Team #

STOP

NATIVE PLANTS AND FORESTRY

Do NOT change
F - A

_____
5

1) Emerald ash borer has been found in Manitoba. Briefly describe two (2) different negative impacts emerald ash borer could have have in Manitoba. (2 pts – 1 pt each)

_____

_____

2) Emerald ash borer is threatening Winnipeg's urban forest. List three (3) different emerald ash borer management options that could be used to slow the spread of this pest in the city. (1.5 pts – 0.5 pt each)

_____

_____

_____

3) Invasive forest pests can be introduced through wood packing material. Name one (1) other way invasive forest pests can be moved to new areas. (0.5 pt)

_____

4) Briefly describe how emerald ash borers kill ash trees. (1 pt)

_____

_____

_____

Team #

Table required?	No
Supervisor required?	No
Local feature required?	
Description of local feature	
Hands on question?	
List of equipment, props, and/or samples	
Difficulty of question	Medium
Answer to question	1) Ecological/Loss of biodiversity - invasive forest pests often don't face normal predation or their hosts lack natural defences. In vulnerable habitats, tree species may be nearly completely removed from the ecosystem (1 pt) Economic/social consequences - protection and monitoring costs, control costs, remediation costs, loss of livelyhood due to quarantines and regulatory action (1 pt) 2) Quarantines, tree removal, treatment with insecticides (1.5 pts - 0.5 pt each) 3) Any 1 of the following: Firewood, nursery stock, raw and untreated ash products (0.5 pt) 4) The larvae feed in the nutrient conducting vessels of trees under the bark (0.5 pt) eventually disrupting the flow of nutrients in affected trees (0.5 pt)
Reference to student material	1) Alien Forest Pests, p 10, 11, 12 2) Emerald Ash Borer, p 7, 8 3) Don't Move Firewood - Provincial 4) Emerald Ash Borer, p 4
Directions for printing and laminating	
Equipment supplied by Discipline	
Direction for stop set-up	
Directions for attendant	

STOP

NATIVE PLANTS AND FORESTRY

Do NOT change
F - B

5

1) Your study material talks about an area on the east side of Lake Winnipeg called Pimachiowin Aki, which translates as the "Land that Gives Life". This area is managed based on TEK. "Passed down from generation to generation over millennia, the cultural tradition of Ji-ganawendamang Gidakiiminaan, (Keeping the Land) guides actions and decisions that ensure the long term health and sustainability of nature and of the communities within Pimachiowin Aki."

　　a) What does the acronym TEK stand for? (1 pt)

　　_____

　　b) What is a method generally used to transfer or pass along TEK? (1 pt)

　　_____

2) Resources in the boreal forest are highly dispersed, with highly favoured resources often found in specific and small patches. Akiiwi-gikendamowining, the land-based knowledge of Anishinaabeg, is especially important in locating these patches.

With a majority of First Nations communities located in the Boreal forest, TEK will need to adapt to assist in locating of these patches. How is it estimated that vegetation, and the ability to locate vegetation, be impacted by climate change? (1 pt)

　　_____

　　_____

　　_____

3) Wildfire is a key driver of change and continuity in the boreal forest, affecting the availability of preferred plant and animal resources. The location of trapping and hunting sites shifts over time in response to the movement of animals and changes in habitat associated with ecological succession.

　　a) How will climate change affect the frequency of wildfire? (1 pt)

　　_____

　　_____

b) How will changes in wildfire impact availability of preferred plant and animal resources? (1 pt)

_____

_____

2018 Manitoba Envirothon
(name of Region) Regional Field Test

Table required?	No
Supervisor required?	No
Local feature required?	
Description of local feature	
Hands on question?	
List of equipment, props, and/or samples	
Difficulty of question	Medium
Answer to question	1a) Traditional Ecological Knowledge (1 pt) 1b) Passed on orally, and/or through story telling/legend, music/song, drawings (1 pt) 2) Changes in ecological relationships, leading to the loss of cold climate species, especially near the southern limit of their ranges. Some resources will not be available. Some will be harder to find. Some will "move" north. (1 pt) 3a) As the climate becomes warmer and drier, Manitoba's forests will become more vulnerable to fire. There will be an increase in the number and intensity of wildfires. (1 pt) 3b) Some plants and animals will be come more available, others will decrease. (1 pt)
Reference to student material	1a) Training 1b) Training; Pimachiowin Aki, p 20, 27, 44, 45 2) Pimachiowin Aki, p 21; Climate Change Connection, p 2-3 3a)-3b) Pimachiowin Aki, p 26; Climate Change Connection, p 2-3
Directions for printing and laminating	
Equipment supplied by Discipline	
Direction for stop set-up	
Directions for attendant	

STOP

NATIVE PLANTS AND FORESTRY *This question requires materials provided at the stop and features found at the stop*

Do NOT change
F - C

5

1) Determine the age of the tree sample labelled F-D. (1 pt)

F-D _____ years

2) Using the Field Guide to the Native Trees of Manitoba or your own general knowledge, identify the tree samples labelled F-A and F-B to species. (2 pts - 1 pt each)

F-A _____

F-B _____

3) Using the Suunto clinometer and diameter tape, measure the tree labelled F-C. (2 pts - 1 pt each)

Diameter _____ cm

Height _____ m

2018 Manitoba Envirothon
(name of Region) Regional Field Test

Table required?	Yes
Supervisor required?	Yes
Local feature required?	This question requires features found at the stop
Description of local feature	2 different tree species for ID, if possible Tree for diameter and height measurement
Hands on question?	This question requires materials provided at the stop
List of equipment, props, and/or samples	Suunto clinometer diameter tape Field Guide to Native Trees of Manitoba flagging tape; perm marker; pig-tail pin; 50m measuring tape trees and/or branch and twig samples to identify labelled F-A, F-B tree to measure labelled F- C tree cookie labelled F-D
Difficulty of question	Difficult
Answer to question	Regional host responsible to provide TBD answers for 2) and 3) to Envirothon Coordinator for test marking purposes. 1) TBD* (1 pt) 2) TBD (full common or Latin name required) (2 pts - 1 pt each) 3) TBD* (2 pts - 1 pt each measurement) *Partial marks: a marking range will be developed once TBDs are determined
Reference to student material	1), 2), 3) Regional Training (Equipment Usage and Dichot. keys)
Directions for printing and laminating	
Equipment supplied by Discipline	10 identical tree cookies, two for each Region
Direction for stop set-up	HOST must collect 2-3 samples of one conifer and one winter hardwood IN SPRING before leaf out and stored in fridge until event for ID. Use live trees at stop if possible for ID and measurements. Set up the exact spot at which teams to measure tree height: mark the distance to target tree on flagging tape tape tied to pigtail pin inserted in ground so that students can use the correct equipment scale. Ensure extra clinometers and d-tapes on hand in case they "walk away". Have extra labelled branch samples of all material available in case of damage or overuse.
Directions for attendant	Monitor samples and replace with extra samples as needed, making sure labelling is correct. Make sure clinometer and diameter tape don't leave stop.

STOP

NATIVE PLANTS AND FORESTRY

1) Name two (2) control measures for Dutch elm disease. (1 pt – 0.5 pt each)

_____

_____

2) What is the common name for Manitoba's provincial tree? (1 pt)

_____

3) Urban and rural trees grow under different conditions, which results in different amounts of carbon being sequestered

   a) True/False: Indicate whether the statement is true (T) or false (F) by circling the appropriate answer. (0.5 pt)

   T   F   The average urban tree in Canada sequesters more carbon over an 80-year period than an average rural tree.

   b) Explain what causes this difference. (0.5 pt)

   _____

4) State two (2) benefits of urban forests. (1 pt)

   _____

   _____

5) Describe two (2) threats or challenges to urban trees and forests. (1 pt - 0.5 pt each)

   _____

   _____

2018 Manitoba Envirothon
(name of Region) Regional Field Test

Table required?	No
Supervisor required?	No
Local feature required?	
Description of local feature	
Hands on question?	
List of equipment, props, and/or samples	
Difficulty of question	Medium
Answer to question	1) Any 2 of the following: removal of diseased and hazardous elms, basal application of pesticides, regular pruning of dead brances, fungicide injections (1 pt - 0.5 pt each) 2) White Spruce (1 pt) 3a) F (0.5 pt) 3b) In the urban environment, it is assumed that the annual litter fall from the tree is removed, so no carbon is added to the soil. (0.5 pt) 4) Any 2 of the following: protection from climatic conditions (heat, cold, or wind), decrease energy costs associated with heaitng and cooling, reduce run-off in urban areas, remove dust particles and pollutants from the air, beautify neighbourhoods and parks, provide habitat for animals and birds, provide outdoor recreation and learning opportunities. (1 pt - 0.5 pt each) 5) Any 2 of the following: compacted soils, lack of nutrients, street salts, air and water pollution, vandalism native forest pests and diseases, invasive forest pests and diseases. (1 pt - 0.5 pt each)
Reference to student material	1) Five-Year Report on the Status of Forestry, p 38-39 2) Manitoba Fact Sheet 3) What Trees can do to reduce atmospheric CO2, p 8 4) Urban Forestry in Manitoba 5) Urban Forestry in Manitoba
Directions for printing and laminating	
Equipment supplied by Discipline	
Direction for stop set-up	
Directions for attendant	

STOP

SOILS AND LAND USE *This question requires materials provided at the stop*

1) Examine the sample of rock labelled S-F.

  a) What type of parent material is it? (0.5 pt)

  _____

  b) Circle the two (2) regions in Manitoba where this type of parent material is dominant. (1 pt – 0.5 pt each)

      Hudson Bay Lowlands

      Boreal Forest

      Canadian Shield

      Interlake

      Turtle Mountains

  c) What is the specific mineral constituent of this parent material that reacts with dilute hydrochloric acid (HCl)? (0.5 pt)

  _____

  d) What two (2) geological processes were responsible for the distribution of this mineral constituent throughout much of Manitoba? (1 pt – 0.5 pt each)

  _____

  _____

2) Examine the sample of soil labelled S-G.

  a) Use the dilute HCl provided to test the sample of soil. Is the result positive (reaction observed) or negative (no reaction)? (0.5 pt)

  _____

  b) What is the gas generated by a positive HCl test of a soil sample? (0.5 pt)
  _____

c) From what soil horizon was this soil sample most likely taken: A, B or C? (0.5 pt)

_____

d) Circle which of the following symbols is used in soil classification to indicate the presence of the mineral named in 1c)? (0.5 pt)

m

g

k

j

e

2018 Manitoba Envirothon
(name of Region) Regional Field Test

Table required?	Yes
Supervisor required?	Yes
Local feature required?	
Description of local feature	
Hands on question?	This question requires materials provided at the stop
List of equipment, props, and/or samples	sample of limestone labelled S-F sample of soil labelled S-G two bottles of dilute HCl safety goggles MSDS sheets disposable gloves paper towels/water
Difficulty of question	Difficult
Answer to question	1a) limestone (0.5 pt) 1b) both of the following: the Hudson Bay lowlands (0.5 pt), the Interlake (0.5 pt) 1c) calcium carbonate or CaCO3 (0.5 pt) 1d) breaking or weathering of rock (0.5 pt) and movement of the rock by glaciers (0.5 pt) 2a) positive (0.5 pt) 2b) carbon dioxide or CO2 (0.5 pt) 2c) C (0.5 pt) 2d) k (0.5 pt)
Reference to student material	1) Soil Management Guide Chapter 1 p5-17 2) Soil Management Guide Chapter 1 p6-7, 19-20
Directions for printing and laminating	
Equipment supplied by Discipline	Sample of parent material S-F and sample of soil S-G.
Direction for stop set-up	Place the two sets of props such that two teams can have access to them.
Directions for attendant	Ensure that each set of props is returned to its proper location on the table prior to the arrival of the next team(s). Tell students to put on safety goggles and gloves before using HCl. Ensure that bottles of dilute hydrochloric acid are sealed between uses. Read MSDS sheet and be familiar with safety protocols.

Team #

STOP

SOILS AND LAND USE

Do NOT change
S - B

5

1) What is the relationship between soil organic matter and carbon? (1 pt)

_____

_____

_____

2) Climate change is related, in part, to loss of soil carbon sinks.

a) Describe briefly what a SOIL CARBON SINK is. (1 pt)

_____

_____

b) Name the type of organism that takes carbon out of the atmosphere and puts it into soil. (1 pt)

_____

3) Which soil horizon of a grassland soil (e.g. Eluviated Black Chernozem) is the most significant carbon sink? Circle the best response. (0.5pt)

a) Ah - topsoil or surface horizon

b) Ae - near surface horizon

c) Bm - mid- to lower-solum

d) Ck - parent geological material

4) Which soil horizon of an organic soil (e.g. Terric Fibrisol) is the most significant carbon sink? Circle the best response. (0.5pt)

a) Om - mesic surface horizon

b) Of - fibric subsurface horizon

c) C - parent geological material

5) The term SOD BUSTER describes pioneers who developed much of the Western Canadian Prairies to grow crops. This name originates from how they had to break up the thatch of the grassland and work the soil for a seedbed to grow food crops. In modern times with the concern about climate change, why would someone want to consider these people to be CARBON BUSTERS instead? (1 pt)

_____

_____

_____

_____

2018 Manitoba Envirothon
(name of Region) Regional Field Test

Table required?	No
Supervisor required?	No
Local feature required?	
Description of local feature	
Hands on question?	
List of equipment, props, and/or samples	
Difficulty of question	Medium
Answer to question	1) carbon is in organic matter OR organic matter is made up of carbon OR organic matter releases carbon dioxide (or methane, a carbon compound) when it decays (1 pt) 2a) the removal of carbon dioxide from the atmosphere into the soil OR the storage of carbon/organic matter in the soil OR photosynthesis storing carbon/organic matter in plant tissues in the soil (roots) (1 pt) 2b) plant OR primary producer (1 pt) 3) a (0.5 pt) 4) a) OR b) (0.5 pt) 5) opening up the soil (or tilling it) has released some of the carbon out of the soil (it has taken carbon out of storage and put it into the atmosphere) (1 pt)
Reference to student material	1) Soils and Land Use Document: Climate Change and Agriculture p 48; Reducing Agricultural Emissions - Soils As Sinks for Carbon p 52 2) Soils and Land Use Document: Reducing Agricultural Emissions - Soils As Sinks for Carbon p 52; Soil Forming Factors p 10 3) - 4) Soils and Land Use Document: What is Soil? - The Soil Profile p 6-7 and Soil Components p 12 -13 5) Soils and Land Use Document: Reducing Agricultural Emissions - Soils As Sinks for Carbon - p 52
Directions for printing and laminating	
Equipment supplied by Discipline	
Direction for stop set-up	
Directions for attendant	

STOP

SOILS AND LAND USE   *This question requires materials provided at the stop*

Do NOT change
S - C

5

1) Using the soil textural triangle labeled S-B, determine the texture of the soil labeled S-A. (1 pt)

_____

2) Using the table describing Agricultural Capability classes (labelled S-C) answer the following questions based on the soil labeled S-A.

    a) If the water table where this soil was collected was very high, what class and subclass would best describe the soil agriculture capability? Circle the best response. (0.5 pts)

        i) 2T

        ii) 3W

        iii) 4E

        iv) 4PD

        v) 6W

    b) Alternatively, if this soil was very susceptible to wind erosion, what class and subclass would best describe the soil agriculture capability? Circle the best response. (0.5 pts)

        i) 2T

        ii) 3W

        iii) 4E

        iv) 4PD

        v) 6W

3) What three (3) classes of land are commonly used for cultivated annual crop production? (1.5 pts – 0.5 pt each)

_____

_____

_____

4) What soil class would describe an active sand dune? (1 pt)

_____

5) What soil survey scale is more accurate for land use planning purposes? Circle the best response. (0.5 pt)

     a) 1:20,000 scale

     b)1:125,000 scale

2018 Manitoba Envirothon
(name of Region) Regional Field Test

Table required?	Yes
Supervisor required?	Yes
Local feature required?	
Description of local feature	
Hands on question?	This question requires materials provided at the stop
List of equipment, props, and/or samples	Sample of very coarse sand labeled S-A Textural triangle labeled S-B (from regional kits) Ag Capability table labeled S-C (S_ag capability_C_LAMINATE)
Difficulty of question	Easy
Answer to question	1) sand (1 pt) 2a) 3W or 6W (0.5 pt) 2b) 4E (0.5 pt) 3) Classes 1,2 & 3 (1.5 pt - 0.5 pt each) 4) Class 7 (1 pt) 5) scale of 1:20,000 (0.5 pt)
Reference to student material	1) Manitoba Soil Management Guide, p12 2)-3) Manitoba Soil Management Guide, p 31-33 4)-5 Manitoba Soil Management Guide, p 27-28
Directions for printing and laminating	Print and laminate 3 copies per Regional of S_ag capability_C_LAMINATE.
Equipment supplied by Discipline	Soil sample labeled S-A
Direction for stop set-up	
Directions for attendant	

Team #

STOP #

SOILS AND LAND USE
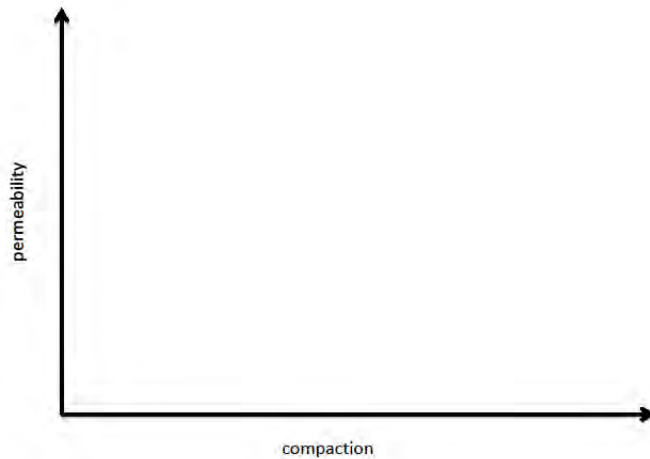
Do NOT change
S - D

_____
5

1) Fill in the blank: Complete the sentences with the most appropriate words.

a) Soil compaction brings _____ closer together, and
reduces both _____ and water flow. (1 pt - 0.5 pt each)

b) Soil compaction _____ (increases/decreases) porosity and
_____ (increases/decreases) bulk density. (1 pt - 0.5 pt each)

2) Using the figure below, draw the relationship between compaction and permeability. (1 pt)

3) List two (2) ways that soil compaction affects soil fertility. (2 pts - 1 pt each)

_____

_____

Team #

Table required?	No
Supervisor required?	No
Local feature required?	
Description of local feature	
Hands on question?	
List of equipment, props, and/or samples	
Difficulty of question	Easy
Answer to question	1a) aggregates or particles; air (1 pt - 0.5 pt each) 1b) decreases; increases (1 pt - 0.5 pt each) 2) inverse curved line (1 pt) Partial marks: straight line with a negative slope (0.5 pt) 3) Any 2 of the following: restricts rooting depth, reduces uptake of water and nutrients by plants, decreases soil temperature, decreases pore size, increases proportion of water-filled pore space at field moisture, decreases rate of decomposition of soil organic matter and subsequent nutrient release, increases susceptibility of water erosion (2 pts - 1 pt each)
Reference to student material	1) Compaction; Soil and Land Use Document, p 32, 35; Soil Management Guide, p109 2) Compaction; Soil and Land Use Document, p 32, 35 3) Compaction; Soils and Land Use Document, p 35
Directions for printing and laminating	
Equipment supplied by Discipline	
Direction for stop set-up	
Directions for attendant	

STOP

THEME   *This question requires materials provided at the stop*

1) 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   In coming decades climate models project greater warming for Canada's south than Canada's north.

T   F   Across Canada, but especially in the north, temperatures are expected to warm more during winter months than during other seasons.

T   F   Warming of Arctic regions amplifies planetary warming due to a reduction in reflectivity from snow and sea ice.

T   F   Canada's Arctic is expected to get much drier during August in coming decades.

2) Which of the following describes the High Carbon scenario used by the Prairie Climate Centre? Circle the best response. (0.5 pt)

a) It closely matches our present emissions trend.

b) It assumes that humanity will continue to emit more and more greenhouse gases into the atmosphere well into the future.

c) It combines data from 12 different climate models.

d) It is based on the expected greenhouse gas concentration known as Representative Concentration Pathway 8.5 or RCP8.5.

e) All of the above

3) Review the handout labelled T-A which shows climate change projections for Churchill, Manitoba.

a) Indicate the average number of days per year = -30°C during the baseline period (1981-2010) for the High Carbon Emissions scenario. (1 pt)

_____

b) Indicate the mean projection for average days per year = -30°C for the 2051-2080 period for the High Carbon Emissions scenario. (1pt)

_____

c) Is annual precipitation in Churchill projected to increase or decrease in the future? (0.5 pt)

_____

Team #

Table required?	No
Supervisor required?	No
Local feature required?	
Description of local feature	
Hands on question?	This question requires materials provided at the stop
List of equipment, props, and/or samples	Churchill Report Card from Prairie Climate Centre, labelled T-A (T_ClimateModelling_A_LAMINATE)
Difficulty of question	Medium
Answer to question	1) F, T, T, F (2 pts - 0.5 pt each) 2) e (0.5 pt) 3a) 44.6 days (1 pt) 3b) 4.0 days (1 pt) 3c) Increase (0.5 pt)
Reference to student material	1) Climate Change in the North, p 76, 78-81 2) Climate Change in the North, p 76-77 3a)-3c) Ability to read and interpret data
Directions for printing and laminating	Print and laminate 3 copies per Regional of T_ClimateModelling_A_LAMINATE), both sides, doubled-sided. After printing, label T-A at the top of each handout between the Prairie Climate Centre logo and the map of the 3 prairie provinces, then laminate.
Equipment supplied by Discipline	
Direction for stop set-up	
Directions for attendant	

STOP

THEME

1) Phenology is an important concept to understand when looking at the impacts of climate change on wildlife.

    a) Define PHENOLOGY. (1 pt)

    _____

    b) Give an example of why changes in climate are important to the phenology of amphibians. (1 pt)

    _____

    _____

2) Both Grey Jays and Snowshoe Hares are vulnerable to changes in climate. Choose one (1) of these species. (2 pts - 1 pt each)

    a) Describe what about the animal's life history makes them vulnerable to climate change. (1 pt)

        _____

        _____

    b) Explain how climate change may affect their populations. (1 pt)

        _____

        _____

3) Winter thaws and rain-on-snow events are likely will become more common with climate change. Explain why these events are a problem for grazing animals (i.e. ungulates). (1 pt)

_____

_____

2018 Manitoba Envirothon
(name of Region) Regional Field Test

Table required?	Yes
Supervisor required?	No
Local feature required?	
Description of local feature	
Hands on question?	
List of equipment, props, and/or samples	
Difficulty of question	Difficult
Answer to question	1a) timing of life cycle events such as breeding and overwintering (1 pt) 1b) The answer should contain the idea that, "Climate change may result in shifts in phenology, especially for species that breed early or late in the season" (0.5 pt); and any 1 of the following (0.5 pt): - a shift to earlier breeding may leave amphibians exposed to fluctuating weather conditions; - a warm spell in late winter followed by a cold storm after breeding can freeze animals; - a deep freeze may penetrate below the ground surface to affect animals emerging in spring, or overwintering hibernacula in winter; - survival of annual recruits may be tied to their size at metamorphosis, which may depend upon when breeding occurs. 2a) Any 1 of the following (1 pt total as indicated) Gray Jays rely on cold temperatures during autumn and winter seasons as they are known to hoard a broad range of perishable food items (0.5 pt) and, while they are not dependent upon a single food source, they do rely heavily upon reliable food-storage conditions (i.e., consistently cold temperatures) (0.5 pt) OR Snowshoe hares are typically killed by predators. Thus, predator avoidance is a critical aspect of snowshoe-hare behavior. (0.5 pt) They use both coloration of their coat (hare pelage) to avoid predators. (0.5 pt) 2b) Any 1 of the following matching the species chosen above (1 pt total as indicated)) Gray Jays are showing a reduced reproductive performance (0.5 pt) after warmer winters (0.5 pt), i.e. their populations are decreasing as temperatures get warmer. OR Hares may be particularly vulnerable when their coloration does not match the background-a white hare on a brown background is more visible to predators. With climate change, spring snowmelt is predicted to occur earlier and snow cover lost sooner in areas inhabited by the snowshoe hare. (0.5 pt) Hare pelage change has limited plasticity in the rate of the spring white-to-brown molt, but both initiation dates of color change and the rate of the fall brown-to-white molt are fixed. (0.5 pt) 3) Refreezing creates a layer of ice over the vegetation (their food) that may be difficult for animals to penetrate with their hooves (1 pt)
Reference to student material	1a) Climate Change in the North, p 58 1b) Climate Change in the North, p 58 2a) Climate Change in the North, p 60-61, 62-63

	2b) Climate Change in the North, p 60-61, 62-63 3) Climate Change in the North, p 41
Directions for printing and laminating	
Equipment supplied by Discipline	
Direction for stop set-up	
Directions for attendant	

STOP

THEME   *This question requires materials provided at the stop*

1) Permafrost belongs to the Cryosolic soil Order. What is the technical name for the soil process that formed the soil profile in Diagram T-C? (1 pt)

_____

2) What are two (2) signs that permafrost is thawing? (2 pts - 1 pt each)

_____

_____

3) Look at the soil profile of a Cryosolic Peatland labelled T-D, and answer the following questions.

   a) What regions of Canada contain the most peatlands? (0.5 pt)

   _____

   b) Compared to the amount of carbon in the atmosphere, how much carbon is stored in the global frozen peatlands? Circle the best response. (0.5 pt)

      i)   1/3 of the amount in the atmosphere

      ii) 1/2 of the amount in the atmosphere

      iii) Equal the amount in the atmosphere

      iv) Twice the amount in the atmosphere

4) What is meant by the term PERMAFROST CARBON FEEDBACK? (1 pt)

   _____

   _____

   _____

2018 Manitoba Envirothon
(name of Region) Regional Field Test

Table required?	No
Supervisor required?	No
Local feature required?	
Description of local feature	
Hands on question?	This question requires materials provided at the stop
List of equipment, props, and/or samples	Photo of cryoturbation soil feature (T_Soils_C_LAMINATE) Northern Cryosolic Peatland (T_Soils_D_LAMINATE)
Difficulty of question	Medium
Answer to question	1) Cryoturbation (1 pt) 2) Any 2 of the following: buildings and roads becoming unstable; trees in the forest falling over and growing crookedly (drunken forest); coastline and shoreline erosion; drying of southern peatlands; increased forest fires in the southern boreal region; measured soil temperatures increasing above the mean annual temperature of OC, or warming of soil; measured decrease of carbon stored in peatlands or increasing carbon release of peatlands (2 pts - 1 pt each) 3a) Boreal and Subarctic regions, or high north, or northern regions (0.5 pt) 3b) iv (0.5 pt) 4) As the permafrost thaws, the soil organic matter of peatlands will release CH_4 from saturated conditions, and CO_2 from drier conditions (0.5 pt) AND These greenhouse gases will go into the atmosphere, increasing global warming, and will further increase permafrost thawing (0.5 pt)
Reference to student material	1) Climate Change in the North, p 27 2) Climate Change in the North, p 29-30 3a) Climate Change in the North, p 30-31 3b) Climate Change in the North, p 30 4) Climate Change in the North, p 32
Directions for printing and laminating	Print and laminate 3 copies for each Regional of T_Soils_C_LAMINATE and T_Soils_D_LAMINATE
Equipment supplied by Discipline	
Direction for stop set-up	
Directions for attendant	

Team #

STOP

THEME

Do NOT change

T - D

____

5

1) For an arctic freshwater ecosystem, list two (2) potential impacts from climate change for the following kinds of impacts.

    a) Physical impacts (1 pt – 0.5 each)

       _____

       _____

    b) Biogeochemical impacts (1 pt – 0.5 each)

       _____

       _____

    c) Biological impacts (1 pt – 0.5 each)

       _____

       _____

2) Refer to the photos labelled T-B to answer the following questions.

    a) Which of the lakes, Lake 1 or Lake 2, would you expect to be more productive? (1 pt)

       _____

    b) Give two (2) reasons why that lake would be more productive. (1 pt – 0.5 each)

       _____

       _____

Table required?	Yes
Supervisor required?	No
Local feature required?	
Description of local feature	
Hands on question?	Yes
List of equipment, props, and/or samples	3 each of photos labelled T-B (T_FreshwaterImpacts_B_LAMINATE)
Difficulty of question	Medium
Answer to question	1a) Any 2 of the following: total loss of some aquatic systems; increased drainage and evaporation; increased precipitation; loss of ice cover; increased light/photosynthesis; increased UV radiation; heating of water; changes in stratification; increased mixing (1 pt - 0.5 pt each) 1b) Any 2 of the following: increased reaction rates; less gas exchange; increased nutrients/organic inputs; reduced oxygen/anoxia; increased CO2 and methane production; mobilization of stored carbon/ nutrients; increased erosion, decreased pH (1 pt - 0.5 pt each) 1c) Any 2 of the following: impair cold-adapted organisms; complete food web shift; increased species richness; changes in community structure; displacement of native fish (1 pt - 0.5 pt each) 2a) 2 (1 pt) 2b) Greater light availability; larger photic zone (1 pt - 0.5 pt each) Partial marks: 0.5 pt - reduced ice cover
Reference to student material	1a) Climate Change in the North, p 34-35 1b) Climate Change in the North, p 35-36 1c) Climate Change in the North, p 36 2a) Climate Change in the North, p 34 2b) Climate Change in the North, p 34
Directions for printing and laminating	Print and laminate 3 copies for each Regional of T5_FreshwaterImpacts_B_LAMINATE
Equipment supplied by Discipline	
Direction for stop set-up	
Directions for attendant	

STOP

WATER AND AQUATIC ECOSYSTEMS   *This question requires materials provided at the stop*

Do NOT change
A - A
5

1) All life forms depend on water to survive. Humans need safe water to drink and aquatic organisms need a suitable environment to live in. Water quality monitoring helps to protect water bodies. List two (2) typical monitoring tests researchers use to assess water quality. (1 pt – 0.5 pt each)

_____

_____

2) The two vials labeled A-A and A-B contain water samples that were obtained from different sources. These samples were prepared so that you will be able to determine the pH of the water. Follow the directions below and record the pH of samples A-A and A-B. (1 pt - 0.5 pt each)
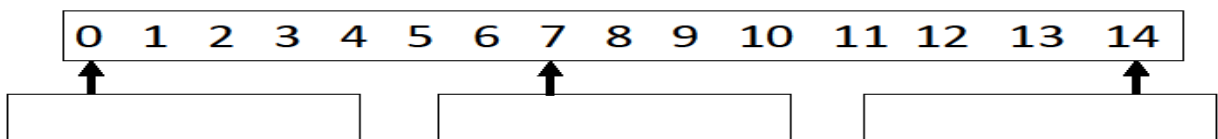
Directions: Compare the colour of the water in the vial to the colour on the laminated card provided by holding the vial up against the white background of the card. There is a diagram of how to do this on the back of the card. The number below the colour on the card is the pH value. If the water sample is between 2 colours on the card, state a number half way between (e.g. colour between 4 and 5, record 4.5).

A-A _____

A-B _____

3) The pH scale is outlined below

   a) In the boxes provided below the pH scale, write the following descriptions in the appropriate locations. (1.5 pts - 0.5 pt each)

```
0  1  2  3  4  5  6  7  8  9  10  11  12  13  14
   ↑                    ↑                        ↑
 [      ]            [      ]              [          ]
```

most acidic,   most alkaline   neutral

b) On the pH scale above, indicate where the 2 water samples that you tested lie along this pH scale. Circle the numerical value and write the sample number (A-A or A-B) above the circle. (1 pt – 0.5 pt each)

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

       T   F   The water you tested in vial A-B is harmful to fish.

Team #

Table required?	Yes
Supervisor required?	Yes
Local feature required?	
Description of local feature	
Hands on question?	This question requires materials provided at the stop
List of equipment, props, and/or samples	3 sets of 2 vials labeled A-A and A-B containing different colours of water 3 laminated test cards from the pH water quality test kits 2 plastic bins to hold the vials and laminated test cards.
Difficulty of question	Medium
Answer to question	1) Any 2 of the following: temperature, pH, dissolved oxygen, nitrates/nitrites/nitrogen, total dissolved solids, salinity, turbidity, total coliform bacteria, phosphorus/phosphate. (1 pt - 0.5 pt each) 2) A-A: 6; A-B: 10, 10.5 OR 11 (1 pt - 0.5 pt each) 3a) left to right: most acidic, neutral, most alkaline (1.5 pts - 0.5 pt each) 3b) Values recorded in 2) circled on scale (whether correct for 2) or not) and correct sample ID written above circle (1 pt - 0.5 pt each). 4) T (0.5 pt)
Reference to student material	1) Water Quality, p 3-17 2) LiveStream training; ability to follow directions 3) Water Quality, p 5 4) Water Quality, p 6
Directions for printing and laminating	
Equipment supplied by Discipline	3 sets of two vials each which contain coloured tap water, labeled A-A and A-B. The colour is created using food colour. A-A has a colour matching pH 6, A-B has a colour between pH 10-11 inclusive.
Direction for stop set-up	Place one set of vials labelled A-A and A-B and a laminated pH test card in a plastic bin at each end of the table so that 2 teams can work at the same time. Keep the third set of vials as backup.
Directions for attendant	No special precautions are needed to handle the vials. They contain tap water and food colouring. Make sure 2 vials labelled A-A and A-B and a laminated test card are in each plastic bin before the next set of teams arrive. In case of accidental loss of sample, a spare set of vials has been provided.

Team #

STOP

WATER AND AQUATIC ECOSYSTEMS   *This question requires materials provided at the stop*

Do NOT change A - B
5

1) Using the ruler provided, measure the fork length of the fish labeled A-E and A-F to the nearest centimeter. Reminder: fork length is the distance from the tip of the snout to the fork in the tail. (1 pt - 0.5 pt each)

A-E _____

A-F _____

2) Sometimes it's not possible to weigh a fish when sampling. Instead, researchers can estimate the weight of a fish by comparing its length to lengths and weights of other fish of the same species. Using graph A-G, estimate the weights of the fish labeled A-E and A-F in grams (make sure you use the appropriate line on the graph for each fish). (1 pt - 0.5 pt each)

A-E _____

A-F _____

3) By using length and weight information, researchers can calculate a parameter called "condition factor" to determine how healthy a fish is. A skinny (unhealthy) fish will have a condition factor less than 0.8, while a healthy fish will have a condition factor around 1 or higher.

a) Look at the equation and example below which shows how to calculate the condition factor. Using length and weight information determined above, calculate the condition factors for fishes A-E and A-F according to the equation below. (2 pts - 1 pt each)

Equation: condition factor = (weight in grams ÷ (length in cm)^3) x 100

Example: length = 30 cm, weight = 300 g
$$\text{condition factor} = (300 \text{ g} \div (30)^3) \text{ x } 100$$
$$= (300 \text{ g} \div 27000) \text{ x } 100$$
$$= 0.0111 \text{ x } 100$$
$$= 1.11$$

Condition factor of fish A-E:_____

Condition factor of fish A-F:_____

b) Based on the condition factors, which fish is healthier (A- E or A- F)? Circle the best answer (1 pt)

A – E

A - F

2018 Manitoba Envirothon
(name of Region) Regional Field Test

Table required?	Yes
Supervisor required?	Yes
Local feature required?	
Description of local feature	
Hands on question?	This question requires materials provided at the stop
List of equipment, props, and/or samples	3 copies of laminated page showing fish A-E/A-F (A_fish sampling_EF_LAMINATE.pdf) 3 30-cm rulers (make sure they have cm increments) 3 laminated graphs A-G (A_fish sampling_G_LAMINATE.pdf)
Difficulty of question	Difficult
Answer to question	1) A-E: TBD, A-F: TBD (1 pt - 0.5 pt each) 2) A-E: TBD, A-F: TBD (1 pt - 0.5 pt each) 3a) A-E: TBD, A-F: TBD (2 pt - 1 pt each) 3b) TBD (1 pt)
Reference to student material	1) Ability to follow instructions; Aquatic Sampling Techniques Document p. 7 2) Ability to follow instructions; ability to read a graph 3) Ability to follow instructions; ability to calculate a simple equation
Directions for printing and laminating	Print and laminate 3 copies for each Regional of A_fish sampling_EF_LAMINATE (these are on one page and can be laminated as one) and A_fish sampling_G_LAMINATE
Equipment supplied by Discipline	
Direction for stop set-up	Make 2 piles on the table, each containing: one laminated fish A-E, one laminated fish A-F, one laminated graph A-G, and one 30 cm ruler.
Directions for attendant	The students will measure the "fork length" of the fish, which is from the tip of the snout (nose) to the "fork" of the tail (the middle; as opposed to the tips of the tail fins on the top or bottom). They are to make this measurement in centimeters. If they ask for assistance, you can tell them that they are supposed to measure from the tip of the nose to the fork of the tail (it says this in the question), and you can tell them to measure in cm (round to the nearest cm). When they are reading the graph, they should find the length of the fish along the line on the graph, and then look at the y axis to determine the corresponding weight (in grams). Third set of materials is for back-up.

STOP

WATER AND AQUATIC ECOSYSTEMS   *This question requires materials provided at the stop*

Do NOT change
A - C

5

1) Rivers and streams are conduits for the movement of surface waters across landscapes. Because of the immense importance of water to humans, we frequently measure and quantify, and sometimes control, these movements. Complete the following statements with the most appropriate words. (1 pt - 0.5 pt each)

   a) Flow rates in Canadian rivers can be seasonably variable with the highest discharges typically occurring in the _____ each year. (Hint: answer is a season.)

   b) Flow rates (or discharges) in a river or stream are estimated by making frequent measurements of channel depth, channel width and _____.

2) Document A-H contains photos of two Manitoba dams. The upper dam is located at Grand Rapids on the Saskatchewan River just before it flows into Lake Winnipeg. The lower dam is located at Seven Sisters on the Winnipeg River as it flows through the transition between Precambrian Shield and prairie soils.

   a) Which of the possible uses listed below would have been the primary purpose for constructing each dam, based on its location? (1 pt - 0.5 pt each)

   Irrigation   Flood protection   Electricity generation

        Recreation   Municipal drinking water

   Grand Rapids: _____

   Seven Sisters: _____

   b) While dams can provide valuable services, they can also cause problems within their riverine ecosystems and beyond. For each of the following, indicate whether the statement is true (T) or false (F) by circling the correct answer. (2 pts - 0.5 pt each)

        T   F   Upstream fish migration is frequently prevented or reduced by dams.

        T   F   Greenhouse gases are produced from flooded vegetation upstream of dams.

T   F   Dissolved oxygen concentrations are increased in the upstream water stored behind dams.

T   F   Variation of flow rates downstream from dams usually is less extreme than before the dams were constructed.

3) As a province with a sea coast, Manitoba is downstream from much of Alberta, Saskatchewan, northwestern Ontario, and parts of the northern U.S.A (as depicted in map A-I). Water from multiple provinces and states ultimately flows into the ocean at Hudson Bay. Locate the Saskatchewan River drainage basin on map A-I and look at how the water flows across the landscape from Alberta toward Hudson Bay (a distance of approximately 2500 km!).

List the two (2) drainage basins that connect the Saskatchewan River watershed to Hudson Bay (i.e., what drainage basins would a drop of water flow through if it traveled from the Saskatchewan River watershed to Hudson Bay?). (1 pt – 0.5 pt each)

_____

_____

2018 Manitoba Envirothon
(name of Region) Regional Field Test

|	
Table required?	Yes
Supervisor required?	No
Local feature required?	
Description of local feature	
Hands on question?	This question requires materials provided at the stop
List of equipment, props, and/or samples	3 copies of A_Rivers_H_LAMINATE.pdf 3 copies of A_Rivers_I_LAMINATE.pdf
Difficulty of question	Medium
Answer to question	1a) spring (0.5 pt) 1b) velocity (or flow velocity or water velocity) (0.5 pt) 2a) Grand Rapids: electricity generation (0.5 pt); Seven Sisters: electricity generation (0.5 pt) 2b) T, T, F, T (2 pts - 0.5 pt each) 3) Lake Winnipeg, Nelson River (order not important) (1 pt - 0.5 pt each)
Reference to student material	1a) Aquatic Ecology Document, p 17 1b) Aquatic Ecology Document, p16 2a) Aquatic Ecology Document, p 49-52 2b) Basics of Stream Ecology, p 3 3) Basics of Stream Ecology, p 1; Aquatic Ecology Document, p 14-15
Directions for printing and laminating	Print and laminate 2 copies for each Regional of A_Rivers_H_LAMINATE.pdf and A_Rivers_I_LAMINATE.pdf. Make sure A_Rivers_I is printed in high quality so rivers are clearly visible on map.
Equipment supplied by Discipline	
Direction for stop set-up	Laminated pages should be made available for use by teams.
Directions for attendant	

Team #

STOP

WATER AND AQUATIC ECOSYSTEMS

*Do NOT
change
A - D*

5

1) As rain falls from the sky it reaches the earth's surface across the landscape. Rain that is not absorbed into the ground runs across the surface, dissolving and picking up substances, before reaching a water body. Different types of landscapes contribute different substances or pollutants to surface waters. For each of the landscapes pictured below, name two (2) types of pollutants they may contribute to water. (3 pts - 0.5 pt each)

farm   industrial   city
              facility

A) _____   B) _____   C)_____

_____   _____   _____
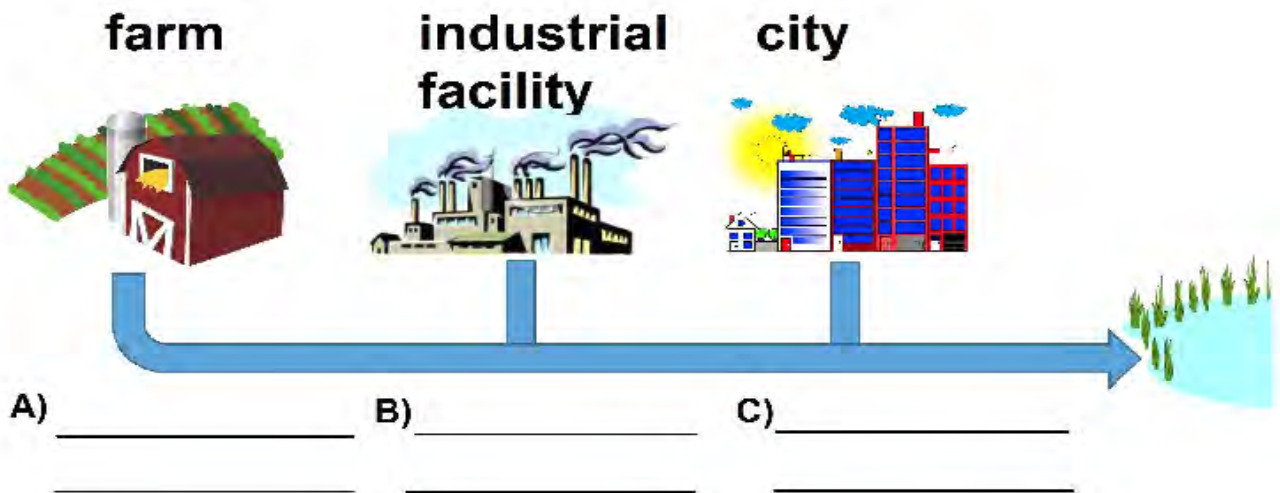
2) So what is being done about all of this pollution? Every level of government can play a role in protecting and improving the quality of our water. Municipalities work on the front line and can reduce their impact by installing water treatment plants that remove toxic substances. Provincial and federal governments can prevent toxic substances from ever entering our waterways by regulating harmful activities. Name one (1) Federal or Provincial Act that is responsible for regulating the pollution of our waterways. (1 pt)

_____

3) As a homeowner, you would like to reduce your impact on our waterways by improving your efforts in protecting water quality. Briefly describe one (1) example of a change that you could make in your home to achieve this goal. (1 pt)

_____

_____

2018 Manitoba Envirothon
(name of Region) Regional Field Test

Table required?	No
Supervisor required?	No
Local feature required?	
Description of local feature	
Hands on question?	
List of equipment, props, and/or samples	
Difficulty of question	Easy
Answer to question	1a) Any 2 of the following: increased concentrations of nutrients, pesticides or suspended sediments. (1 pt) 1b) Any 2 of the following: increased concentrations of metals or toxic chemicals, the addition of suspended sediment, increased temperature, or lower dissolved oxygen in the water. (1 pt) 1c) Any 2 of the following: increased concentrations phosphorus, nitrogen, sediments, animal wastes (fecal coliform and pathogens), petroleum products, or road salts. (1 pt) 2) Any 1 of the following: The Canadian Environmental Protection Act (CEPA)/Government of Canada, The Water Protection Act/Manitoba Sustainable Development, The Environment Act/Manitoba Sustainable Development. (1 pt) 3) Any 1 of the following: recycle products that are not degradable such as glass, cans and motor oil; choose non-hazardous products; don't misuse the sewage system; don't use pesticides or other hazardous materials in your garden; or don't dump hazardous products into storm drains, or responses deemed appropriate by the marker. (1 pt)
Reference to student material	1) Aquatic Ecology, p 39 2) Aquatic Ecology, p 67; Water Policy and Legislation - Provincial and International, p 11-13 3) Aquatic Ecology, p 40-42, 67
Directions for printing and laminating	
Equipment supplied by Discipline	
Direction for stop set-up	
Directions for attendant	

Team #

STOP

WILDLIFE AND WILDLIFE MANAGEMENT

Do NOT change
W - A

5

Many animals have special adaptations or behaviours that are unique to their species. Match the following adaptations to the appropriate species. (5 pts - 0.5 pt each)

A) Feet are densely furred with stiff hairs on the hind feet

B) Generally solitary and will cache food for future use

C) Male feeds the female so she doesn't have to leave the nest during incubation period

D) Fur has the best insulative properties of any mammal

E) Population cycle impacts and is mirrored by the Canada Lynx

F) Nests are vulnerable to predators and parents will defend nest if present

G) Nests in deep cracks and crevices in rocks

H) Black skin and clear, transparent fur

J) Feet are furred for insulation and traction on ice

K) Stays in flocks except when on breeding grounds

Snowshoe Hare: 1)_____   2)_____

Tundra Swan: 1)_____   2)_____

Polar Bear: 1)_____   2)_____

Snow Bunting: 1)_____   2)_____

Arctic Fox: 1)_____   2)_____

Table required?	No
Supervisor required?	No
Local feature required?	
Description of local feature	
Hands on question?	
List of equipment, props, and/or samples	
Difficulty of question	Easy
Answer to question	Snowshoe Hare: A, E (0.5 pt each) Tundra Swan: F, K (0.5 pt each) Polar Bear: H, J (0.5 pt each) Snow Bunting: C, G (0.5 pt each) Arctic Fox: B, D (0.5 pt each)
Reference to student material	Mammals of MB, p 13, 15, 16; Birds of MB, p 12, 37
Directions for printing and laminating	
Equipment supplied by Discipline	
Direction for stop set-up	
Directions for attendant	

Team #

STOP

WILDLIFE AND WILDLIFE MANAGEMENT   *This question requires materials provided at the stop*

Do NOT change
W - B

_____
5

1) Play the call using the Mp3 player labeled W-A. Identify this species by its call. (1 pt)

W-A _____

2) Identify the species whose tracks are labeled W-B and W-C. (2 pts - 1 pt each)

W-B _____

W-C _____

3) Identify the species whose fur swatches are labeled W-D and W-E. (2 pts -1 pt each)

W-D _____

W-E _____

Team #

Table required?	Yes
Supervisor required?	Yes
Local feature required?	
Description of local feature	
Hands on question?	This question requires materials provided at the stop
List of equipment, props, and/or samples	Mp3 Player (prerecorded call TBD) labeled W-A 2 Track Molds (TBD) labeled W-B, W-C 2 Fur Swatches (TBD) labeled W-D, W-E
Difficulty of question	Medium
Answer to question	1) W-A: TBD (1 pt) 2) W-B: TBD (1 pt); W-C: TBD (1 pt) 3) W-D: TBD (1 pt); W-E: TBD (1 pt)
Reference to student material	1) Wildlife Calls 2) Tracks and Scat Training Video 3) Fur Identification Powerpoint, Fur identification Training Video
Directions for printing and laminating	
Equipment supplied by Discipline	
Direction for stop set-up	Place items on table
Directions for attendant	The tracks are fragile, make sure students leave them on the table so they are not damaged. Students can pick up the fur swatches and touch them.

STOP

WILDLIFE AND WILDLIFE MANAGEMENT   *This question requires materials provided at the stop*

Do NOT change
W - C

5

1) Collared lemmings are an important prey item in the subarctic. As part of a long term project looking at the effects of climate change on lemming dynamics, a group of researchers are studying the population of collared lemmings found in Wapusk National Park. As a research assistant, you are helping count the lemmings using the Quadrant Sampling Method.

Your goal is to determine the number of lemmings found within this 50m x 50m plot. Within this plot there are three 1m x1m sample plots. Each tennis ball represents one collared lemming. Based on the three sample plots, estimate the number of lemmings in the 50m x 50m plot using the quadrat sampling formula. (4.5 pts)

2) Name one other method of determining population size (0.5 pt)

_____

2018 Manitoba Envirothon
(name of Region) Regional Field Test

Table required?	No
Supervisor required?	Yes
Local feature required?	
Description of local feature	
Hands on question?	This question requires materials provided at the stop
List of equipment, props, and/or samples	3 - 1m x 1m squared off areas on the grass 8 tennis balls to represent lemmings (3 tennis ball distributed in one square, four tennis ball in the second and one tennis ball in the third) flagging tape pegs to park off area measuring tools to measure each
Difficulty of question	Difficult
Answer to question	1) Number of lemmings in each 1m x 1m: 3, 4 and 1 (1.5 pts - 0.5 pt each) Mean number of lemmings per plot = (3+4+1)/3 = 2.67 (1 pt) Correct formula: population = mean number of lemmings/m2 x total area (0.5 pt) Correct substitution: population = 2.6/m2 x (50 x 50) (0.5 pt) Correct calculation: population = 2.6/m2 x 2500 = 6500 (1 pt) 2) 1 of the following: complete census, transects, mark-recapture, mist net, or bal-chatri (0.5 pt)
Reference to student material	Wildlife Document p 48-52
Directions for printing and laminating	
Equipment supplied by Discipline	Tennis balls, pegs, flagging tape
Direction for stop set-up	Set out 3 1mx1m quadrats using pegs and flagging tape. Place 3 tennis balls in one quadrat, 1 tennis ball in the second, and 4 tennis balls in third.
Directions for attendant	Please make sure teams do not move the tennis balls while counting or working on the problem.

STOP

WILDLIFE AND WILDLIFE MANAGEMENT

1) Define the three following terms. Include characteristics of each that differentiates it from the other terms. (3 pts - 1 pt each)

HIBERNATION:

_____

_____

TORPOR:

_____

_____

SEASONAL LETHARGY:

_____

_____

2) Indicate whether each statement is true (T) or false (F) by circling the correct answer. (2 pts - 0.5 pt each)

T   F   Homeotherms have the means for internal temperature control.

T   F   Bears are true hibernators.

T   F   Chioneuphores are animals that hibernate under snow in the winter.

T   F   Many marsupial species undergo daily torpor as a way to conserve energy during colder periods.

Team #

Table required?	No
Supervisor required?	No
Local feature required?	
Description of local feature	
Hands on question?	
List of equipment, props, and/or samples	
Difficulty of question	Medium
Answer to question	1) HIBERNATION is a state of inactivity and metabolic depression in animals characterized by lower body temperature, slower breathing, and lower metabolic rate. (0.5 pts) True hibernators reduce their body temperature to near that of the environment. (0.5 pts) TORPOR is when animals lower their body temperature and metabolism (0.5 pts) for a shorter period of time (less than 24 hours) in order to save energy. (0.5 pts) SEASONAL LETHARGY is defined as profound dormancy when animal remains at a body temperature only 2-5°C less than normal during the winter. (0.5 pts) Not all animals are able to lower their temperature and their heart rate as much as true hibernators. (0.5 pts) Other answers as appropriate 2) T, F, F, T (2 pts - 0.5 pt each)
Reference to student material	1) Wildlife in Winter Document, p 1-3 2) Wildlife Document, p 10; Wildlife in Winter Document, p 1-3
Directions for printing and laminating	
Equipment supplied by Discipline	
Direction for stop set-up	
Directions for attendant	