feel free to do further research on any uses that seem particularly obscure to you!
- Do you know the chemical symbol for silver?

L30:

- You read a fascinating article in the newspaper about an incredible copper mine but it does not mention the name or location of the mine. Given the information below, do you think it is most likely that the mine is located in (1) Utah, USA, (2) Papua, Indonesia or (3) BC, Canada? Can you name the mine?
    - Ore is crushed onsite at the mine
    - Ownership of the mine is shared between more than one company/entity
    - The mine currently employs 17,848 people
    - As well as being a copper mine, the mine is also one of the largest gold mines in the world
    - The mine is located at the boundary of two tectonic plates and close to remnants of a glacier

L31:

- At which stage of mineral resource development would feasibility and engineering studies be conducted and capital be raised?
- Where in Canada would you find the highest concentration of actively mined porphyry deposits?
- Where is the largest producing mine for Ni-Cu-PGE?
- Imagine you are through a forested valley and you stumble upon several grape-sized gold nuggets!
- Glancing around you see you are at the base of a steep treeless hillside with a fast-moving stream about 7 meters to your right. What type of deposit are these gold nuggets most likely to represent?
- Give reasons to explain your answer.
    - A) Primary deposit
    - B) eluvial deposit
    - C) alluvial deposit
    - D) porphyry deposit
    - E) coluvial deposit

L32:

- Which areas of the world are most impacted by artisanal and small scale mining?
- How do governments typically view artisanal mining?
- How do environmentalists view artisanal mining?
- How do large mining companies view artisanal mining?
- In addition to fair labour conditions and worker's rights, what are some other variables are taken into consideration when labelling a product as "fair trade?"

L33:

- Compare the biases of the filmmakers in "Red Gold" and "Not your grandfather's copper mine." How does this affect the content of each?
- Consider the types of impacts that large scale gold mining can have against some of the impacts that artisanal and small scale mining can have. Is one 'better' than the other? Is one 'worse' than the other?

L34:

- List advantages and disadvantages of the two core techniques and four modern techniques in metal jewellery production. In your opinion, which technique produces the most attractive results?
- Compare and contrast Lydian Lions with Silver tetradrachms. Consider the date of origin, material, detail, technique of minting and evolution of design over time.
- While travelling in Europe, you discover two very old coins at an archeological site (lucky you!). One of the coins appears to be gold and one appears to be silver. Assuming you have unlimited funds and time, could you determine which country these ancient coins came from? If so, how easy or difficult would this be to do? Why?