2019 Manitoba Envirothon
Provincial Field Test
Environmental Awareness

2019 MANITOBA ENVIROTHON FIELD TEST
Down by the River

STOP 1

AQUATIC ECOLOGY (5 pts)

1) Scientists studying our changing climate agree that human activities are warming the planet, primarily through the release of excess greenhouse gases to the atmosphere. While the resulting changes are relatively slow and complex, scientists predict that the effects to our aquatic ecosystems will profoundly affect our lives and those of other species. Indeed, we are already observing such effects.

True/False: *Indicate whether each of the following observed changes in the hydrologic cycle, on average, is true (T) or false (F) by circling the correct answer.* (2 pts - 0.5 pt each)

    T   F   Increased concentrations of water vapour in the atmosphere.
    T   F   Reduction in average snow cover and increased melting events in winter.
    T   F   Significant changes in average soil moisture content and runoff patterns.
    T   F   Increased variability in precipitation patterns with more extreme events.

2) As change often results in greater instability and variability, predictions about the future in local regions can be uncertain. However, existing studies point to expected effects, including changes here in Manitoba.

Fill in the blank: *Complete the following sentences with the most appropriate words to indicate how climatic changes are predicted to affect the nearby Assiniboine River and its watershed.* (3 pts - 0.5 pt each)

    a) Precipitation will be _____ during warmer winters.

    b) Summer temperatures will be _____ on average.

    c) Spring flooding events will _____ in magnitude and frequency.

    d) Summer river flows will be _____ .

    e) _____ water temperatures will impact fish spawning.

    f) Water quality in the river will be _____ .

Answer:
1) T, T, T, T (2 pt - 0.5 pt each)

2a) higher or greater   (0.5 pt) (Other words with the same meanings will also be acceptable answers)
2b) higher or hotter (0.5 pt) (Other words with the same meanings will also be acceptable answers)
2c) increase (0.5 pt) (Other words with the same meanings will also be acceptable answers)
2d) reduced or lower (0.5 pt) (Other words with the same meanings will also be acceptable answers)
2e) higher or hotter (0.5 pt) (Other words with the same meanings will also be acceptable answers)
2f) reduced or poorer (0.5 pt) (Other words with the same meanings will also be acceptable answers)

Reference:
1) Aquatic Ecology Provincials Resource p 99
2) Aquatic Ecology Provincials Resource p 103

STOP 2

AQUATIC ECOLOGY (10 pts)
This question requires materials provided at stop.

Southern Manitobans often forget that our province has a sea coast. Most of the water flowing down the Assiniboine River will eventually flow via the Nelson River into Hudson Bay, part of the global ocean system.

1) What name is used for the type of ecosystem at the mouth of the Nelson River where the freshwater from the river enters and mixes with the ocean water of Hudson Bay? (1 pt)

2) The global ocean system is very large and complex.

   a) What percentage of our planet's surface is covered by the global ocean? Circle the best answer from the percentages listed below. (0.5 pt)

      30%   50%   70%   90%

   b) Complete the sentence with the most appropriate word(s). (0.5 pt)

      Although the ocean does not have any boundaries, we have divided it up into five major "oceans", the Indian, Pacific, Atlantic, Southern, and _____ oceans.

3) Diagram A-G illustrates the different spatial ocean zones which are defined based on depth and light. The names of these zones have been replaced in diagram A-G by numbers. The names of these zones, in alphabetical order, are: Abyssal, Aphotic, Benthic, Euphotic, Intertidal, Neritic,

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Pelagic, Oceanic. Write the correct name of each zone beside the corresponding zone number listed below. (4 pts - 0.5 pt each)

zone 1 _____
zone 2 _____
zone 3 _____
zone 4 _____
zone 5 _____
zone 6 _____
zone 7 _____
zone 8 _____

4) Hudson Bay is a relatively small portion of the global ocean. It is ice-covered for much of the year, but it does not have multi-year ice such as occurs in the Arctic Ocean. Sea ice plays an important role in the productivity of the northern ocean.

   a) What marine mammal relies heavily on sea ice for support while hunting and capturing its prey? (1 pt)

   b) What special physical feature of sea ice contributes to its ability to support microscopic photosynthetic organisms? (1 pt)

5) One of the global systems of water movement is driven in large part by temperature and salinity differences affecting water density. It slowly, but continuously, moves water through most regions of the open ocean and has a significant impact on climate in many regions of the world.

   a) What is this system called? (1 pt)

   b) What other system of oceanic water movement is driven by the Moon? (1 pt)

Answer:
1) estuary (1 pt)
2a) 70% (0.5 pt)
2b) Arctic (0.5 pt)
3) zone 1: Intertidal (0.5 pt)
zone 2: Neritic (0.5 pt)
zone 3: Euphotic (0.5 pt)
zone 4: Oceanic (0.5 pt)
zone 5: Benthic (0.5 pt)
zone 6: Aphotic (0.5 pt)
zone 7: Pelagic (0.5 pt)
zone 8: Abyssal (0.5 pt)
4a) polar bear (1 pt)
4b) either 'network of tunnels' or 'brine channels' (1 pt)

5a) either 'global conveyor belt' or 'conveyor belt' (1 pt)
5b) either 'tidal' or 'tides' (1 pt)

Reference:
1) Aquatic Ecology Provincial Resource, p 66-7
2) a) Aquatic Ecology Provincial Resource, p 67
b) Aquatic Ecology Provincial Resource, p 68
3) Aquatic Ecology Provincial Resource, p 68-9
4) Aquatic Ecology Provincial Resource, p 73
5 a) Aquatic Ecology Provincial Resource, p 70
b) Aquatic Ecology Provincial Resource, p 71

STOP 3

AQUATIC ECOLOGY
There is no question for this discipline at this stop.

STOP 4

AQUATIC ECOLOGY (5 pts)

The Assiniboine River, which you can see at several locations along this trail, runs through the prairies of Saskatchewan and Manitoba, passing through three urban centres. It is one of the most important water resources in Manitoba. The availability of quality water from the river is vital to maintaining continued community, agricultural and economic development as well as recreational and environmental sustainability in the region. (from: Assiniboine River Water Demand Study, 2012)

1) There are two classifications of water use. Indicate whether each statement describes an INSTREAM (I) or WITHDRAWAL (W) use by circling the correct answer. (2 pts - 0.5 pt each)

     I   W   crop irrigation
     I   W   recreational boating
     I   W   hydroelectric power generation
     I   W   household uses

2) The Shellmouth Dam and resulting reservoir (Lake of the Prairies) was created on the upper Assiniboine River to reduce the risk of flooding downstream. List two (2) ways dams and their resulting reservoirs can impact the aquatic community. (1 pt)

3) The Province of Manitoba issues licenses to users of the Assiniboine River. Below is a summary table showing how water use is allocated. (Data from: Assiniboine River Water Demand Study, 2012)

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Purpose	2010 allocation (acre-feet)
Municipal	12,963
Industrial	6,605
Irrigation and Agriculture	19,608
Recreational	5,500
La Salle Diversion	22,000
Total	66,676

a) Using a calculator, determine the percentage of the total water allocated for the purpose indicated to one decimal place. (1 pt - 0.5 pt each)

    Irrigation and Agriculture   _____
    Municipal   _____

b) Indicate whether the statement is true (T) or false (F) by circling the correct answer. (1 pt - 0.5 pt each)

    T   F   Irrigation of crops is the largest water consumptive use in the world.
    T   F   Across Canada most water use in the home occurs in the bathroom.

Answer:
1) W, I, I, W (2 pts - 0.5 pt each)
2) Any 2 of: upstream land is flooded, loss of habitat, accumulation of sediment in the reservoir, increased turbidity in the reservoir, decomposition of flooded vegetation causing release of greenhouse gases and mercury, fish contaminated with mercury, barrier to fish movement, change in water levels or stream flow downstream, change in water quality, removes natural variation of stream flows. (1 pt - 0.5 pt each)
3a) irrigation and agriculture: 29.4%, municipal: 19.4% (1 pt - 0.5 pt each)
3b) T, T (1 pt - 0.5 pt each)

Reference:
1) Aquatic Ecology Provincial Resources, p 80-83
2) Aquatic Ecology Provincial Resources, p 84-85
3) Aquatic Ecology Provincial Resources, p 83

STOP 5

AQUATIC ECOLOGY
There is no question for this discipline at this stop.

STOP 6

AQUATIC ECOLOGY
There is no question for this discipline at this stop.

STOP 7

AQUATIC ECOLOGY (5 pts)

The Assiniboine River, which you can see from this trail, is part of the Lake Winnipeg drainage basin and drains a watershed dominated by agriculture. Excluding Winnipeg, the basin is home to about 100,000 people, and the River is the recipient of treated effluent from a number of municipal and industrial wastewater treatment facilities. Nutrient loads to the River from these agricultural and municipal sources can be problematic.

1) The following is an extract from the Assiniboine River Water Quality Study (N. Armstrong, 2012). Fill in the missing words using the word bank provided. (2 pts - 0.5 pt each)

Word Bank:

chlorophyll, blue-red, euphotication, nitrogen, eutrophication, yellow-green, oxygen, oligotrophication, phosphorus, total dissolved solids, blue-green, pH, calcium, cyanobacteria

Nutrient enrichment, also called _____ , is one of the most serious water quality issues in western Canada. High concentrations of plant nutrients, in particular _____ and _____ can result in an increase in the occurrence and extent of algal blooms, corresponding with an overall decrease in aquatic biodiversity. Blooms of _____ algae species, many of which produce potent nerve and liver toxins, may become more common and consumption of waters during and following such blooms presents a health risk for humans, household pets, and livestock.

2) Nutrients originate from both point- and non-point sources. Give an example of each type of source for the Assiniboine River. (1 pt - 0.5 pt each)

a) Point Source:

b) Non-point Source:

Multiple Choice: Which of the choices is correct? Circle the best response.

3) The main cause of algal blooms in Lake Winnipeg is: (0.5 pt)

   a) big wind storms
   b) delivery of nutrients from the Red and Assiniboine Rivers
   c) photosynthesis

4) What is true about nitrogen? (0.5 pt)

   a) cyanobacteria (blue-green algae) can use nitrogren directly from the air
   b) nitrogen is rare in nature
   c) fish take up nitrogen from the water

5) Which does not cause nutrients to increase in lakes in the spring? (0.5 pt)

   a) snowmelt runoff
   b) spring turnover
   c) increasing water temperature

6) An example of a primary producer is: (0.5 pt)

   a) zooplankton
   b) phytoplankton
   c) farmer
   d) fish

Answer:
1) eutrophication, nitrogen, phosphorus (or phosphorus, nitrogen), blue-green or cyanobacteria
(2 pts - 0.5 pt each)
2) a) any 1 of: waste water treatment plant, outlet from a city/town, outlet from an industrial site,
or another response deemed appropriate by the marker (0.5 pt)
2b) any 1 of : agricultural runoff, fertilizer from fields, animal waste, or another response
deemed appropriate by the marker (0.5 pt)
3) b (0.5 pt)
4) a (0.5 pt)
5) c (0.5 pt)
6) b (0.5 pt)

Reference:
1) Aquatic Ecology Provincial Resources, p 32-58, p 92-96
2) Aquatic Ecology Provincial Resources, p 32-58, p 92-96
3) Aquatic Ecology Provincial Resources, p 32-58, p 92-96

STOP 8

AQUATIC ECOLOGY (10 pts)
This question requires materials provided at stop.

1) Using the skills you learned from the training videos and hands-on training, use the equipment provided at the stop to measure 100 mL of sample A-D (water from the Assiniboine River) and then filter the sample through the equipment provided. When all the water has gone through the filter, place the filter in a clean petri dish, tape it shut, and use the permanent marker to label it with your team number. Give the filter to the stop attendant. (2 pts)

2) Filters A-E and A-F were used to filter the same amount of water from two different rivers.

    a) Give one (1) possible reason filters A-E and A-F look different. (1 pt)

    b) Would the filtrate from samples A-E and A-F look different? Briefly explain why or why not. (1 pt)

    c) Did sample A-E or sample A-F have more suspended particulates? Briefly explain how you know this. (1 pt)

3) ***Fill in the blank****: Complete the sentence with the most appropriate words.* (2 pts - 1 pt each)

    Many different types of analyses can be done on a sample of water, including pH, Nutrients, oxygen ands metals. The purpose of filtering a water sample before analysis is to separate the _____ from the
_____ .

4) Turbidity is the cloudiness or opacity of a fluid. The Assiniboine River has high turbidity. List three (3) effects of increased turbidity in a water body. (3 pts)

Answer:
1) filter has the circle of particulates in the middle of the filter (nothing going off the edge) and looks like it had the right volume of water filtered through it (compare to reference filter). (2 pts)
Partial marks: circle of particulates goes off the edge of the filter OR filter is very light or dark compared to reference (1 pt)
Zero marks: the team does not hand in a filter, or the petri dish isn't labeled with the team #
2a) the two rivers have different amounts of particulates/turbidity. (1 pt)
2b) No. All particulates should be removed by the filter, so the filtrate should look the same. Also ok for a team to indicate that the particulates would all be removed by the filter but that the colour of the two samples might be different. (1 pt)
2c) A-F. The filter is darker/has more particulates on it. (1 pt)
3) dissolved fraction, particulate or suspended fraction (in any order) (2 pts - 1 pt each)

4) Any 3 of the following. Block sunlight, increases water temperature, impacts fish, increased pathogenic bacteria (3 pts - 1 pt each)

Reference:
1) training videos (think trees and livestream #2), Aquatic Ecology provincials resource p 129-130
2) training videos (think trees and livestream #2), Aquatic Ecology provincials resource p 95-96
3) training videos (think trees and livestream #2), Aquatic Ecology provincials resource p 129-130
4) training video (livestream #3), Aquatic Ecology provincials resource p 97

STOP 9

AQUATIC ECOLOGY (5 pts)
This question requires materials provided at stop

1) Using the Key to Manitoba's Sport Fish, identify the organisms labeled A-A and A-B. (2 pts - 1 pt each)

A-A _____

A-B _____

2) Using the Stroud Centre Freshwater Macroinvertebrate ID key, identify the organism labeled A-C. (1 pt)

A-C _____

3) Assuming that A-A is planktivorous and A-B is piscivorous, create a simplified food chain including organisms A-A, A-B, A-C, and an autotroph. (2 pt - 0.5 pt each)
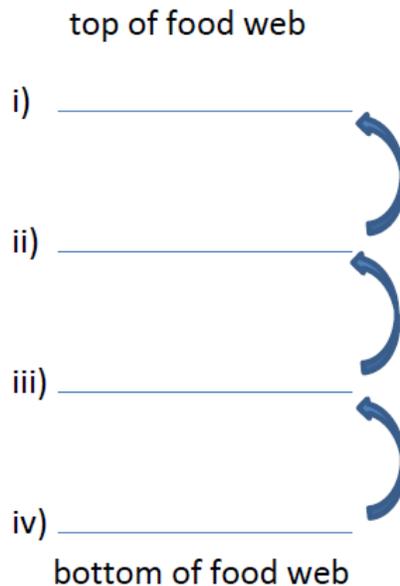
top of food web

i) _____

ii) _____

iii) _____

iv) _____

bottom of food web

Answer:
1)A-A: TBD (1 pt)
A-B: TBD (1 pt)
2) TBD (1 pt)
3) i) A-B
3ii) A-A
3iii) A-C
3iv) an autotrophic organism that could be consumed by the invertebrate (e.g., algae, phytoplankton, etc.)

Reference:
1) Aquatic Ecology Provincials resource document p 32, 35-36, Key to Manitoba's Sport Fish
2) Aquatic Ecology Provincials resource document p 32, 35-36, Stroud Centre Guide to Freshwater Macroinvertebrates
3) Aquatic Ecology Provincials resource document p 32, 35-36

STOP 10

AQUATIC ECOLOGY
There is no question for this discipline at this stop.

STOP 11

AQUATIC ECOLOGY (5 pts)

1) Explain why snow usually appears white even though water is clear? (1 pt)

2) Identify one (1) colour that may be reflected by snow. Explain what causes this colour. (1 pt)

3) *True/False: Indicate whether the statement is true (T) or false (F) by circling the correct answer.* (2 pt – 0.5 pt each)

   T   F   Snow is the largest source of precipitation in the prairies.
   T   F   Snowflakes are 6-sided clusters of ice crystals.
   T   F   Animals often dig snow caves to hibernate through the winter. Compacted snow
           provides the best insulation.
   T   F   Large anoxic (no oxygen) zones typically occur at the top of a frozen lake.

4) The type of ice that forms on the surface of a lake during calm conditions is transparent.

   a) What is this type of ice called? (0.5 pt)

   b) In what direction does this ice grow? (0.5 pt)

Answer:
1) Most snow appears white because visible light is white, and most visible light is reflected back by the snow surface. (1 pt)
2) Any 1 of the following: Blue - Snow may appear blue if light is scattered multiple times through the ice crystals, or in dim lighting. Red/Pink - watermelon snow occurs because of a freshwater algae that contains a bright red pigment. Deep red colour - oxidization of iron rich water commonly found in glacial areas. (1 pt)
3) F, T, F, F (2 pt - 0.5 pt each)
4a) black ice (0.5 pt)
4b) black ice grows downward as lake water freezes to the underside of the ice. (0.5 pt)

Reference:
1) Aquatic Ecology Provincial Resource, p 17
2) Aquatic Ecology Provincial Resource, p 17
3) Aquatic Ecology Provincial Resource, p 16-19
4) Aquatic Ecology Provincial Resource, p 18

STOP 12

AQUATIC ECOLOGY
There is no question for this discipline at this stop.

STOP 13

AQUATIC ECOLOGY (5 pts)
This question requires materials provided at stop.

1) Photo A-H is an aerial view of the Assiniboine River upstream of Portage la Prairie. Based on what you see in the photo, answer the following questions.

    a) Is this river channelized or meandering? (0.5 pt)

    b) Is this river slow-flowing or fast-flowing? (0.5 pt)

2) Channelization is one way that humans have tried to manage and control rivers. This includes building dikes on either side to prevent the water from spilling over the banks. Briefly describe one (1) way in which channelization can enhance the impacts of flooding. (1 pt)

3) The following factors can affect on the size of a flood. Indicate which factors increase and which factors decrease the size of a flood by writing their associated letters in the table below. (3 pt - 0.5 pt each)

    A. wetland habitat

B. urban development
C. the channelization of the river
D. the presence of riparian vegetation
E. flood protection dams
F. bridges and other structures in waterways

Factors that **increase** the size of a flood	Factors that **decrease** the size of a flood

Answer:
1a) meandering (0.5 pt)
1b) slow-moving (0.5 pt)
2) Any 1 of the following: Velocity increases (less water spills into the floodplain); erosive power increases (water gathers energy as it flows downhill); people are more inclined to live in areas where channelized rivers exist, creating an increased risk to lives and property (1 pt)
3) Factors that increase the size of a flood: B, C, F; Factors that decrease the size of a flood: A, D, E (3 pt - 0.5 pt each)

Reference:
1)-3) Aquatic Ecology Provincial Resource, pages 39 - 41

STOP 14

AQUATIC ECOLOGY (10 pts)
This question requires materials provided at stop.

1) Define the term WATERSHED (also known as a DRAINAGE BASIN). (1 pt)

2) Graph A-I shows the relationship between nutrient concentrations in lakes and the size of the area drained by the lakes. If a lake drains a large area of land, will it likely have low or high nutrient concentrations? (1 pt)

3) Topographic maps are useful tools for studying the landscape around water bodies. Use topographic map A-J to answer the following questions:

    a) What are CONTOUR LINES? (1 pt)

    b) What is the contour interval of this map? (0.5 pt)

c) What is the approximate elevation of point A? (0.5 pt)

d) When water flows across and landscape, will it typically flow parallel or perpendicular to contour lines? (0.5 pt)

e) If rain falls on point A, will the water flow on top of the ground toward point B, C, or D? (0.5 pt)

4) Bathymetric maps are like inverse topographic maps; instead of elevation, bathymetric maps show the depth of a water body. Map A-K shows the bathymetry of three lakes. Use these maps to answer the following questions:

a) What is the approximate depth of lake ii at point *? (0.5 pt)

b) If we were to cut each lake in half along the dashed lines, the resulting cross-sections of the basins would look like the ones pictured below (based on the depths of the contour lines for each lake). Write the lake number (i, ii, or iii; from diagram A-K) under the matching cross-section. (3 pt - 1 pt each)

5)

lake: _____   lake: _____   lake: _____

Lakes that are primarily fed by groundwater are called _____ lakes, while lakes that are fed by inflowing streams and surface runoff are called _____ lakes. (1 pt - 0.5 pt each)

6) Small streams that flow into larger rivers are called _____. Circle best response. (0.5 pt)

    a) aquifers
    b) tributaries
    c) ephemeral streams
    d) waterfalls

Answer:
1) some variation of: the area of land that drains into a river or lake (1 pt)
2) high (1 pt)
3a) some variation of: Each contour line on a topographic map represents a ground elevation or vertical distance above a reference point such as sea level. A contour line is level with respect to

the earth's surface just like the top of a building foundation. All points along any one contour line are at the same elevation (1 pt)
3b) 10 m (0.5 pt)
3c) ~635 m (accept 631-639 m) (0.5 pt)
3d) perpendicular (0.5 pt)
3e) C (0.5 pt)
4a) 9.5 m (accept 9.1 to 9.9 m) (0.5 pt)
4b) left to right: ii, i, iii (3 pts - 1 pt each)
5) seepage, drainage (1 pt - 0.5 pt each)
6) b) tributaries (0.5 pt)

Reference:
1) Aquatics Provincials resource p 23
2) ability to read a graph
3a) Aquatics Provincials resource p 136-137
3b)-c) Aquatics Provincials resource p 137
3d)-e) Aquatics Provincials resource p 138
4) Aquatics Provincials resource p 136-138; ability to read a map
5) Aquatics Provincials resource p 49
6) Aquatics Provincials resource p 23

STOP 15

AQUATIC ECOLOGY
There is no question for this discipline at this stop.

STOP 1

PLANT ECOLOGY
There is no question for this discipline at this stop.

STOP 2

PLANT ECOLOGY
There is no question for this discipline at this stop.

STOP 3

PLANT ECOLOGY (5 pts)
This question requires materials AND/OR features found at stop

1) Draw and label a diagram that shows the strata of forest communities. (2 pts)

2) What strata does the plant labeled P-H belong to? (1 pt)

3) Identify the arrangement of the veins in the plant labeled P-I. (1 pt)

4) Name one (1) other type of vein arrangement. (0.5 pt)

5) Which of the following is NOT correct? Circle the best response. (0.5 pt)

    In plants, veins:

      a)   carry food and water through the leaf.
      b)   provide structural support to the blade.
      c)   transport oxygen through the leaf.
      d)   collect glucose made by the leaf.

Answer:
1) Diagram must show and correctly label any four of the following: overstory, canopy, understory, shrub layer, floor (2 pts - 0.5 pt each)
2) Shrub layer (1 pt)
3) TBD (1pt)
4) TBD (0.5 pt)
5) c) (0.5 pt)

Reference:
1) Plant Ecology Document, p 43-44
2) Plant Ecology Document, p 43-44
3) Plant Ecology Document, p 18-19
4) Plant Ecology Document, p 18-19
5) Plant Ecology Document, p 18-19

STOP 4

PLANT ECOLOGY
There is no question for this discipline at this stop.

STOP 5

PLANT ECOLOGY (5 pts)

1) Habitats vary across the world.

    a) Name four (4) habitats, or vegetational formations. (2 pts)

    b) What vegetational formation represents the largest portion of Earth's vegetation? (0.5 pt)

    c) Name three (3) types of grasslands (1.5 pts)

2) Forest are widespread and diverse. What is the difference between the main type of tree you find in a coniferous forest and the main type you find in a deciduous forest? (1 pt)

Answer:
1a) Any four of the following: grasslands; shrubland; tundra; forests; deserts (2 pts - 0.5 pts for each)
1b) Grasslands (0.5 pt)
1c) Any three of the following: cultivated and successional grassland; Tallgrass prairie; Mixed-grass prairie; short-grass steppe (1.5 pts - 0.5 pts for each)
2) Coniferous forests contain cone-bearing trees that are evergreen (having foliage all year). (0.5 pt) Deciduous forests contain deciduous trees that drop their leaves annually. (0.5 pt)

Reference:
1) Plant Ecology, p 47-57
2) Plant Ecology, p 53-56

STOP 6

PLANT ECOLOGY (10 pts)
This question requires materials provided at stop.

1) Vegetation structure and flower composition are often studied to provide researchers information about a plant community. In order to better study the vegetation structure and flower composition of an area, a few different kinds of measurements are taken.

    a) What is COVER? (1 pt)

    b) What is PHYTOMASS? (1 pt)

    c) What is LEAF AREA INDEX (LAI)? (1 pt)

2) Pathogens are a natural part of any ecosystem. Look at the picture labeled P-J.

    a) What is the growth shown in picture P-J? (1 pt)

    b) Why do these growths form? (1 pt)

3) List three (3) reasons forests are measured. (3 pts)

4) Name two (2) of the three pillars of sustainable agriculture. (2 pts)

Answer:
1a) as a percentage, the surface area of the sample plant covered in plants (1 pt)
1b) the mass of plants, expressed as a dry mass or productivity (1 pt)
1c) the projected area of leaves over a unit of land (1 pt)
2a) swelling growth that can be found on the external tissues of plants or plant gall (1 pt)
2b) Plant galls are a response by plants to an alien substance in their tissues, such as fungi, bacteria, insects, or mites. (1 pt)
3) Any three of the following: forest growth, stand development and health, site productivity measurements, permanent sample plots, volume of harvest, calculation of forest regeneration status and survival, dendrochronolgy, standardized measurements (3 pts - 1 pt each)
4) Any two of the following: the economy, the environment and society (2 pts - 1 pt each)

Reference:
1) Plant Ecology, p 90
2) Plant Ecology, p 92
3) Plant Ecology, p 94-95
4) Plant Ecology, p 96

STOP 7

PLANT ECOLOGY
There is no question for this discipline at this stop.

STOP 8

PLANT ECOLOGY (5 pts)

1) A plant is made up of three basic organs: roots, stems, and leaves.

    a) What is one (1) function of a root? (0.5 pt)

    b) What is the difference between a taproot and fibrous root? (0.5 pt)

c) What is one (1) function of a plant stem? (0.5 pt)

d) Stems are made of at least 6 different, specialized regions (e.g., a node). What are two (2) other specialized structures that can be found on a plant stem? (1 pt)

e) What is the primary function of leaves? (0.5 pt)

2) The stem of a vascular plant is made out of a variety of structures.

a) What is the primary function of the xylem? (0.5 pt)

b) What is the primary function of the phloem? (0.5 pt)
c) In what structure within the vascular stem are the xylem and phloem contained? (0.5 pt)

d) What is the name of the outermost layer of cells covering the plant? (0.5 pt)

Answer:
1a) Any one of the following - anchor the plant into the soil; absorb water and minerals; store food (0.5 pts)
1b) Fibrous roots have many slender roots about the same size that spread out. whereas taproots grow straight down. (0.5 pts)
1c) Any one of the following - conduct water, minerals, and food to other parts of the plant; store food; green stems can be locations where photosynthesis takes place (0.5 pts)
1d) Any two of the following - terminal bud; bud; lateral/axillary bud; vegetative shoot; internode (1 pt - 0.5 pts each)
1e) primary site of photosynthesis (0.5 pts)
2a) transport tissue moving water from roots to shoots and leaves (0.5 pts)
2b) transport tissue moving organic compounds (sugar) within the plant (0.5 pts)
2c) vascular bundles (0.5 pts)
2d) Epidermis (0.5 pts)

Reference:
1) Plant Ecology, p9
2) Plant Ecology, p10

STOP 9

PLANT ECOLOGY (5 pts)
This question requires materials provided at stop.

1) What is plant-pollinator coevolution? (1 pt)

2) Describe an example of plant-pollinator coevolution. (1 pt)

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3) One way of classifying plants is by ecological groups, based on the type of environment they are adapted to. Look at the photos on the document labeled P-F. Match each plant with the correct ecological group by drawing a line between each pair. (2 pts - 0.5 pt each)

hydrophyte   a)

xerophyte   b)

mesophyte   c)

halophyte   d)

Answer:
1) Plant-pollinator coevolution is when flowering plants and pollinators evolve together to ensure that the correct pollinator feeds from the correct plant (or that pollinators transfer pollen to other flowers of the same species) (1 pt).
2) A flower evolves to be deeper and pollinator responds and evolves a longer mouth part (or proboscis) or other appropriate answer (1 pt).
3a) Xerophyte (0.5 pt)
3b) Halophyte (0.5 pt)
3c) Mesophyte (0.5 pt)
3d) Hydrophyte (0.5 pt)

Reference:
1) Plant Ecology Document, p 37
2) Plant Ecology Document, p 37
3) Plant Ecology Document, p 62

STOP 10

PLANT ECOLOGY (5 pts)

1) Plants have many different adaptations to survive winter conditions. One of these is shedding leaves in the fall.

    a) Why type of tree looses its leaves in the fall? (0.5 pt)

    b) Why do these trees shed their leaves? (1 pt)

    c) What substance gives some leaves an orange color? (0.5 pt)

2) Trees in very cold locations, like the Taiga, have other adaptations to survive the harsh conditions.

    a) What type of tree is dominant in these regions? (0.5 pt)

b) What three (3) adaptations do these plants have to survive this severe winter? (1.5 pts)

c) What special feature do Taiga trees often have to increase their freeze resistance? (1 pt)

Answer:
1a) Deciduous (0.5 pts)
2b) Reduce/prevent water evaporation (1 pt)
2c) Carotene (0.5 pts)
2a) Coniferous (0.5 pts)
2b) All three of the following: Evergreen allowing the tree to photosynthesize as soon as the temperature rises to a minimum temperature; dark colour to increase solar/sun/heat absorption; hair-like growth for insulation (1.5 pts - 0.5 pt each)
2c) Special valve in their cells that can seal off individual frozen cells to prevent a freezing chain reaction (1 pt)

Reference:
1) Plant Ecology, p. 64
2) Plant Ecology, p. 65

STOP 11

PLANT ECOLOGY (10 pts)
This question requires materials provided at stop.

Using the field guides provided, identify plants P-A, P-B, P-C, P-D and P-E. See directions at the stop for what parts of each field guide to use for each plant. (10 pts - 2 pts each)

P-A _____

P-B _____

P-C _____

P-D _____

P-E _____

Answer:
P-A TBD (tree) (2 pts)
P-B TBD (shrub) (2 pts)
P-C TBD (grass) (2 pts)
P-D TBD (flowering perennial) (2 pts)
P-E TBD (Fruiting angiosperm) (2 pts)

Reference:
Plant Ecology, p 23-27; Hands-on-training

STOP 12

PLANT ECOLOGY (5 pts)

1) A variety of products are used to increase plant growth.

    a) Why are pesticides used? (1 pt)

    b) Why are fertilizers used? (1 pt)

2) Why is the use of too many pesticides a problem? (1 pt)

3) Explain why the use of too much fertilizer is a problem for aquatic ecosystems? (2 pts)

Answer:
1a) Pesticides are used to kill off insects and other pests that might consume or negatively impact plants (1 pt)
1b) Fertilizers are materials that are applied to soils or plant tissues to supply one or more essential nutrients to assist with plant growth (1 pt)
2) One of the following: Some may kill animals that are detritivores and an important part of the nutrient cycling within an area; Pesticides may also pollute the air, water, and soil, and as a result, plant and animal life may become sick, malformed, or even die (1 pt)
3) Excess nutrients can wash off the soil into aquatic environments leading to eutrophication and other problems. (1 pt) Phosphorus from fertilizer can cause algae to accumulate in lakes and ponds, leading to decreased oxygen and the death of aquatic animals such as fish (1 pt).

Reference:
1)-3) Plant Ecology, p. 72-73

STOP 13

PLANT ECOLOGY
There is no question for this discipline at this stop.

STOP 14

PLANT ECOLOGY
There is no question for this discipline at this stop.

STOP 15

PLANT ECOLOGY (10 pts)
This question requires materials provided at stop.

1) Some plants reproduce with cells that are not seeds.

    a) How do seed-free plants reproduce? (0.5 pt)

    b) Where do these reproductive cells develop? (0.5 pt)

2) What is VEGETATIVE REPRODUCTION? (1pt)

3) What is the difference between ACTINOMORPHIC and ZYGOMORPHIC flowers? (1 pt)

4) Look at the plant specimen labeled P-G.

    a) What process is occurring to the plant? (1 pt)

    b) Name and describe the three (3) major steps of this process. (6 pts)

Answer:
1a) Seed-free plants use spores (0.5 pt)
1b) Spores develop in the sporangium (0.5 pt)
2) Vegetative reproduction is a form of asexual reproduction where a new plant grows from a fragment of a parent plant or grows from a specialized reproductive structure. (1 pt)
3) Actinomorphic flowers are radially symmetrical; zygomorphic flowers are bilaterally symmetrical. (1 pt - 0.5 pts each)
4a) The seed is germinating (1 pt)
Partial marks: 0.5 pt for sprouting
4b) (6 pts total as follows)
Imbibtion (1 pt) – seeds rapidly take up water (0.5 pts) causing the seed coat to swell and soften (0.5 pts).
Interim or lag phase (1 pt) – the seed activates internal physiology, cells begin respiration, (0.5 pts) and the seed starts to make proteins and metabolizes the food stores found underneath its seed coat (0.5 pts).
Radicle and root emergence (1 pt) – As cells develop, elongate, and divide (0.5 pts), the epicotyl and radicle (primary root) emerge from the seed (0.5 pts).

Reference:
1) Plant Ecology, p 28-29
2) Plant Ecology, p 29
3) Plant Ecology, p 31
4) Plant Ecology, p 31-32

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STOP 1

SOILS AND GEOLOGY (5 pts)
This question requires features found at stop.

1) At this site, you may notice that the river bank shows some signs of erosion and slumping. Briefly describe two (2) specific practices that may reduce or eliminate this erosion. (2 pts)

2) What soil order would you expect this unstable river bank to be? (1 pt)

3) What are two (2) main identifying characteristics of the soil order from your answer in 2)? (2 pts)

Answer:
1) Any 2 of the following: maintaining a protective cover on the soil (vegetation, riprap, etc), creating a barrier to the water, modifying the landscape to control runoff amounts and rates, shortening the length and reducing the steepness of slopes, increasing water infiltration, improving aggregate stability, or any example of the above. (2 pts - 1pt each)
2) Regosolic (1 pt)
3) Any 2 of the following: thin and weakly developed, young materials, no B horizon, material instability/unstable soil, fresh alluvial deposits, mass-wasted slopes, sand dunes, limited vegetative growth (not fully stabilized by vegetation). (2 pts - 1 pt each)

Reference:
1) Soil Quality Resource Concerns: Soil Erosion
2) Lindsey's Basic Guide to Soil Orders; Soil Management Guide, p. 19; Soil and Land Use Document, p. 39 and 42
3) Lindsey's Basic Guide to Soil Orders; Soil Management Guide, p. 21

STOP 2

SOILS AND GEOLOGY
There is no question for this discipline at this stop.

STOP 3

SOILS AND GEOLOGY (5 pts)
This question requires BOTH materials AND features found at stop.

Due to increasing use of Camp Assiniboia, you have been tasked with upgrading the current sanitation system on the trail, which is currently the outhouse at this stop. Use the map and other

information provided on Soils Report S-F (map plus 6 pages of text) to answer the following questions and determine the suitability of the site for a septic field.

1) Look at Soils Report S-F for information about the soil.

a) What is the full name of the soil series at Stop 3? (0.5 pt)

b) What is the soil order? (0.5 pt)

c) What is the soil texture? (0.5 pt)

d) What is the drainage class? (0.5 pt)

2) Look at Soils Report S-F for information about the map.

a) Is this a detailed or reconnaissance map? (0.5 pt)

b) How do you know which type of map it is? (0.5 pt)

c) Indicate whether the statement is true (T) or false (F) by circling the correct answer. (0.5 pt)

T   F   Both detailed and reconnaissance maps are appropriate for land use assessment.

3) Would you recommend adding a septic field near the outhouse? Briefly explain why or why not? (1.5 pt)

Answer:
1a) Fisher (0.5 pt), must have full name not just abbreviation for point
1b) Regosol (0.5 pt)
1c) Silty Clay Loam (0.5 pt)
1d) imperfect (0.5 pt)
2a) detailed (0.5 pt)
2b) the scale is 1:20000 (0.5 pt)
2c) F (0.5 pt)
3) no (0.5 pt) because the limitation is described as severe (0.5 pt) due to a high seasonal water table and possible contamination to ground water (0.5 pt)

Reference:
1) Training on how to use a soils report
2) Soil Management Guide, p. 28
3) Training on how to use a soils report

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STOP 4

SOILS AND GEOLOGY (10 pts)
This question requires BOTH materials AND features found at stop.

1) The name of the soil on this site is shown on the sign by the soil pit.

   a) What soil order does it belong to? (0.5 pt)

   b) What soil great group does it belong to? (0.5 pt)

2) A dilute hydrochloric acid solution is used to find the undeveloped parent material (C horizon) in most Prairie soils by reacting with calcium carbonate.

   Directions*: Put on the gloves and goggles provided. Use the dilute HCL to find the top of C horizon.*

   a) What is the approximate depth (in cm) of the top of the C horizon? (1 pt)

   b) Why is calcium carbonate in the C horizon and not the horizons above it? (0.5 pt)

3) Remove a handful of soil from the A horizon labelled S-E, or take some from the tray labelled S-E.

   a) Describe the aggregate structure. (1 pt)

   b) Try to form a ball with the soil. If it is too dry, add water. Use the soil texturing flow chart to determine the texture of this soil. Write the texture below. (1.5 pts)

   c) Use the Munsell colour chart to determine the colour of the soil that you textured in question 3b. Write the parameters below. (1 pt - 0.5 pt each)
      Hue 10YR   Value _____   Chroma _____

   d) Dull gray or blue-gray colours and rusty red spots anywhere in the soil profile indicate gleying and mottling. Why would a soil have gleying and mottling? (1 pt)

4) What is the parent material and origin for this soil? Circle the best answer. (0.5 pt)

   a) Organic deposit from accumulated leaf litter
   b) Alluvial deposit from the river
   c) Aeolian deposit originating from beach sand
   d) Morainal deposit from limestone or shale pulverized by a glacier

5) In case you didn't notice, there is no farming on this spot.

a) List two (2) specific agricultural capability limitations of soils in this area. (1 pt)

b) List three (3) land uses that are more suited for the soils of this area. (1.5 pt)

Answer:
1a) TBD (0.5 pt)
1b) TBD (0.5 pt)
2a) TBD (1 pt; up to 10 cm of deviation from our answer is acceptable)
2b) It leached/translocated from the upper soil profile (0.5)
3a) TBD (1pt)
3b) TBD; allowed to be 1 step to left/right or up/down of the pre-judged soil texture (1.5 pts)
Partial marks: 1.0 pt - Ribbon length AND/OR grittiness/smoothness is incorrect by 2 steps in any direction; 0.5 pt - Ribbon length AND/OR grittiness/smoothness is incorrect by 3 steps in any direction.
3c) TBD (1 pt - 0.5 pt each)
3d) one of the following: temporary or permanent presence of water, poor or imperfect drainage in the soil, oxidation and reduction of iron (1 pt)
4) b (0.5 pt)
5a) Two of the following: wetness (W), flooding/inundation (I), or slope/topography (T). (1 pt - 0.5 pt each)
5b) Three of the following: recreation (e.g. camping, sports, golf course), residential or urban development, hunting or trapping
set-aside (preserve), forest harvest, wildcraft (collecting plants for food, materials, or medicine), grazing responsibly, another reasonable answer (1.5 pt - 0.5 pt each)

Reference:
1) Canadian System of Soil Classification, p A.9
2) Training, Soils and Land Use Document, p 19-20; Soil Management Guide, p 16-17, Think Trees TV: Let's Get the Dirt on Soil
3) Soil Management Guide: p 13-15, Appendix F - Determining Soil Texture by Feel; training
4) Soils and Land Use Study Guide: Soil Formation; Parent Material
5) Soil Management Guide, p 33

STOP 5

SOILS AND GEOLOGY
There is no question for this discipline at this stop.

STOP 6

SOILS AND GEOLOGY (5 pts)

1) What is the most prominent land use in Manitoba? (0.5 pt)

2) What are two (2) influences that pH have on how well crops grow? (1 pt)

3) *True/False*: *Indicate whether each statement is true (T) or false (F) by circling the correct answer.* (2 pts - 0.5 pt each)

      T   F   Agriculture generally tends to lower pH of soils over time.
      T   F   A low pH value (lower than 7) indicates acidity.
      T   F   Water flowing through soil removes nutrients over time.
      T   F   Soil biodiversity is an important factor contributing to soil quality.

4) Name three (3) micro or macro-organisms that play important roles in helping to break down organic material in top soil. (1.5 pts)

Answer:
1) Agriculture (0.5 pt)
2) Any two (2) of the following: nutrient availability/potential toxicity, microorganism activity, disease organism activity, potential crop damage by some herbicides. (1 pt - 0.5 pt each)
3) T, T, T, T (2 pts - 0.5 pt each)
4) Any 3 of the following: Fungi, bacteria, actinomycetes, algae, protozoa, nematodes, earthworms, arthropods (insects, spiders, etc.), rodents. (1.5 pts - 0.5 pt each)

Reference:
1) Soils and Land Use Resource, page 4, Table 1.2
2) Soils and Land Use Resource, page 21, "Soil Chemical Properties"
3) Soils and Land Use Resource, page 21, "Soil Chemical Properties"
4) Soils and Lane Use Resource, page 24, "Soil Organic Matter"

STOP 7

SOILS AND GEOLOGY (5 pts)
This question requires BOTH materials AND features found at stop.

Welcome to the tallgrass prairie region of Manitoba, dissected here and there by rivers which recharge the water in the earth and soil, and which gradually change the shape of our landscape.

1) Observe Diagram S-A, and consider the above description. Which of the following are the three (3) soil orders most likely to have originated in this area? Circle the correct answers. (1.5 pts)

      Organic   Chernozem   Cryosol
      Podzol   Regosol   Gleysol

2) Which one (1) of the above soils is a mature grassland soil? (0.5 pt)

3) Name one (1) soil characteristic required for the soil named in 2) to be classified as a mature grassland soil. (1 pt)

4) There are mature trees here. But this is not a mature forested soil (a Luvisol). Which one (1) of the five soil forming factors is required for a forest soil to reach maturity? (1 pt)

5) Name one (1) soil characteristic required for the soil in this area to be classified as a mature forest soil. (1 pt)

Answer:
1) Chernozem, Regosol, Gleysol (1.5 pts – 0.5 pt each)
2) Chernozem (0.5 pt)
3) Ah horizon (OR surface layer) enriched with organic matter (OR carbon) (1 pt)
4) Time (1 pt)
5) One of the following: Washed out Ae horizon (or surface layer), OR a Bt horizon (OR subsurface layer) enriched with organic matter and/or fine-textured soil particles (OR clays) (1 pt)

Reference:
1) Soils and Land Use Document p 39 – 41; and Basic Guide to the Soil Orders (1 page)
2)-3) Soils and Land Use Document p 39 – 41; and Basic Guide to the Soil Orders (1 page)
4) Soils and Land Use Document p 8 – 11
5) Soils and Land Use Document p 39 – 41; and Basic Guide to the Soil Orders (1 page)

STOP 8

SOILS AND GEOLOGY
There is no question for this discipline at this stop.

STOP 9

SOILS AND GEOLOGY (10 pts)
This question requires materials provided at stop.

1) What does CEC stand for? (1 pt)

2) CEC is an important soil property because it can indicate which nutrients and contaminants will be held to the soil particles. Many nutrients, contaminants, and soil particles have positive or negative charges. A positively charged ion is called a cation, while a negatively charged ion is called an anion. Similar to a magnet, positive charges attract negative charges, and like charges will repel. In the container labeled S-C, different coloured beads represent the charges found in a soil sample. Cations are represented by blue beads, while anions are represented by red beads.

a) Look at container S-C, but do not open it. Is the soil sample represented by S-C more positively or more negatively charged? (1 pt)

b) Based on your answer in part a), would you expect the plant-essential nitrate anion (NO_3^-) to be held by the soil represented by S-C or would it leach out? Explain why. (1 pt)

3) The CEC level of a soil is a chemical property that indicates how strongly the soil will hold onto cations. Soils that have a lower CEC level generally require more frequent applications of fertilizer because the fertilizer won't be held as tightly by the soil. This can increase the risk of nutrient loading in runoff. To lessen this risk, you could increase the CEC of the soil so the fertilizer is held more tightly and/or you can reduce runoff.

a) What is one (1) way that you could increase the CEC of a soil? (1 pt)

b) What are two (2) ways to reduce nutrient loading in runoff on a field? (2 pts)

4) Soil survey reports and maps contain a great deal of technical information about the chemical and physical properties of a soil. While reviewing a soil survey, you come across the following map unit: NDL/xc1x.

a) Identify the symbol(s) representing the following components: (2.5 pts - 0.5 pt each)

Degree of Stoniness   _____
Degree of Salinity   _____
Topography   _____
Soil Series Symbol   _____
Degree of Erosion   _____

b) After referring to the legend, you realize that NDL is the Newdale soil series. You look it up, and find an example of a soil analysis, shown in table S-B. What trend in the CEC (meq./100gm) do you observe? (0.5 pt)

c) Why would we expect to see this trend in the CEC levels? (1 pt)

Answer:
1) Cation Exchange Capacity (1 pt)
2a) S-C is more negatively charged (more red/negative beads than blue/positive beads). (1 pt)
2b) Nitrate will leach out because S-C and nitrate are both negatively charged (like charges repel). (1 pt)
3a) Any 1 of the following: increase organic matter, increase clay content (1 pt)
3b) Any 2 of the following: increase vegetative cover, establish buffer strips, incorporate fertilizers, apply fertilizer according to soil test recommendations, adjust fertilizer application rates/placements/timing, apply fertilizer on flatter land, don't apply on soils where water ponding or risk of flooding occurs, caution when applying on clay surface textures (2 pts - 1 pt each)

4a) Degree of Stoniness is 1, Degree of Salinity is x, Topography is c, Degree of Erosion is x, and the Soil Series Symbol is NDL (2.5 pts - 0.5 pt each)
4b) CEC decreases with depth (0.5 pt)
4c) The amount of organic matter decreases with depth, which contributes to the decrease in CEC levels with depth (1 pt).

Reference:
1) From The Surface Down, p. 14
2) From The Surface Down, p.14
3a) From The Surface Down, p. 14-15; Soils Document, p. 23; Soil Management Guide, p. 151
3b) Soil Management Guide, p.10, 53
4a) Soil Document, p. 43-44
4b) Soil Management Guide, p. 41
4c) From The Surface Down, p. 15; Soils Document, p. 23; Soil Management Guide, p. 41 and 151

STOP 10

SOILS AND GEOLOGY
There is no question for this discipline at this stop.

STOP 11

SOILS AND GEOLOGY (5 pts)
This question requires materials provided at stop.

1) Define SOIL STRUCTURE. (1 pt)

2) Look at the samples labeled S-J through SM.

    a) Match each of the samples with the correct soil structure by drawing a line between the pair. (2 pts - 0.5 pt each)

sub-angular blocky	S-J
massive	S-K
structureless	S-L
granular	S-M

    b) Which sample is associated with an A horizon? (0.5 pt)

c) Which sample is associated with a B horizon? (0.5 pt)

d) Choose two (2) of the four soil structure types represented by the samples. Briefly describe how water movement is affected by each of the two chosen soil structures (ex. holding versus releasing water, uptake by plants). (1 pt)

Answer:
1) Soil structure is the aggregating (clinging together) of soil particles to form aggregates/clods. Decomposing organic matter "glues" together mineral components of soil. Soil structure can be well developed (ex. strong granular) or poorly developed (ex. weak granular). If there are no visible aggregates, the soil is structureless. (1 pt)
2a) sub-angular blocky S-K, massive S-L structureless S-M granular S-J (2 pts - 0.5 pt each)
2b) S-J
2c) S-K
2d) Any 2 of the following: (1 pt - 0.5 pt each)
GRANULAR - good aggregation of soil particles gives a soil a high water holding capacity
SUB-ANGULAR BLOCKY - lego-like blocks have seams and cracks between them allowing excess water to pass through, reducing water stress on growing plants
MASSIVE - density restricts water entry and penetration by plant roots
STRUCTURELESS - no aggregation means little to no water holding capacity and a poor plant growth environment

Reference:
1) Soil Management Guide, pp.13-14
2a)-2c) training
2d) Soil Management Guide, p.14

STOP 12

SOILS AND GEOLOGY
There is no question for this discipline at this stop.

STOP 13

SOILS AND GEOLOGY (10 pts)
This question requires materials provided at stop.

After submitting a soil sample to a nutrient testing laboratory, you receive the report labeled S-D. Using the report, answer the following questions FOR FIELD P1. Note: This is an actual report from 2018 fall soil sampling.

1) What is the concentration of the following nutrients? Include the correct units.

a) Nitrate 0-60 cm (0.5 pt)

b) Phosphorus 0-15 cm (0.5 pt)

c) Potassium 0-15 cm (0.5 pt)

2) Why are the above three nutrients known as macronutrients? (0.5 pt)

3) How is nitrogen made plant-available in the soil? (0.5 pt)

4) How are phosphorus and potassium made plant available in the soil? (0.5 pt)

5) Based on soil P regulatory thresholds, what is the maximum amount of phosphorus would you be allowed to apply to the soil? (1 pt)

6) What is the pH of the soil? (0.5 pt)

7) List two (2) soil characteristics or interactions that pH affects? (2 pts)

8) What is the concentration of soluble salts in the soil? Include the correct units. (0.5 pt)

9) This soil is _____. Circle best response. Note:mmhos/cm=dS/m (0.5 pt)

   a) non saline
   b) slightly saline
   c) weakly saline
   d) moderately saline
   e) strongly saline

10) Briefly describe two (2) distinct reasons why it is important for agricultural producers to soil test. (2 pts)

Answer:
1a) 7 ppm (0.5 pt) or 0 pt without units
1b) 7 ppm (0.5 pt) or 0 pt without units
1c) 198 ppm (0.5 pt) or 0 pt without units
2) nutrients needed by plants in large amounts (0.5 pt)
3) decomposed from organic matter/microorganisms (0.5 pt)
4) weathering of parent material (0.5 pt)
5) no restrictions/any amount (1 pt)
6) 6.6 (0.5pt)
7) Any two of: availability of nutrients, ,micro-organisms, pesticide interactions, mobility of heavy metals or corrosivity (2 pts -1 pt each)
8) 0.16 mmhos/cm or dS/m (0.5 pt) or 0 pt without units

9) a) (0.5 pt)
10) economic reasons (fertilizers cost money, etc) (1 pt) and environmental reasons (runoff, leaching, etc.) (1pt)

Reference:
1a-1c) ability to read table
2) Soils and Land Use p 28
3) Soils and Land Use p 28
4) Soils and Land Use p 28
5) Soil Management Guide p 57
6) ability to read table
7) Soil Quality Indicators: pH
8) ability to read table
9) Soil Management Guide p 67
10) Soil Management Guide pp 52-53

STOP 14

SOILS AND GEOLOGY (5 pts)
This question requires materials provided at stop.

1) How many sections are in a township? (0.5 pt)

2) Examine the diagram showing the township labeled S-G. Determine the range and township for this location.

    a) Range (0.5 pt)

    b) Township (0.5 pt)

3) Examine the soil survey map labeled S-H.

    a) Identify the dominant soil type at this location. (0.5 pt)

    b) Is the soil developed from fine, medium or coarse-textured materials? (0.5 pt)

4) Name one (1) dominant soil forming factor at this location. (0.5 pt)

5) The dominant soil type at this location has the same name as that of a Manitoba community. Estimate the following two distances between this location and that community: (1 pt - 0.5 pt each)

    a) shortest distance in space (i.e. as the crow flies or direct)

b) most direct distance by road

6) Your team is lost in the woods of Camp Assiniboia.

　　a) Which of the two maps provided (S-H and S-I) at this stop is more useful in finding your way out? (0.5 pt)

　　b) Explain your answer to a). (0.5 pt)

Answer:
1) 36 (0.5 pt)
2a) 1 (0.5 pt each)
2b) 10 (0.5 pt each)
3a) St. Norbert Clay (Wooded associate) of the Red River Association (0.5 pt)
3b) fine (0.5 pt)
4) One of the following: periodic deposition of fluvial materials due to river flooding, vegetation type - deciduous trees (0.5 pt)
5a) value between 25 and 30 km (0.5 pt)
5b) value between 35 and 40 km (0.5 pt)
6a) Either of: S-H or the soil survey map (0.5 pt)
6b) S-H due to the larger scale which has more local features. (0.5 pt)

Reference:
1)-6) The Dominion Land Survey: Mapping Western Canada; training

STOP 15

SOILS AND GEOLOGY
There is no question for this discipline at this stop.

STOP 1

THEME
There is no question for this discipline at this stop.

STOP 2

THEME (5 pts)

1) Compare and contrast BIOINDICATORS and BIOMONITORS. (4 pts)

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2) Give one (1) example of a bioindicator organism and name one thing it can indicate. (1 pt)

Answer:
1) A reasonable answer containing the following components: Bioindicators and biomonitors can be used to assess the health of an ecosystem. (1 pt) They are organisms that modify their abundance, distribution, behaviour or physiology in response to environmental change (1 pt). Bioindicator: an organism that contains information on the QUALITY of the environment (1 pt). Biomonitor: is an organism that contains information on the QUANTITATIVE ASPECTS of the quality of the environment. (1 pt)
2) Any one of the following: canaries (air quality in coal mine); acanthocephalans (water pollution); lichens (air pollution, sulfur dioxide); algae (excess nutrients); freshwater macroinvertebrates (water quality) (1 pt - 0.5 pt for example; 0.5 pt for environmental parameter)

Reference:
1) Environmental Awareness, p 51-52
2) Environmental Awareness, p 52

STOP 3

THEME (10 pts)

1) List three (3) current drivers of extinction in Canada. (3 pts)

2) List three (3) characteristics of an organism that make it more vulnerable to becoming extinct. (3 pts)

3) Canada has a national Species At Risk Act. Briefly describe two (2) of the main objectives of this law. (2 pts)

4) ***Fill in the blank****: Complete the sentences below with the most appropriate choice from the Answer Bank.* (2 pts - 0.5 pt each)

Answer Bank:

50	*20%*	*90%*
250	*50%*	*100 km²*
10%	*70%*	*500 km²*

According to the IUCN Red List, a species is considered to be CRITICALLY ENDANGERED when all evidence indicates that its population has either:

a) been seen to be reduced by _____ or more in last 10 years or three generations,

b) its geographic range has been reduced to less than _____ and severely fragmented or less than 10 km²,

c) population size of less than _____ individuals, or

d) quantitative modeling suggests the probability of extinction at least _____ in the next 10 years.

Answer:
1) Any 3 of the following: habitat destruction and fragmentation, invasive species, overharvesting (unsustainable harvest), pollution, and
climate change (3 pts - 1 pt each)
2) Any 3 of the following: rarity, endemism, ineffective dispersers, life-history traits (long generations, low fecundity, large body size,
high survival), seasonal migration, little genetic diversity, specialized niche, require pristine habitat, form groups, and/or have no prior
contact with humans (3 pts - 1 pt each)
3) Any 2 of the following: to prevent wildlife species in Canada from disappearing, to provide for the recovery of wildlife species that are
extirpated (no longer exist in the wild in Canada), endangered, or threatened as a result of human activity, and to manage species of
special concern to prevent them from becoming endangered or threatened (2 pts - 1 pt each)
4a) 90% (0.5 pt)
4b) 100km^2 (0.5 pt)
4c) 50 (0.5 pt)
4d) 50% (0.5 pt)

Reference:
1) Environmental Awareness, p 40
2) Environmental Awareness, p 43
3) Environmental Awareness, p 42
4) Environmental Awareness, p 41

STOP 4

THEME
There is no question for this discipline at this stop.

STOP 5

THEME (5 pts)

1) In North America, attitudes towards conservation have evolved over time. The changing views have been categorized as the Romantic-Transcendental Conservation Ethic, Resource Conservation Ethic, and Evolutionary-Ecological Land Ethic.

Name the ethic that best corresponds to each of the statements below. (2 pts - 0.5 pts each)

a) Ecosystems are equilibrial systems of species interacting with the environment.

b) Efficient functioning of systems requires that all parts be present.

c) The preservation of wild nature is a morally superior way to use natural resources.
d) The natural world should be conserved to maintain a production level for future generations.
2) Name and briefly describe the three (3) measures used to determine priorities for protecting biodiversity. (3 pts)

Answer:
1a) Evolutionary-Ecological Land Ethic (0.5 pt)
1b) Evolutionary-Ecological Land Ethic (0.5 pt)
1c) Romantic-Transcendental Conservation Ethic (0.5 pt)
1d) Resource Conservation Ethic (0.5 pt)
2) (3 pts - 0.5 pt for each name; 0.5 pt for each description)
Distinctiveness or Irreplaceability – rare, taxonomically unusual genetic characteristics are prioritized
Endangerment – how at risk is a specific area or species
Utility – if an ecosystem or species has value as food, or may be valuable, or has some value as a tourism location it is prioritized for preservation

Reference:
1a) Environmental Awareness, p 49
1b) Environmental Awareness, p 49
1c) Environmental Awareness, p 48
1d) Environmental Awareness, p 48
2) Environmental Awareness, p 54

STOP 6

THEME (5 pts)

1) What is HABITAT FRAGMENTATION? (1 pt)

2) What is an EDGE EFFECT? (1 pt)

3) Briefly describe three (3) consequences of habitat fragmentation, other than edge effects. (3 pts)

Answer:
1) Habitat fragmentation is the process by which a large piece of habitat is converted into a smaller number of patches with smaller areas that are isolated from each other (1 pt)
2) Habitat fragmentation creates far more edge habitat compared to what was previously available (0.5 pt). When a habitat is fragmented, species adapted to the middle of an ecosystem, and not the edge, suddenly have far less area to use. (0.5 pt)
3) Any three of the following: Immigration is reduced; Movement of exotic species; loss of habitat variability; habitat loss; population sizes are restricted. (3 pts - 1 pt each)

Reference:
1) Environmental Awareness, p 28
2) Environmental Awareness, p 29
3) Environmental Awareness, p 28-29

STOP 7

THEME (10 pts)

1) Define and give an example of each type of success in conservation listed in the table below.

Type	Definition	Example
microscale	(0.5 pt)	(0.5 pt)
mesoscale	(0.5 pt)	(0.5 pt)

macroscale		
	(0.5 pt)	(0.5 pt)

2) What is SUSTAINABLE DEVELOPMENT? (1 pt)

3) The United Nations has developed seventeen sustainable development goals for 2030. List four (4) of these goals. (2 pts)

4) Briefly describe the three (3) components of ecosystem stewardship. (3 pts)

5) How can an individual citizen help conservation movements through legal and institutional instruments? (1 pt)

Answer:
1) (3 pts - 0.5 pt for each definition; 0.5 pt for each example)
Microscale - conservation involving direct efforts to protect species/habitats. Examples: protected areas; controlling illegal hunting
Mesoscale - conservation at a regional scale. Examples: trans-boundary agreements; international wildlife trade
Macroscale - conservation at a global scale. Examples: changing consumer demands; legislation
2) Sustainable development is about finding better solutions and ways of doing things in our lives, both to improve our future and the present. (1 pt)
3) Four of the following: No poverty; Zero Hunger; Good health and well-being; quality education; gender equality; clean water and sanitation; affordable and clean energy; decent work and economic growth; industry, innovation infrastructure; reduced inequalities; sustainable cities and communities; responsible consumption and production; climate action; life below water; life on land; peace, justice and strong institutions; partnerships for the goals (2 pts - 0.5 pts each)
4) Reduce vulnerability of a system to expected changes; Foster resilience to sustain desired conditions in the face of uncertainty and change; Transform from unwanted directions when other opportunities present themselves (3 pts - 1pt each)
5) As a concerned and active citizen, it is imperative for everyone to be in the political process and advocate for the world they desire. Environmental legislation has often been passed after political pressure from engaged citizens. (1 pt)

Reference:
1) Environmental Awareness, p 67-68
2) Environmental Awareness, p 71
3) Environmental Awareness, p 70
4) Environmental Awareness, p 72-73

5) Environmental Awareness, p 74

STOP 8

THEME
There is no question for this discipline at this stop.

STOP 9

THEME
There is no question for this discipline at this stop.

STOP 10

THEME (5 pts)

1) The world is facing a plastic problem. The annual production of plastics has increased almost 200-fold in less than 70 years.

Which of the following industries produced the most plastic in 2015? Circle the best response. (0.5 pt)

   a) Textiles
   b) Packaging
   c) Construction
   d) Electronics

2) Briefly describe the three (3) main pathways by which plastic can affect wildlife and ecosystems. (3 pts)

3) *True/False: Indicate whether the statement is true (T) or false (F) by circling the correct answer.* (1.5 pt - 0.5 pt each)

   T   F   Particles of plastic smaller than 4.75 mm in diameter are too small to be harmful.
   T   F   Plastic degrades in quality with recycling.
   T   F   Most of the plastic produced between the years 1950 and 2015 is still in use.

Answer:
1) b) (0.5 pt)

2) Entanglement - Marine animals may become entrapped, encircled, or constricted by plastics (1 pt); Ingestion - plastic ingestion can occur intentionally, unintentionally, or indirectly through the ingestion of prey containing plastics (1 pt); Interaction - plastic debris can interact with animals, including collisions, obstructions, abrasions or being used as a substrate (1 pt)
3) F, T, F (1.5 pt - 0.5 pts each)

Reference:
1) Environmental Awareness, p 35
2) Environmental Awareness, p 37
3) Environmental Awareness, p 36, 37, 78

STOP 11

THEME
There is no question for this discipline at this stop.

STOP 12

THEME (10 pts)
This question requires materials provided at stop.

1) Community A is represented by the laminated figures in the flagged area. Each laminated figure represents one individual of that species. Calculate the four measures of biodiversity indicated below for Community A. Show your work or reasoning for each calculation.

    a) Species Richness (S) (1 pt)

    b) Abundance (A)

        Species abundance for mice (1 pt)

        Species abundance for foxes (1 pt)

    c) Shannon-Weiner Index (H') (2 pt)

        The Shannon-Weiner Index for this community is 1.394. Most of the calculations required to determine H' have been done and are shown in the table below.

        Use the scientific calculator provided at the stop tocomplete the shaded cells in the table for the squirrel population. Give your answers to 3 decimal places.

$$H' = -\sum_{i=1}^{s} p_i ln p_i$$

Mammals	N_i	P_i	lnP_i	$-(P_i * lnP_i)$
Raccoon	2	0.067	-2.708	0.180537
Mouse	13	0.433	-0.836	0.362374
Squirrel				
Rabbit	4	0.133	-2.015	0.268654
Fox	3	0.100	-2.303	0.230259

d) Evenness (E) (1 pt)

Recall E = H'/lnS. Give your answer to 3 decimal places.

2) The biodiversity of another biological community of mammals was measured. The values for three indicators are given below.

Community B: S = 5, H' = 0.223, and E = 0.138

Look at the indicators for the two communities. Briefly describe what each of the indicators tells you about the similarities or differences between the two communities.

a) Species Richness (S) (1 pt)

b) Shannon-Weiner Index (H') (1 pt)

c) Evenness (E) (1 pt)

3) *True/False: Indicate whether the statement is true (T) or false (F) by circling the correct answer.* (1 pt - 0.5 pt each)

T   F   A biodiversity hotspot is a biogeographic region that is a significant reservoir of biodiversity and is threatened with destruction.

T   F   Biodiversity hotspots make up >10% of the world's surface.

Answer:
1a) Species richness = 5 (1 pt)
1b) number of 13 mice (0.5 pt); Abundance for mice = 13/30 (0.5 pt)
number of 3 foxes (0.5 pt); Abundance for foxes = 3/30 (0.5 pt)
1c) Ni = 8 (0.5 pt), Pi = 0.267 (0.5 pt), lnPi = -1.322 (0.5 pt), -(Pi*lnPi) = -.352 (0.5 pt)
1d) correct substitution in formula (0.5 pt), E = 0.866 (0.5 pt)
2a) S is equal for Community A and Community B. (0.5 pt) They have the same number of species. (0.5 pt)
2b) The higher H' value of Community A (0.5 pt) represents a greater biodiversity (0.5 pt) than Community B.
2c) The higher E value of Community A represents higher evenness - populations of species in community A are closer in size. (0.5 pt)There is more variation in the size of populations of the species in Community B. (0.5 pt)
3) T, F (1 pt - 0.5 pt each)

Reference:
1) Environmental Awareness, p 16-18
2) Environmental Awareness, p 16-18
3) Environmental Awareness, p 15

STOP 13

THEME
There is no question for this discipline at this stop.

STOP 14

THEME (5 pts)

1) Define PROTECTED AREA. (1 pt)

2) List two (2) types of unprotected areas that can contribute to environmental health. (2 pts)

3) Briefly describe four (4) ways that unprotected areas can be beneficial to the environment. (2 pts)

Answer:
1) A protected area is a geographic region which has been recognized, dedicated, and managed, through legal or other means. (0.5 pt) This area has been protected to attain long term conservation of nature and cultural values (0.5 pt)
2) Any two of the following: Selectively or long-rotation logging areas, agroforests, tree plantations, urban areas, military lands, and private reserves (2 pts - 1 pt each)

3) Any four of the following: buffer zones, stop-over areas for migrating species, habitat for generalist (non-picky) species, foraging areas for nearby species, educational opportunities, cheap conservation opportunities (2 pts - 0.5 pts each)

Reference:
1) Environmental Awareness, p. 65
2) Environmental Awareness, p. 61
3) Environmental Awareness, p. 61

STOP 15

THEME (5 pts)

1) You get home from school and your room is a mess. You decide it is time to clean up. You spend hours cleaning and tidying, and once you are done, you are shocked at how much stuff you had. You find some things you want to get rid of.

For each of the items below, state one (1) way you could either beneficially reuse the item or dispose of it in an environmentally conscious manner.

    a) an uneaten, rotting banana (0.5 pt)

    b) plastic grocery bags (0.5 pt)

    c) empty plastic water bottles (0.5 pt)

    d) some shirts that you don't like anymore (0.5 pt)

2) Reducing your consumption is even better than reusing or recycling items. Describe how you could have reduced consumption for one (1) of the items above. (1 pt)

3) You want to eat more sustainable, locally grown food and decide to learn how to garden. Briefly describe two (2) techniques you can use to maximize the sustainability of your garden. (2 pts)

Answer:
1a) compost (0.5 pt)
1b) recycle at store or use around the house (0.5 pt)
1c) recycle or reuse (0.5 pt)
1d) donate or give to a friend (0.5 pt)
2) Any reasonable answer (1 pt)
3) Any two of the following: Composting allows gardeners to cycle nutrients in their yard, square foot gardening allows gardeners to make optimal use of the space they have, vertical gardening takes advantage of vertical space, rainwater use allows gardeners to conserve high quality

drinking water, backyard poultry can add a significant source of protein to gardens, aquaponics incorporates aquaculture and hydroponics in a system using fish waste as fertilizer for plants (2 pts - 1 pt each)

Reference:
1) Environmental Awareness, p 75
2) Environmental Awareness, p 75
3) Environmental Awareness, p 89-90

STOP 1

WILDLIFE ECOLOGY (10 pts)
This question requires materials provided at stop.

You are a hunter, and have purchased a Conservation Moose License for GHA 17A. You are walking in the bush before sun down to find a good hunting spot when you come across a moose.

1) Watch the video of a moose on the i-Pad.
Indicate whether the statement is True (T) or False (F) by circling the correct answer. (1.5 pts - 0.5 pt each)

    T   F   The behavior seen in the video is a mating display for a female.
    T   F   The behavior seen in the video can be induced by parasites.
    T   F   The moose in the video is suffering from winter tick.

2) Name a parasite of concern in GHA 17A, 26 and 36. (1 pt)

3) Briefly describe each stage in the life cycle shown in the diagram below. (3 pts - 0.5 pt each)

Brain Worm Life Cycle
Parelaphostrongylus tenuis

Intermediate Host
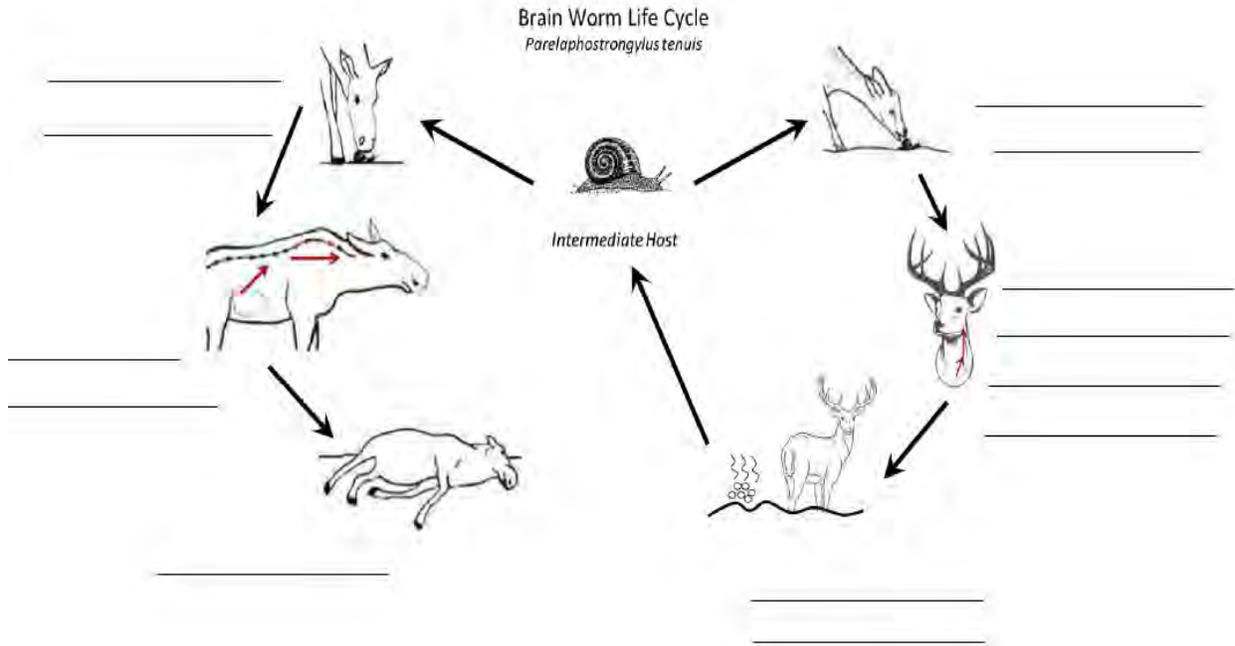
4) The White-Tailed Deer population is a growing concern for the moose population in some areas of Manitoba.

a) In which GHA is the deer population currently a concern for the moose population? (0.5 pt)

b) How many deer licenses are available in that area in order to drastically reduce the deer population from spreading parasites to the moose population? (0.5 pt)

c) List four (4) factors related to carrying capacity that will be affected by reducing the population in this area? (2 pt)

7) List three (3) management practices other than hunting that Manitoba Sustainable Development and other organizations use to understand and help the moose population? (1.5 pt)

Answer:
1) F, T, T (1.5 pts - 0.5 pt each)
2) Either one of: Brain Worm or Liver Fluke (1 pt)
3) Counter-clockwise from upper left: moose eats infected slug or snail; larvae travel to spinal chord/brain; moose dies; larvae passed through deer's feces; larvae move from deer's stomach to spinal chord/brain and lay eggs, new larvae move to lungs and are coughed up or swallowed; deer eats infected slug or snail (3 pts- 0.5 pt each)
4a) GHA 26 (0.5 PT)

4b) 3 (0.5 PT)
4c) Any 4 of the following: improved resource, less social stress, less competition, lower amount of parasite spread, less habitat damage, lower predation (2 pts – 0.5 pt each)
5) Any 3 of the following: Monitoring, researching, increased enforcement, refugees, public education, cooperative agreements (1.5 pts – 0.5 pt each)

Reference:
1) Pathogens and Parasites Document, p 5-6
2) Wildlife Document , p 37
3) Manitoba Hunting Guide 2018, p 38
4a) Manitoba Hunting Guide 2018, p 38
4b) Manitoba Hunting Guide 2018, p 38
4c) Wildlife Document, p 6
5) Wildlife Document, p 33, 34, 35

STOP 2

WILDLIFE ECOLOGY (5 pts)

1) List two (2) ecological factors that present problems for wildlife in the winter. (1 pt)

2) Animals that are active in winter can cope with the cold through adaptations (acclimatization) in three categories. In the table below list the three (3) categories, and provide an example for each. (3 pts - 0.5 pt each)

Category	Example

3) List two (2) advantages that invasive species have over native species? (1 pt)

Answer:
1) Temperature and snow (1pt – 0.5 pt each)

2) (3 pts – 0.5 for each category, and 0.5 for each correct example)
BEHAVIORAL: stashing food, subnivean tunnels, change diet to high fat, increased eating, other examples as appropriate.
PHYSIOLOGICAL: shivering, counter current heat exchange, fur changing colour
ANATOMICAL: thickening of insulation, fur, increase of feathers for insulation, smaller ears and feet.
3)Any two of the following: Competition, predation, pathogens & parasites, hybridization, habitat alteration (1 pt - 0.5 pt each)

Reference:
1) Wildlife and Winter, p 1
2) Wildlife and Winter, p 3-5
3) Wildlife Document, p 42

STOP 3

WILDLIFE ECOLOGY
There is no question for this discipline at this stop.

STOP 4

WILDLIFE ECOLOGY (5 pts)
This question requires materials provided at stop.

Your team is on the last night of sampling a closed population of Deer Mice (Peromyscus maniculatus). Your objective is to estimate the entire population of mice. Individuals are being caught using Sherman live-traps, marked, and released. During the first night of trapping, 18 individuals were trapped and marked. The data from the first two survey nights was recorded on the data sheet.

Plastic mice are being used to represent individual mice in the population. Mice that have been 'marked' are represented by mice marked by a large dot.

Check the data sheet labeled W-W to see how many individuals were caught during survey #1-2. Check each trap to see how many individuals were caught over night on survey #3, and count how many marked mice are present in the selection.

1) Record the number of marked individuals in the chart below: (1.5 pt)

Survey #1 _____
Survey #2 _____
Survey #3 _____

2) Using the Peterson method, N=(MC)/R, calculate the total population size (N) for each trial. (3 pts - 1 pt each)

Survey #1
Survey #2
Survey #3

3) Calculate the average (mean) population of mice (0.5 pt)

Answer:
1) Survey #1 - 6, Survey #2 - 3, Survey #3 - 5 (1.5 pt)
2) N = (MC)/R; M = 18, C = 15
Survey #1 - 6 marked, N=(18x15)/6 = 45 (1 pt)
Survey #2 - 3 marked, N=(18x15)/3 = 90 (1 pt)
Survey #3 - 5 marked, N=(18x15)/5 = 54 (1 pt)
3) (Sum of 3 estimated populations from question 2)/3 = (45+90+54)/3 = 63 (0.5 pt)

Reference:
1)-3) Wildlife Document, p 50-53

STOP 5

WILDLIFE ECOLOGY (10 pts)
This question requires BOTH materials AND features found at stop.

1) We learned on Sesame Street that "some of these things just don't belong here, some of these things just aren't the same". Check out the site around you and examine the wildlife and wildlife signs that you see. Identify the species that belong in the area that you are standing in. (5 pts - 1 pt each)

a) _____

b) _____

c) _____

d) _____

e) _____

2) You look to your left and notice a skunk meandering through the area. Use the Peterson Field Guide to Mammals to answer the following questions.

a) Circle the species of skunk you saw on the picture below. (0.5 pt)

b) What is the common name of species of skunk that you saw? (0.5 pt)

c) What is the Latin name? (0.5 pt)

d) Draw in the distribution range on the map below. (0.5 pt)

3) There are six species of bats found in Manitoba. Use the Peterson Field Guide to Mammals to determine which species migrate and which hibernate. Circle the correct answer next to each name. (3 pts - 0.5 pt each)

a)	Little Brown bat (Myotis lucifugus)	Migrate	Hibernate
b)	Northern long-eared bat (Myotis septentrionalis)	Migrate	Hibernate
c)	Silver haired bat (Lasionycteris noctivagans)	Migrate	Hibernate
d)	Red bat (Lasiurus borealis)	Migrate	Hibernate
e)	Hoary bat (Lasiurus cinereus)	Migrate	Hibernate
f)	Big Brown bat (Eptesicus fuscus)	Migrate	Hibernate

Answer:
1a) TBD (1 pt)
1b) TBD (1 pt)
1c) TBD (1 pt)
1d) TBD (1 pt)
1e) TBD (1 pt)
2a) top left (0.5 pt)
2b) Striped Skunk (0.5 pt)
2c) Mephitis mephitis (0.5 pt)
2d) Coloured correct range (0.5 pt)
3a) Hibernate (0.5 pt)
3b) Hibernate (0.5 pt)
3c) Migrate (0.5 pt)
3d) Migrate (0.5 pt)
3e) Migrate (0.5 pt)
3f) Hibernate (0.5 pt)

Reference:
1) Ability to use field guide, Wildlife Training, Wildlife Training Videos
2) Ability to use field guide
3) Ability to use field guide

STOP 6

WILDLIFE ECOLOGY
There is no question for this discipline at this stop.

STOP 7

WILDLIFE ECOLOGY
There is no question for this discipline at this stop.

STOP 8

WILDLIFE ECOLOGY (5 pts)
This question requires materials provided at stop.

1) Look at the skull labeled W-A.

    a) Calculate the dental formula for skull W-A. (2.5 pts)

    b) Identify what species skull W-A belongs to based on the dental formula. (0.5 pt)

2) What is the purpose of the carnassial tooth? (1 pt)

3) What is the purpose of the cheek teeth? (1 pt)

Answer:
1a) I 3/3, C 1/1, P 4/4, M 2/2 = 40 (2.5 pts)
(0.5 points each for incisor, carnassial, premolar, molar and total number)
1b) Raccoon (0.5 pt)
2) The carnassials are a pair of teeth on each side of jaw that do most of the shearing action when a carnivore is eating meat. (1 pt)
3)These teeth do most of the mastication of the food. (1 pt)

Reference:
1a) Wildlife Document Pages 18-20
1b) Ability to use keys
2) Wildlife Document Page 20
3) Wildlife Document Page 21

STOP 9

WILDLIFE ECOLOGY
There is no question for this discipline at this stop.

STOP 10

WILDLIFE ECOLOGY (10 pts)
This question requires materials provided at stop.

1) Compare and contrast OBSERVATIONAL and MANIPULATIVE ethology research techniques. (2 pts)

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2) You have been studying the behaviour of Grey Wolves (Canis lupus) for the last 6 weeks, and have been documenting their behaviours with photos and recording notes daily. Use photos W-I through W-V to answer the following questions.

    a) List five (5) common behaviours occurring within this wolf pack. (2.5 pts)

    b) What is the most common behaviour that is occurring within this wolf pack? (0.5 pt)

    c) What is the least common behaviour that is occurring within this wolf pack? (0.5 pt)

    d) Briefly describe the behavior in photo W-M and its causation (mechanism). (1 pt)

    e) How does the behaviour in photo W-M contribute to the animal's survival and reproductive success? (1 pt)

    f) How does the behaviour in photo W-M develop during the animal's lifetime? (1 pt)

    g) Which photo shows evidence of how the behaviour in photo W-M develops. (1 pt)

    h) In image W-P, the wolves are communicating. How does this behaviour provide an advantage to the pack? (0.5 pt)

Answer:
1) Observational: animal behaviour is observed in a natural environment without interference and trends are observed. (1 pt)
Manipulative: animal behaviour can be observed in a natural environment with some manipulation by the researcher. (1 pt)
2a) Hunting, sleeping, rearing young, mating, communicating (2.5 pts - 0.5 pt each)
2b) Communicating (0.5 pt)
2c) Mating (0.5 pt)
2d) The wolves are hunting (0.5 pt) by circling their prey (0.5 pt)
2e) Provides food and sustenance for the pack in order to live (1 pt)
2f) Through playing with the adults and learning from them (1 pt)
2g) photo W-O (1 pt)
2h) They are howling which can cover long distances and can reach another member of the pack far away (0.5 pt)

Reference:
1) Wildlife Document p 54
2a) Wildlife Document p 56
2b) Images provided, Wildlife Document p 55
2c) Images provided, Wildlife Document p 55
2d) Image provided, Wildlife Document p 55

2e) Wildlife Document p 55
2f) Wildlife Document p 55
2g) Wildlife Document p 55
2h) Wildlife Document p 55

STOP 11

WILDLIFE ECOLOGY
There is no question for this discipline at this stop.

STOP 12

WILDLIFE ECOLOGY (5 pts)
This question requires materials provided at stop.

1) The graph below shows the results of diet reconstruction for a number of species.
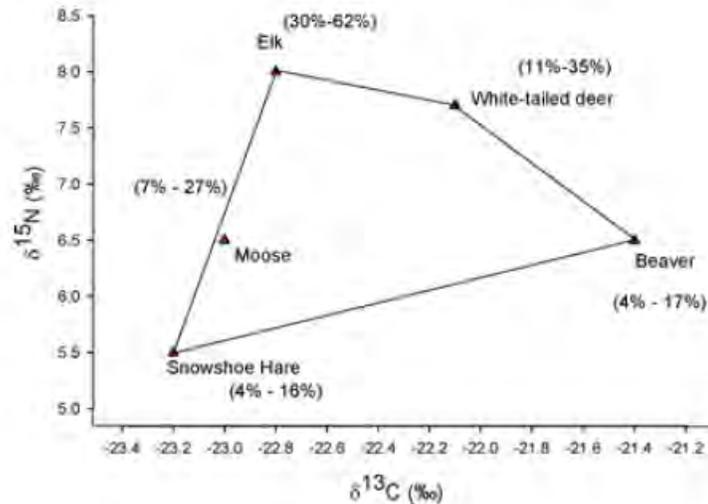
Urton and Hobson 2005

a) Name the method of Diet Reconstruction shown in the graph above. (0.5 pt)

b) Name the two (2) most common elements used in this method of Diet Reconstruction. (1 pt)

c) A wolf was studied and found to have the following element percentages: 7%-22.8%. Plot the data for the wolf on the graph above.(0.5 pt)

d) Based on the graph above, what are most likely to be the two (2) main species of prey this wolf has been consuming? (1 pt)

2) Look at the scat labeled W-B.

Directions: Put on a mask and a pair of gloves.

a) Identify what predator species the scat labeled W-B belongs to. (0.5 pt)

b) Using tweezers, examine the items found in the scat. What two (2) prey species has this predator has consumed? (1 pt)

c) What is the method of diet reconstruction that you just used? (0.5 pt)

Answer:
1a) Stable Isotope Analysis (Will also accept Isotope Analysis) (0.5 pt)
1b) Carbon & Nitrogen (1 pt - 0.5 pt each)
1c) See Marking Diagram for correct plot (0.5 pt)
1d) Moose, Elk (1 pt - 0.5 pt each)
2a) Raccoon (0.5 pt)
2b) TBD #1 & TBD #2 (1 pt - 0.5 pt each)
2c) Stomach & Fecal Analysis (Will also accept Fecal Analysis or Scat Analysis) (0.5 pt)

Reference:
1a) Wildlife Document pg. 53
1b) Wildlife Document pg. 53
1c) Wildlife Document pg. 54
1d) Wildlife Document pg. 54
2a) Scat Identification Document pg. 23
2b) Wildlife Document pg. 53
2c) Wildlife Document pg. 53

STOP 13

WILDLIFE ECOLOGY (5 pts)
This question requires materials provided at stop.

1) Examine the dissected specimen. Identify the organs pinned and labeled W-C, W-D, W-E, W-F, W-G, and W-H in the dissected mammal. (3 pts – 0.5 pt each)

W-C _____

W-D _____

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W-E _____

W-F _____

W-G _____

W-H _____

2) State one (1) function of the kidney. (1 pt)

3) Imagine you are a biologist doing a necropsy on an animal you have found. You notice very little perirenal fat (fat located around the kidney). Briefly explain what this indicates about the health of the animal. (1 pt)

Answer:
1) W-A: TBD (possibly heart) (0.5 pt)
W-B: TBD (possibly liver) (0.5 pt)
W-C: TBD (possibly lung) (0.5 pt)
W-D: TBD (possibly kidney) (0.5 pt)
W-E: TBD (possibly stomach) (0.5 pt)
W-F: TBD (possibly small intestine) (0.5 pt)
2) Any 1 of the following: regulation of electrolytes, blood pressure regulation through salt and water balance, maintaining the pH of blood, blood filtration to remove wastes, reabsorption of sugars/glucose/water/amino acids (1 pt)
3) The animal is most likely starving because the fat around the kidneys is generally the last to be lost when an animal goes into a starvation state.

Reference:
1) Wildlife Document, p 11
2) Wildlife Document, p 13
3) Wildlife Document, p 13

STOP 14

WILDLIFE ECOLOGY
There is no question for this discipline at this stop.

STOP 15

WILDLIFE ECOLOGY (5 pts)
This question requires materials provided at stop.

1) Circle four (4) species which are considered Problem Wildlife? (2 pts– 0.5 pt each)

a) Bison
b) Black Bear
c) Grouse
d) Fox
e) Moose
f) Fisher
g) Skunk
h) Beaver
i) Elk
j) Turkey
k) Coyote
l) Porcupine

2) List two (2) animals that can be personally dispatched by a landowner on their private property if the animal has become a nuisance to the property owner? (1 pt)

3) Wild boar are considered a nuisance species in Manitoba. They can be harvested by Manitoba Residents all year long without a hunting or trapping license. List two (2) pieces of information that is required to be reported to Manitoba Sustainable Development after a boar has been taken. (1 pt)

4) Wildlife can cause significant damage to agricultural land.

   a) What management practice is implemented by Manitoba Sustainable Development to reduce wildlife damage to agriculture land? (0.5 pt)

   b) What nuisance animals is this management practice intended for? (0.5 pt)

Answer:
1) Any 4 of the following: b, d, g, h, i, k (2 pt – 0.5 pt each)
2) Black Bear and wolf (1pt – 0.5 pt each)
3) Number of boar seen and location of kill (1 pt – 0.5 pt each)
4a) Bait station or Lure crop (0.5 pt)
4b) Migratory Game Birds or any one (1) species that falls with in the Migratory game bird classification (0.5 pt)

Reference:
1) Wildlife Document pg 35-37, training
2) Ability to read for information
3) Ability to read for information
4) Ability to read for information