

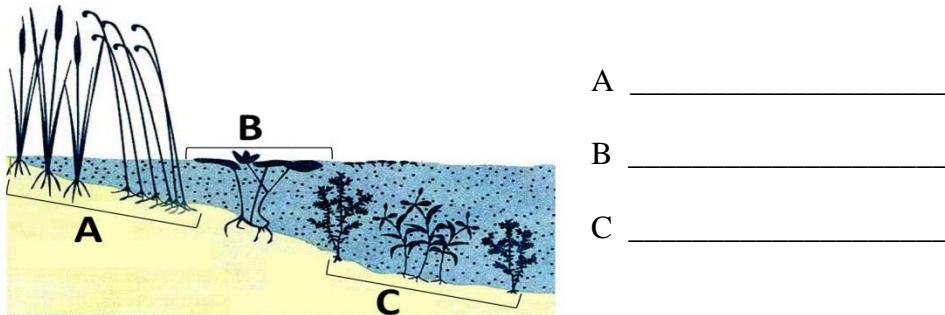
2014 MANITOBA ENVIROTHON TRAIL TEST Prairies and Sloughs

STOP 1

Aquatic Ecology (10 pts) – STOP 1

This question requires materials provided at the stop.

- 1) Algae are primary producers in aquatic ecosystems.
 - a) Algae that are attached to rocks and plants are called _____, and algae that float freely in the water column are called _____. (1 pt - 0.5 pt each)
 - b) Agricultural runoff can contribute to excess nutrients in the water column, leading to increased algal growth. What is the term used to describe pollution that enters waterways from many locations across the landscape? (0.5 pt)
 - c) Name one of the major nutrients that can contribute to excessive algal growth in aquatic ecosystems (0.5 pt)
- 2) Macrophytes are also primary producers in aquatic ecosystems.
 - a) They fall into three main categories based on their physical structure. Label these three categories on the figure below (1.5 pt – 0.5 pt each)



- b) Specimen A-A is an aquatic macrophyte commonly found in Manitoba. What is its common name? (0.5 pt)
- 3) Benthic invertebrates are primary consumers that live on the bottom of lakes and rivers. Figure A-B shows an invasive benthic invertebrate that has recently entered Manitoba. What is it? (1 pt)

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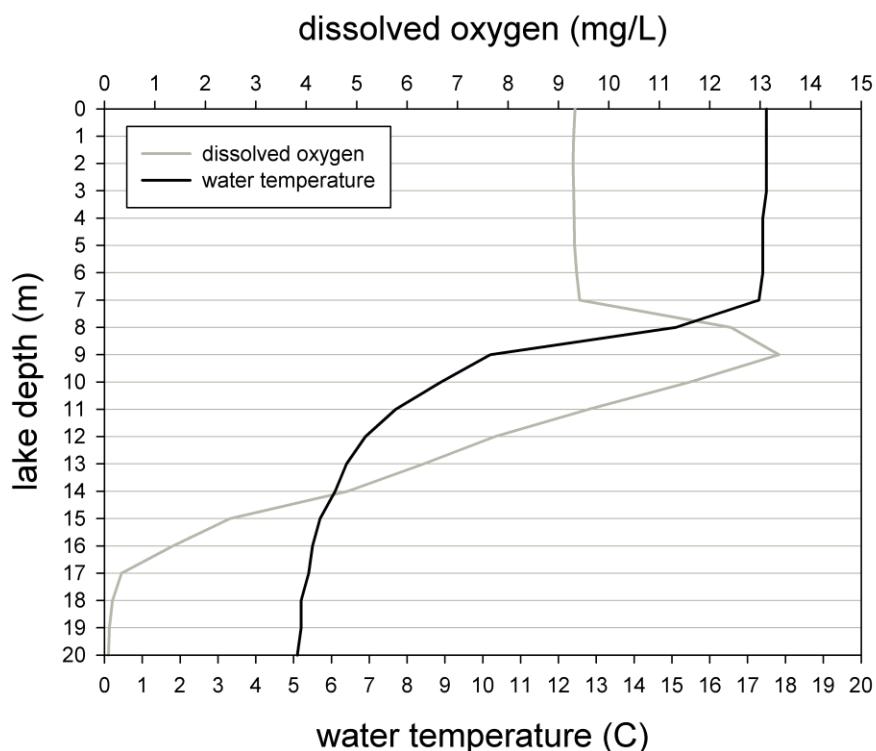
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4) Forage fish, such as minnows, are secondary consumers in aquatic ecosystems. Figure A-C shows pictures of several types of equipment that can be used for sampling fish. Name two (2) of these pieces of equipment that might be used to sample forage fish. (1 pt – 0.5 pt each)

5) Researchers often analyze stable isotopes of carbon and nitrogen in organisms in a food web to determine their trophic status. The rule is, the higher the nitrogen value, the higher that organism is in the food web. For example, a lake trout will have a higher nitrogen value than a zooplankton. Keeping this information in mind, look at Figure A-D. Using the shapes as organism names, list the organisms from lowest to highest trophic level. (2 pts – 0.5 pt each)

6) The piscivorous top predator lake trout prefers to live in water where the temperature is less than 15 °C and the dissolved oxygen concentration is greater than 6 mg/L. Many lakes “stratify” as they warm up during the summer, so that temperatures and oxygen concentrations are different at different depths. This means that the lake trout may be restricted to certain depths in the water column. On the figure below, draw the upper boundary (based on temperature) and lower boundary (based on oxygen concentration) for “preferred” lake trout habitat on the figure. Use the ruler to make straight lines across the figure. (2 pts – 1 pt each)



Answers:

- 1a) periphyton, phytoplankton (1 pt - 0.5 pt each)
- 1b) non-point source pollution (0.5 pt)
- 1c) nitrogen or phosphorus (0.5 pt)
- 2a) emergent, floating, submergent or submerged (1.5 pt - 0.5 pt each)
- 2b) cattail (0.5 pt)

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- 3) zebra mussel (1 pt)
- 4) any two of: seine net, minnow trap, gill net (1 pt - 0.5 pt each)
- 5) triangle, square, diamond, circle (2 pt, 0.5 pt each)
- 6) upper boundary at 8 m (7 to 9 m acceptable), lower boundary at ~13 m (12 to 14 m acceptable) (2 pt - 1 pt each)

References:

- 1) Lake Ecology, p 35
- 2) Lake Ecology, p 26
- 3) Lake Ecology, p 23
- 4) Aquatic Sampling Techniques, p6
- 5) Lake Ecology, p 8-12; Lake Ecology Document, p 31
- 6) Lake Ecology, p 21-35

Forestry (2 pts) – STOP 1

- 1) Define ANNUAL ALLOWABLE CUT. (1 pt)
- 2) In terms of the forest itself, what does ACC generally equal? (1 pt)

Answers:

- 1) AAC is the amount of timber that can be harvested on a sustainable basis each year from an area. (1 pt)
- 2) AAC is approximately equal to the volume (amount) of forest that grows each year. (1 pt)

References:

- 1) and 2) Forestry Document, p 9; Manitoba's Forests, p 4

Soils and Land Use (2 pts) – STOP 1

Manitoba's Provincial Soil is found to the north and northwest of this location.

- 1) What is Manitoba's provincial soil (series)? (1 pt)
- 2) To which ORDER does this soil belong? (0.5 pt)
- 3) To which GREAT GROUP does this soil belong? (0.5 pt)

Answers:

- 1) Newdale or Newdale clay loam (1 pt)
- 2) Chernozem (0.5 pt)
- 3) Black (0.5 pt)

References:

- 1), 2) and 3) Newdale Soil Series p 1, 4

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Theme (2 pts) – STOP 1

- 1) Look near; look far. List two (2) specific examples of agricultural practices that YOU CAN SEE have taken place in this area that are environmentally sustainable. (1 pt – 0.5 pt each)
- 2) Describe briefly one (1) environmental benefit gained from EACH of those two (2) practices. (1 pt – 0.5 pt each)

Answers:

1) Any 2 of the following: Establish perennial vegetation cover; Establish and/or maintain shelterbelts (tree rows); Retain water in the wetland instead of draining it away; Establish and/or maintain buffer strip next to water course and around wetland; Conserve trees and shrubs and other deep rooted species in riparian buffers; (Only if water troughs are still visible on upland) Establish off-stream watering for livestock; Engage in beneficial grazing management practices (different fields constructed for livestock rotation, riparian field fenced separately from upland fields, no livestock grazing in wet season – spring; rest from grazing during growing season); Use minimum tillage as indicated by stubble or surface residues; Mixed farming; Ideal land use choice: preserve treed ravine (habitat); Other reasonable answers (1 pt - 0.5 pt each)

2) 2 of the following, tied directly with their answers in 1) (1 pt - 0.5 pt each)

PERENNIAL VEGETATION COVER - Appropriate vegetation for class of land (land unsuitable for annual crops because of steepness and wetness) prevents erosion, compaction, sedimentation, nutrient or water escape, sequester carbon to mitigate climate change

SHELTERBELTS - conserve snow for more snow meltwater and shelter wildlife, biodiversity, and pollinators and provide natural pest control

WATER RETAINED IN WETLAND instead of being drained away - preventing erosion, sedimentation, nutrient escape, and conserving water, creating habitat for wildlife and plants

BUFFER STRIP next to water course and around wetland buffer it from adjacent cropland - allow nutrient filtering, prevent compaction of soil, prevent erosion and prevents nutrient and water from escaping, and provides habitat for pollinators, pest predators, and other flora/fauna, sequester carbon to mitigate climate change

CONSERVE TREES and shrubs and other deep rooted species in riparian buffers - allow nutrient filtering, prevent compaction of soil, prevent erosion and prevents nutrient and water from escaping, and provides habitat for pollinators, pest predators, and other flora/fauna, sequester carbon to mitigate climate change

(if troughs are still on upland) **OFFSTREAM WATERING FOR LIVESTOCK** - prevents compaction, overgrazing and erosion and nutrient buildup in areas adjacent to water bodies, prevents habitat degradation

BENEFICIAL GRAZING MANAGEMENT (different fields constructed for livestock rotation, riparian field fenced separately from upland fields, no livestock grazing in wet season – spring; rest from grazing during growing season) - prevents compaction, overgrazing and erosion and nutrient buildup in areas adjacent to water bodies, and improves vegetation growth on uplands to slow runoff, improves habitat

MINIMUM TILLAGE as indicated by stubble or surface residues - reduces erosion and sedimentation of water courses, conserves moisture by catching snow and preventing drying

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from winds, provides organic matter/nutrients to soil, improves soil health so pests can be managed better, sequester carbon to mitigate climate change

MIXED FARMING - conserves biodiversity which is important for many reasons.

IDEAL LAND CHOICE - preserve treed ravine: Habitat preservation for tree/shrub/wetland/shade dwelling species. Provides habitat for pollinators and pest predators. Other reasonable answers.

References:

1) and 2) *Theme Document, p 33-37, 39-40; and Companion Document, 52, 53, 64, 69-70, 89, 93-94, 98, 100-104, 113-114*

Wildlife (2 pts) – STOP 1

- 1) Look around this stop.
 - a) What evidence do you see that indicates the presence of a ground-dwelling animal species? (0.5 pts)
 - b) What ground-dwelling animal species may be using this habitat? (0.5 pts)
- 2) Describe a simple field-based manipulative experiment a researcher could use to study the differences in behavioural response of adults and juveniles of this species to a predatory bird. (1 pt)

Answers:

1a) *Holes in ground, evidence of burrowing, possibly actual presence of ground squirrels, etc. (0.5 pt)*

1b) *Richardson's ground squirrel (ideally), but if no individuals present any small burrowing rodent acceptable (0.5 pt)*

2) *Present ground squirrel colony with a caged predator, a model, or other possible cues of the avian predator (0.5 pt) and document the responses of ground squirrels that have been differentiated based on age class. (0.5 pt)*

References:

1) *Mammals of Manitoba, p 11*
2) *Wildlife Document, p 56*

STOP 2

Aquatic Ecology (2 pts) – STOP 2

This question requires materials provided at the stop.

Hydraulic fracturing, or "fracking", is an industrial process used to force additional natural gas and crude oil from wells drilled into shale deposits. It is being used in many regions of North America and has become a controversial issue. The process is described in the graphic labelled

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A_A: Fracking. While this figure illustrates fracking for natural gas, the same basic process is used for oil.

Fracking has been used in southwestern Manitoba for more than 20 years, primarily to obtain more oil from wells drilled horizontally into the Bakken shale deposits. This activity has increased greatly in recent years, with about 600 new wells drilled in Manitoba last year. While oil companies using the process can significantly increase their output, a number of concerns have been expressed about possible negative effects, particularly concerning the water source that is most important for rural Manitobans.

1) What is the largest source of water for most human activities in rural Manitoba? Circle the best answer. (1 pt)

snow and ice groundwater rivers lakes

2) Based on the information in the graphic, briefly describe one way in which fracking could negatively impact this important water source. (1 pt)

Answers:

- 1) groundwater (1 pt)
- 2) Either of the following: contamination of the aquifer with toxic fracking chemicals; depletion of the aquifer through removal and subsequent disposal of large quantities of fracking water (1 pt)

References:

- 1) and 2) Aquatic Ecology Document: Groundwater Contamination, p 72-76
Information available from the fracking document supplied at the stop.

Forestry (2 pts) – STOP 2

1) Aboriginal communities can map examples of Traditional Ecological Knowledge on a landscape in order to help forest managers understand the importance of certain areas to their community.

List four (4) examples of Traditional Ecological Knowledge that might be shown on a map in a forestry planning area. (2 pts - 0.5 pt each)

Answers:

- 1) Any 4 of the following: Places where animals are harvested for food, clothing, medicines, tools, and other purposes; Places where plant materials are harvested for food, clothing, medicines, tools, shelter and fuel; Places where rocks, minerals, and soils are collected for making tools, conducting ceremonies, and other purposes; Ecological knowledge of habitats and sites critical to the survival of important animal populations (caribou migration corridors, islands where moose calve, waterfowl breeding grounds and staging areas, and spawning beds); Habitation sites (settlements, trading posts, cabins, camps, and burial grounds); Spiritual or sacred places (ceremony sites, rock paintings, areas inhabited by non-human or supernatural

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beings, and birth and death sites); Legends and other accounts about specific places; Travel and trade routes; Aboriginal place names (2 pts - 0.5 pt each)

References:

- 1) *Chief Kerry's Moose, p 2; Training*

Soils and Land Use (10 pts) – STOP 2

This question requires materials provided at the stop.

Use the Google Earth image of the City of Brandon (labelled S-A), Map 1: Urban Land Use (labelled S-B), and the map of the 100/300 Year Flood Extent for the area (labelled S-C) to answer the following questions. ***Hint: To match locations, match the shape of the river for the area in the Google Earth image to the other two maps.***

- 1) According to the Urban Land Use map labelled S-B, what are the MAIN two (2) Urban Land Use designations for the area outlined in yellow on the Google Earth image that is within city limits? (2 pts - 1 pt each)
- 2) According to the 100/300 year Flood extent map labelled S-C, is most of the area outlined in yellow on the Google Earth image OUTSIDE of the flood zone? (1pt)

yes no

- 3) The following is a list of proposed projects for the area outlined in yellow on the Google Earth image. Circle the best two (2) choices. (2 pts - 1 pt each)

- a) apartment building
- b) market garden
- c) plumbing business
- d) city park
- e) grocery store
- f) potato chip factory

- 4) The Envirothon Trail Test location is shown in yellow on the 100/300 Year Flood map labelled S-C.

- a) Based on the the Urban Land Use map labelled S-B, what is the most likely designation of the housing development visible from this stop? (1 pt)
- b) According to the 100/300 Year Flood Extent map labelled S-C, is most of the area in the housing unit to the east OUTSIDE of the flood zone? (1 pt)

yes no

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5) What map scale of soil information would be best for planning purposes? Circle the best response. (1 pt)

1:125,000 1:50,000 1:20,000

6) In Manitoba which single Act primarily governs the local decisions for designating use of land within a planning district? Circle the best response. (2 pts)

- a) Environment Act
- b) Planning Act
- c) Crown Lands Act
- d) Water Protection Act

Answers:

- 1) Agricultural and Parks/Open space (2 pts - 1 pt each)
- 2) No (1 pt)
- 3) b) and d) (2 pts - 1 pt each)
- 4a) Residential (1 pt)
- 4b) Yes (1 pt)
- 5) 1:20,000 (1 Pt)
- 6) Planning Act (2 Pts)

References:

- 1) - 7) Soil Management Guide, p 114-115

Theme (2 pts) – STOP 2

This question requires materials provided at the stop.

- 1) Which of the agricultural landscapes labelled T-A and T-B is MOST favorable to BOTH pollinator communities AND crop production? (0.5 pt)
- 2) Describe one (1) example of how pollinators are essential to food production. (0.5 pt)
- 3) Name the two (2) main qualities of a habitat that is suitable for bees. (1 pt - 0.5 pt each)

Answers:

- 1) T-A (0.5 pt)
- 2) One of the following: Many crops are seeds or fruits which need to be created from flowers that are fertilized by pollinators; OR Some forage crops used to feed livestock need their flowers to be fertilized by pollinators in order to perpetuate their kind (0.5 pt)
- 3) flowering plants available continuously throughout the growing season AND nesting materials (old trees, rotten wood, dead leaves, tunnels, mud, etc.) (1 pt - 0.5 pt each)

References:

- 1) Theme Document, p 23; Companion Document, p 52
- 2) Theme Document, p 23

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3) Companion Document, p 52

Wildlife (2 pts) – STOP 2

- 1) The practice of monoculture (planting a single crop in large area and for long period of time) often requires more insect pollinators than are found naturally in the area. To meet this increased pollination demand, what practice has become common for many economically important crops, such as almonds? (0.5 pt)
- 2) Some insect species are used as a form of biological control.
 - a) Define BIOLOGICAL CONTROL with respect to its use on invasive species. (0.5 pt)
 - b) Briefly describe one (1) way an insect species helps to control an invasive species. (0.5 pt)
 - c) Name one (1) invasive plant species for which insect biological control has been effectively used in Manitoba. (0.5 pt)

Answers:

- 1) "Artificial migration" of pollinators by humans across country (0.5 pts)
- 2a) Introducing the natural enemies of a particular invasive species in a controlled and monitored manner (0.5 pt)
- 2b) Any 1 of the following: Insects adults or larvae feed on a part of a plant disrupting the natural processes (i.e. roots, leaves, etc.), larvae or adults consume seeds, endoparasitism of invasive insect species, or other appropriate answers (0.5 pt)
- 2c) Either of: Leafy spurge, purple loosestrife (0.5 pt)

References:

- 1) Human Use Of Insects, p 3 - 4
- 2a), 2b) and 2c) Human Use Of Insects, p 4 – 5

STOP 3

Aquatic Ecology (2 pts) – STOP 3

- 1) The Province of Manitoba has been promoting a consistent message in regards to what individuals should do with water based equipment to prevent the spread of Aquatic Invasive Species. What is the message? (2 pts - 0.5 pt each)

Answers:

- 1) Clean, Drain, Dry and Dispose (2 pts - 0.5 pt each)

References:

- 1) Zebra Mussel AIS fact sheet, handed out at Training

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Forestry (2 pts) – STOP 3

- 1) What is the disc-shaped feature on the tree labelled F-A? (1 pt)
- 2) What biological process is currently occurring in that tree? (1 pt)

Answers:

- 1) Conk
- 2) Decay

References:

Manitoba's Forests, p 12

Soils and Land Use (10 pts) – STOP 3

This question requires materials provided at the stop.

- 1) Using the Canadian System of Soil Classification (CSSC) provided and your own knowledge, answer the following questions about the soil at this stop. (***Hint: Not a Podzol***)
 - a) What is the Soil Order? (2 pts)
 - b) What is the Great Group? (2 pts)
 - c) What is the depth of the A horizon? (1 pt)
 - d) What is the structure of the A horizon? (1 pt)
 - e) Using the dilute HCl solution, determine the depth to carbonates. (1 pt)
 - f) Using the Munsell Soil Color chart, determine the color of the A horizon. (1 pt)
 - g) Are there mottles present? (1 pt)
 - h) In order for mottles to be present in the soil, what element is needed? (1 pt)

Answers:

- 1a) - 1g) TBD (9 pts)
- 1h) iron (1 pt)

References:

1a) - 1h) Provincial training

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Theme (2 pts) – STOP 3

- 1) What is THE ONE (1) THING that consumers can do to motivate agricultural producers to sell food locally? (0.5 pt)
- 2) Name three (3) distinct ways that consumers can access locally grown food. (1.5 pts - 0.5 pt each)

Answers:

- 1) Either of: choose local food or buy local food. (0.5 pt)
- 2) Any 3 of the following: look for locally branded foods in any grocery store (like Buy Manitoba etc.); local farmers' markets; specialty grocery stores (like Peak of the Market, etc.); buy a Community Supported Agriculture (CSA) share; place an order with Harvest Moon; Farm to school program; U-Pick sites; roadside produce stands (1.5 pts - 0.5 pt each)

References:

- 1) Theme Guide, p 51-52
- 2) Theme Guide, p 50-52; Supplemental Readings, p 129, 137

Wildlife (2 pts) – STOP 3

This question requires materials provided at the stop.

- 1) Identify the organ indicated on the picture. Briefly describe one (1) function of that organ. (2 pts - 0.5 pt each)

W-A: Organ _____

Function _____

W-B: Organ _____

Function _____

Answers:

- 1) W-A: Liver (0.5 pt)
Any 1 of the following functions: detoxification, glycogen storage, protein synthesis, hormone production and the biochemicals necessary for digestion (bile) (0.5 pt)

W-B: Crop (0.5 pt)
Any 1 of the following functions: food storage prior to digestion, production of "crop milk" used to feed young for the first two weeks after hatching, source of regurgitated food fed to young (0.5 pt)

References:

- 1) Wildlife Document, p 14, 16

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STOP 4

Aquatic Ecology (10 pts) – STOP 4

This question requires materials provided at the stop.

When limnologists study a lake ecosystem, they will usually sample the water column from the surface down to the sediment near the deepest part of the lake. Typically, measurements or samples will be taken at 1-metre intervals through this depth range to create a vertical profile of each parameter being measured.

Examine the graph labelled A_A: Lake Profile, which shows profiles of photosynthetically active radiation, water temperature, and dissolved oxygen concentrations from the surface to near the bottom of a 12.5-metre deep lake. Note that the actual readings in each profile have been converted to percentages of the surface value, which permits all three parameters to be plotted on the same scale for easy comparison. The actual surface values for these profiles are:

P.A. Radiation: 2,120 μmol (photons)/($\text{m}^2 \times \text{s}$),
Water Temperature: 23.2 degrees Celsius,
Dissolved Oxygen: 8.3 mg/L.

Based on the shape of each curve with increasing depth, answer the following:

- 1) Photosynthetically Active Radiation, or PAR, is that portion of solar radiation that is used by green plants, including algae, to power photosynthesis, or primary production.
 - a) In this lake, what depth is the "compensation depth", above which levels of PAR are sufficient to support net algal primary productivity and below which respiration exceeds photosynthesis? (1 pt)
 - b) What term do limnologists use for the depth zone between the surface and the compensation depth? (1pt)
- 2) This lake was thermally stratified at the time of sampling.
 - a) What term do scientists use to describe the depth range from 0 to almost 3 metres at the time of this profile? (1pt)
 - b) What meteorological factor is most responsible for determining the depth of this layer? (1 pt)
 - c) What term is used by scientists for the zone of rapid temperature change between 3 and 7 metres in the depth profile? (1 pt)
 - d) What term is used by scientists for the zone below 7 metres in this profile? (1 pt)

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- 3) Note that the oxygen profile has a different shape.
 - a) At what depth do we observe the highest concentration of dissolved oxygen? (1 pt)
 - b) Why is the dissolved oxygen concentration much higher at this depth than at the lake surface where the water is exposed to the air? (1 pt)
 - c) What is the depth below which the lake water is anaerobic? (1 pt)
- 4) In what season (spring, summer, fall, or winter) were these profiles taken? (1 pt)

Answers:

- 1a) compensation depth is at 10 m +/- 0.5 m (1pt)
 - 1b) either photic or euphotic zone (1 pt)
 - 2a) either epilimnion or mixed (mixing) layer (1 pt)
 - 2b) wind speed or action (1 pt)
- Partial marks: 0.5 pt for solar radiation
- 2c) either thermocline or metalimnion (1 pt)
 - 2d) either hypolimnion or profundal zone (1 pt)
- 3a) 7 m (1 pt)
 - 3b) the colder water at 7 m can dissolve a higher concentration of oxygen than the warmer surface water (1 pt)
 - 3c) 11 m (1pt)
- 4) summer (1 pt)

References:

- 1) *Lake Ecology: Light*, p 6
 - 2) *Lake Ecology: Thermal Stratification*, p 9
 - 3) *Lake Ecology: Dissolved Oxygen*, p 17
 - 4) *Lake Ecology*, p 10, 17
- Also: *Aquatic Sampling Techniques*, p 1-3; *Provincial Training*

Forestry (2 pts) – STOP 4

This question requires materials provided at the stop.

- 1) The wood sample labelled F-A has discolouration due to the presence of an organism that was brought to the tree by a forest pest.
 - a) What is the name of the organism that causes the discolouration? (0.5 pt)
 - b) Name the forest pest which carries the first organism to the tree. (0.5 pt)
 - c) Is this forest pest currently found in Manitoba? (0.5 pt)
- 2) The bark sample labelled F-B has another sign of this forest pest. Name the feature indicated. (0.5 pt)

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Answers:

- 1a) Blue-stain fungi
- 1b) Mountain pine beetle
- 1c) No
- 2) Pitch tubes

References:

- 1) and 2) Mountain Pine Beetle 1; Mountain Pine Beetle 2

Soils and Land Use (2 pts) – STOP 4

This question requires materials provided at the stop.

- 1) A sample of soil was analyzed, and the experimental data is shown below. Calculate the bulk density for this soil. Include the units. (2 pts)

Volume of soil: 92 cm³

Mass of empty graduated cylinder: 307.4 g

Mass of graduated cylinder + soil: 436.2 g

Answers:

- 1) $\text{Mass of soil} = 436.2 - 307.4 = 128.8 \text{ g}$ (0.5 pt); $\text{Bulk density} = 128.8 \text{ g}/92 \text{ cm}^3 = 1.4 \text{ g/cm}^3$ (0.5 pts for units (g/cm³); 1.0 pt for correct result (1.4))

References:

- 1) Soil Management Guide, p 14

Theme (2 pts) – STOP 4

- 1) What are the three (3) pillars (or components) of sustainable agriculture? (1 pt)

- 2) For EACH pillar of sustainable agriculture, name one (1) indicator of sustainability in an agricultural operation. (1 pt)

Answers:

- 1) Social, Economic, Environmental OR profit, stewardship, quality of life (1 pt - 0.5 pt for first two answers, 0.5 pt for the third answer)
- 2) See answers in Theme Document, p 15, 16 and Companion Document, p 7-24. (common sense will have to prevail in marking) (1 pt - 0.5 pt for first two answers, 0.5 pt for the third answer)

References:

- 1) Theme Document, p 14; OR Theme Document, p 15, 16, Companion Document, p 7
- 2) Theme Document, p 15-16; MANY other additional answers from Companion Document, p 7-24

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Wildlife (2 pts) – STOP 4

It has been a harsh winter for the local wildlife. Deep snow has hampered the ability of deer and elk to feed. The local municipal government has approached you for input on an emergency deer feeding program that will take place on livestock farms. In responding to their plan, you discuss some of the issues related to disease transmission.

- 1) Give an example of a disease that can be passed from deer to livestock. (0.5 pt)
- 2) Describe the disease transmission pathway. (0.5 pt)
- 3) Describe two (2) ways to prevent transmission of this disease to livestock. (1 pt)

Answers:

- 1) *Bovine Tuberculosis (TB) (0.5 pt)*
- 2) *Bovine TB is transferred between hosts through direct contact, contact with excretions, and inhalation of aerosols. (0.5 pt)*
- 3) *Any 2 of the following: prevent introduction of pathogen (measures designed to exclude or prevent the introduction of a pathogen into unaffected individuals or populations, including habitat modification and changes in human activity), do not feed wildlife, prevent deer and livestock from coming in contact, separate feeding areas, only feed in areas with Bovine TB free populations, immunize against Bovine TB (not possible yet but possibly in the future) (1 pt - 0.5 pt each)*

References:

Pathogens, Parasites, and Disease in Wildlife, p 2-3
Wildlife Document, p 40

STOP 5

Aquatic Ecology (2 pts) – STOP 5

This question requires materials provided at the stop.

Examine the photos of the four (4) organisms on the laminated sheet, labelled A_A: Foodweb, provided at this stop. Each could be present in the food web of a lake. Indicate the food web role or niche of each organism by placing its identifying letter (A, B, C, or D) next to the best description of that role, below. (2 pts - 0.5 pt ea)

- ____ 1) planktonic primary producer found in the euphotic portion of the pelagic zone of oligotrophic lakes.
- ____ 2) benthic filter-feeder typically found in water with moderate to high calcium concentrations.

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- _____ 3) planktonic primary consumer (herbivore) commonly found in a wide range of lakes and ponds.
- _____ 4) secondary consumer (planktivore) found during the day in deep water and feeding nearer the surface at night.

Answers:

- 1) C (*Dinobryon sp.*) (0.5 pt)
- 2) B (*Anodonta sp.*) (0.5 pt)
- 3) D (*Daphnia sp.*) (0.5 pt)
- 4) A (*Chaoborus larva*) (0.5 pt)

References:

- 1) *Freshwater Productivity*, p 2-3
- 2) - 4) *Lake Ecology: Biological*, p 19-24, 31

Forestry (2 pts) – STOP 5

- 1) Define CLEAR CUTTING. (0.5 pt)
- 2) What is the difference between clear cutting and deforestation? (0.5 pt)
- 3) From a forestry perspective, clear cutting has two functions. What are they? (1 pt - 0.5 pt each)

Answers:

- 1) Either of the following: cutting down of virtually all trees from a stand of forest OR the removal of all the trees from an area sufficiently large that the “forest influence” is removed (0.5 pt)
- 2) Clearcuts are usually reforested. Deforestation implies that land will be used for other purposes such as farming or ranching. (0.5 pt)
- 3) Both of the following: a cost and energy efficient way to harvest a high volume of wood; a step in the regeneration process to make the area productive again. (1 pt - 0.5 pt each)

References:

- 1) - 3) *Clearcutting in Manitoba*, p 7

Soils and Land Use (2 pts) – STOP 5

- 1) List the four soil forming factors that act over time to influence soil formation. (2 pts - 0.5 pts each)

Answers:

- 1) Parent material, Relief or topography or slope, climate, organisms (2 pts - 0.5 pt each)

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References:

Soil Management Guide, p 8

Theme (2 pts) – STOP 5

This question requires materials provided at the stop.

All of these foods come from a farmer's market in Brandon.

- 1) Are they sustainably produced? Circle the best response. (0.5 pt)

yes no uncertain

- 2) Explain your answer to 1). (0.5 pt)

- 3) Explain one reason why these products contribute to local economic or social sustainability. (0.5 pt)

- 4) Explain how locally grown fruits and vegetables MAY BE healthier to eat. (0.5 pt)

Answers:

1) *uncertain*

2) *not all locally grown food is grown or produced sustainably (0.5 pt)*

3) *Any 1 of the following: local businesses have more customers and therefore more revenue; local businesses have more revenue and therefore more jobs; better returns for agricultural producers if middle-men are reduced or removed; local jobs or business opportunity for processing, storage, equipment manufacture, markets, and/or distribution systems (incl. CSAs); food security; fresher/healthier food; consumer-producer relationship enhancement; sense of knowledge of where food comes from; cooperation/teamwork development in community/region; cascade of social benefits in community; succession of farms to younger people and immigrants; other reasonable answers (0.5 pt)*

4) *locally grown produce is likely picked at or close to ripeness, marketed at or close to ripeness and therefore holds more nutrients (0.5 pt)*

References:

1) *Theme Document, p 48*

2) *Theme Document, p 48*

3) *Theme Document, p 48, 49*

4) *Theme Document, p 49*

Wildlife (10 pts) – STOP 5

This question requires materials provided at the stop.

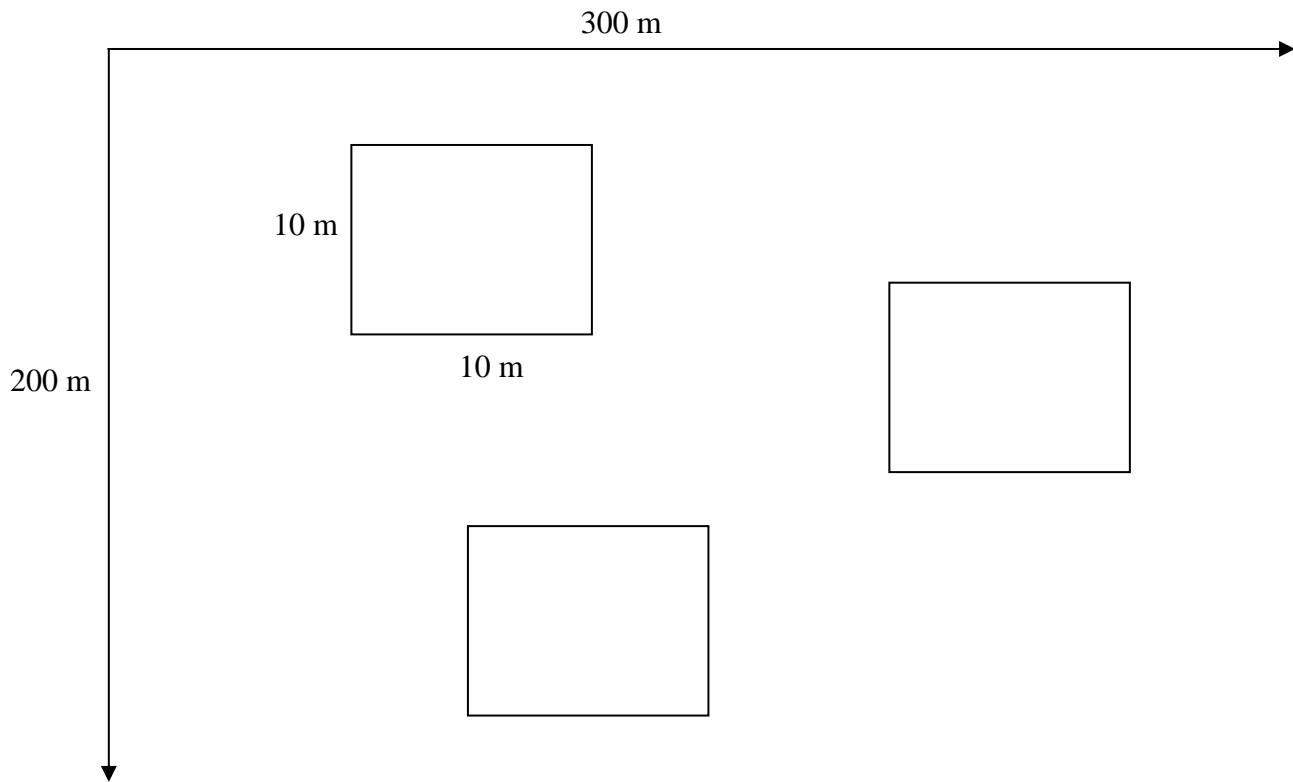
- 1) A group of researchers is studying the population of White Tailed Deer in the Brandon area. The researchers are estimating population size by counting scat using the quadrat sampling

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method. Scat that is less than a day old can easily be identified by its higher moisture content. A single deer produces an average of 13.4 piles of scat per day.

You are responsible for this 200 m x 300 m plot where the trail test is located. There are three (3) sampling quadrats in this plot. Each quadrat represents a 10 m x 10 m area (NOT to scale). Each pile of beads represents one pile of fresh scat (less than a day old). Collect the data from the quadrats and record it on the diagram below. Then, calculate the estimated size of the deer population in the plot using the quadrat sampling formula. Remember that the estimate may or may not be close to the actual number. (6 pts)



2) Quadrat sampling an appropriate way to estimate population size for _____? Circle the correct response(s). (2 pts)

- a) for slow moving animals
- b) for small mammals
- c) for plants

3) Name two other methods of sampling populations. (2 pts)

Answers:

- 1) piles of scat: 3, 4, 1 (1.5 pts - 0.5 pt each)
- average number of piles per quadrat: $8/3 = 2.67$ (0.5 pt)
- area of quadrat: $10 \text{ m} \times 10 \text{ m} = 100 \text{ m}^2$ (0.5 pt)
- total area of plot: $200 \text{ m} \times 300 \text{ m} = 60000 \text{ m}^2$ (0.5 pt)

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correct substitution in formula: estimated number of piles of scat in total plot = number of piles/100 m² x total area = 2.7 piles/100 m² x 60000 m² (1 pt)

correct number of piles = 1600 piles (1 pt)

estimated size of deer population: 1600 piles/13.4 piles per deer = 120 (1 pt)

2) a) and c) (2 pts - 1 pt each)

3) Any 2 of the following: complete census, transects, mark-recapture, mist net, bal-chatri (2 pts - 1 pt each)

References:

1) and 2) Wildlife Document, p 48-49

3) Wildlife Document, p 49-52

STOP 6

Aquatic Ecology (2 pts) – STOP 6

1) Fill in the blanks. (2 pts - 1 pt each)

Aquaponics incorporates aquaculture and hydroponics. In this system, fish waste is used as _____ for plants and the plants _____ the water.

Answers:

1) fertilizer, oxygenate (2 pts - 1 pt each)

References:

1) Theme Document, p 57

Forestry (2 pts) – STOP 6

After regarding fire as destructive and as largely a human act for a number of years, ecologists began to recognize fire as an important ecological force that is a part of the natural environment, along with moisture, temperature, wind, and soil.

1) What three conditions are necessary for fire to assume ecological importance? (1.5 pts - 0.5 pt each)

2) Name two sources of ignition. (0.5 pt)

Answers:

1) an accumulation of organic matter sufficient to burn, dry weather conditions to render the material combustible, a source of ignition (1.5 pts - 0.5 pt each)

2) lightning and people (0.5 pt)

References:

1) and 2) Forestry Document, p 9

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Soils and Land Use (2 pts) – STOP 6

- 1) Digging at this site has exposed lower horizons of the soil profile. Name and briefly describe two (2) of the most likely origins of the parent material found here. (2 pts – 1 pt each)

Answers:

1) Any 2 of the following: Morainal - Material ground up and deposited through glacier actions; Fluvial - Material deposited by flowing waters in contact with glaciers; Lacustrine - Accepted only if specifically described as sand and gravel materials deposited through glacial lake wave action (2 pts – 0.5 pt each name and 0.5 pt each description)

References:

Soils and Land Use Document, p 22-23

Theme (10 pts) – STOP 6

This stop lies on an area where aggregates (eg. coarse sand and gravel) were extracted for road construction or building purposes. It lies in a pasture that cattle have used, and their hoof action is just one reason why this area has remained exposed.

- 1) Name four (4) ecosystem services that are impaired by the condition of this aggregate extraction area. (4 pts – 1 pt each)
- 2) Assuming that this field will remain as one of many fields in a larger grazing operation, list two (2) sustainable agricultural practices that could restore some or all of the impaired ecosystem services to this aggregate extraction area. Describe briefly how each practice you listed will improve the situation. (4 pts – 2 pts each)

Practice 1:

Benefit:

Practice 2:

Benefit:

- 3) Describe briefly two (2) possible challenges that could discourage someone from implementing the beneficial practices that you listed above. (2 pts – 1 pt each)

Answers:

1) Any 4 of the following: Food (for livestock), Clean water, Soil quality maintenance (or fertility), Water quality maintenance, Erosion control, Water quantity regulation, Waste degradation (eg. plant residues, manure), Biodiversity, Pollination, Natural weed and pest

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control, Aesthetic experience (eg. It's ugly), Soil formation, Nutrient Cycling, Biomass production, Other reasonable answers(4 pts - 1 pt each)

2)

Sustainable practice	Improvement
Any 2 of the following (2 pts – 1 pt each) (Correct terminology not required – just general idea)	Any 1 of the corresponding for each practice (2 pts – 1 pt each) (Correct terminology not required – just general idea)
Apply compost, manure or other organic amendment	Builds soil and is suitable for pasture Improves weed suppression
Plant green manure, cover or catch crops	Builds soil and is suitable for pasture Improves weed suppression Reduces amount of sediment and nutrients leaving excavation
Increase vegetation cover by planting aggressive perennials or forages	Improves weed suppression By improving vegetation health it reduces or stops effect of site exposure to raindrop impact, wind and water erosion, or hoof action Builds soil over long term Reduces amount of sediment and nutrients leaving excavation
Use beneficial or rotational grazing practices (may suggest ONLY ONE of the individual subcomponents for 2 marks – develop a rotation that provides adequate rest, exclude sensitive areas at sensitive times or altogether, manage problem spot separately by fencing out and grazing sparingly, supply livestock water and minerals away from sensitive area)	By improving vegetation health it reduces or stops effect of site exposure to raindrop impact, wind and water erosion, or hoof action Exclusion from grazing prevents further damage Reduces amount of sediment and nutrients leaving excavation
Plant vegetation that is site adapted, perennial, native or deep rooted	Reduces or stops effect of site exposure to raindrop impact, wind and water erosion, or hoof action Provide habitat for pollinators and pest predators Improve aesthetic appearance
Plant vegetation, shrubs or trees to catch water and snow	Keeps rainwater and snow on site instead of allowing it to flow overland
Recontour land to catch water and snow	Keeps rainwater and snow on site instead of allowing it to flow overland
Plant a buffer around excavation	Reduces amount of sediment and nutrients leaving excavation

3) Any 2 of the following (2 pts - 0.5 pt each challenge (0.5 pt) and 0.5 pt each corresponding brief description)

COST – for vegetation seed or stock, exclusion fencing, recontouring, soil amendments, fertilizer
RISK OF FAILURE due to environmental constraints – eg. drought, heavy wind, poor growing conditions, poor soil fertility, nutrient leaching in coarse soils

RISK OF FAILURE due to implementation problems – weed invasion, cattle wrecking a revegetation or recontouring effort, cattle breaking down exclusion fences

LACK OF KNOWLEDGE – about how to apply the practices; under-estimating the importance of the problem

COST TO BENEFIT BALANCE – belief that it is a small problem in the great scheme of things compared to the resources, time and cost to fix it

PEER PRESSURE – traditional way is to just ignore it, belief that it is not a real problem, a waste of time

PRODUCTIVITY - don't want to take land out of livestock production by resting it or excluding it from grazing

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Other reasonable answers

References:

- 1) *Theme Document, p 16-19*
- 2) *Theme Document, p 33-36; Companion Document, p 54-59, 69-71, 89-91, 97-104, 106-107*
- 3) *Theme Document, p 44-46*

Wildlife (2 pts) – STOP 6

- 1) What is meant by HARVESTABLE SURPLUS in relation to managed hunting and trapping? (0.5 pts)
- 2) What impact does this practice generally have on natural populations? (0.5 pts)
- 3) Managed hunting and trapping may help with the reduction of “problem wildlife” (i.e. wild animals in inappropriate urban areas with high human populations).
 - a) Name one (1) problem wildlife species. (0.5 pt)
 - b) Give one (1) example of how it might pose a problem to humans. (0.5 pt)

Answers:

- 1) *Harvestable surplus refers to the regulated removal of a portion of a population of a given species before it is lost to "natural" causes and may occur at a time when the population is at its highest.* (0.5 pt)
- 2) *It generally does not cause any threat to the species.* (0.5 pt)
- 3a) *Any 1 of : White-tailed deer, coyotes, raccoon, etc.* (0.5 pts)
- 3b) *Any 1 reason related to answer to 3a) including: property damage, vehicle collisions, injury of pets and humans, transmission of pathogens (disease, parasites)* (0.5 pt)

References:

- 1) and 2) *Wildlife Document, p 35*
- 3) *Wildlife Document, p 37-39*

STOP 7

Aquatic Ecology (2 pts) – STOP 7

This question requires materials provided at the stop.

Examine the photo montage labelled A_A: Thermal, provided on the table at this stop. Note that there are two photos (labelled A and B) of the same lake shoreline, one taken in the spring and the other taken in the fall. Based on your knowledge of the special properties of water, answer the following questions:

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1) How do the ice conditions in these photos differ relative to the sand forming the shoreline? (0.5 pt)

2) Which of these two photos was taken in the spring of the year? (0.5 pt)

A B

3) What special physical property of water accounts for this seasonal difference in ice conditions? Explain how it does so. (1 pt)

Answers:

1) In one photo, the ice is attached to the shore. In the other photo, the open water is next to the shore. (0.5 pt)

2) A is the spring photo. (0.5 pt)

3) Water heats and cools more slowly than the land (absorbs or releases more heat per degree change in temperature). The land warms more quickly in spring and the ice next to the warmer beach melts first. In fall, the land cools before the lake, and the ice forms first against the colder land. (1 pt)

Partial marks: partial correct answer (0.5 pt)

References:

1) - 3) Aquatic Ecology Document: Water Properties-Thermal Properties, p 3

Forestry (10 pts) – STOP 7

This question requires materials provided at the stop.

This "Permanent Sample Plot" was last measured in 2008, when Manitoba Envirothon used this site.

Directions: Using the equipment provided, measure the marked trees in this plot. Record the information in the correct places on the TALLY SHEET provided and perform the calculations required. Mark your team number on the TALLY SHEET. Return the TALLY SHEET with the rest of your test! (10 pts - as shown on Tally Sheet)

Answers:

TBD

Partial marks: (develop a marking range where half points are given for "close" answers)

References:

Regional and Provincial training
Thinktrees MFA YouTube videos

Soils and Land Use (2 pts) – STOP 7

1) What two conditions are required for soil salinity? (2 pts - 1 pt each)

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Answers:

- 1) presence of soluble salts in subsoil, groundwater or both AND high water tables that can result in soluble salts moving into the root zone (2 pts - 1 pt)

References:

- 1) *Soil Management Guide*, p 65

Theme (2 pts) – STOP 7

There are at least five (5) distinct groups of people who are responsible for making the practice of sustainable agriculture more commonplace: agricultural producers, retailers, consumers, government/policymakers, and environmental/social advocates.

- 1) Describe two (2) examples of how agricultural producers can participate in sustainable agriculture. (1 pt - 0.5 pt each)
- 2) Describe two (2) examples of how consumers of agricultural products can participate in sustainable agriculture. (1 pt - 0.5 pt each)

Answers:

- 1) Any 2 of the following - take steps towards implementing sustainable practices (can list any specific practice - there are many in the document); advocate for sustainable ag; understand the motivations of other participants; be aware and informed of sust ag issues; participate in community-supported agriculture or local marketing; identify and manage environmental risk; engage in local food marketing; other reasonable answers (1 pt - 0.5 pt each - correct terminology not required)
- 2) Any 2 of the following - educate themselves about the true and hidden costs of ag products to environment and society; understand the motivations of other participants; be aware and informed of sust ag issues; talk to vendors of food - develop relationships; make their voice heard through purchasing power; partake in the locally sourced food movement; other reasonable answers (1 pt - 0.5 pt each - correct terminology not required)

References:

- 1) and 2) Throughout Theme Document, but primarily p 13, 31, 5\

Wildlife (2 pts) – STOP 7

This question requires materials provided at the stop.

- 1) You are a wildlife technician, and have been collecting data out in the field. All of the data you collected is displayed on the table and has already been labelled. Using the GPS, thermometer and watch provided, collect the remaining data, including the UTM coordinates for the two (2) flagged sites of interest in the field, and complete your field notes of the day in the form below. (2 pts)

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Note: Points will be given for full details and legibility.

Name:	
Date:	Time:
Location:	GPS Coordinate:
Habitat:	
Temperature:	
Data and Observations:	
Photos:	
Collected Items:	

Answers:

- 1) GPS coordinates (1 pt - 0.5 pt each), notes legible and complete (0.5 pt), labelled items entered correctly (0.5 pt)

References:

- 1) Wildlife Document, p 47

STOP 8

Aquatic Ecology (2 pts) – STOP 8

1) In 2009, Canadians used an average of 274 litres of water per day. Listed below are broad categories of household water use. Match the percentages of total household water use to the appropriate categories of water use by drawing a line between the pairs. (2 pts - 0.5 pt each).

<u>Water Use Categories</u>	<u>Percent of Total Water Use</u>
laundry	35%
kitchen/cleaning	30%
showers and bathing	20%
flushing toilets	15%

Answers:

1) laundry - 20 %, kitchen/cleaning - 15 %, showers and bathing - 35%, flushing toilets - 30 %
(2 pts - 0.5 pt)

References:

1) *Aquatic Ecology Document, p 60*

Forestry (2 pts) – STOP 8

Forests are both ecologically and commercially valuable and it is important to maintain both of these values through proper management.

Multiple choice: Which of the following is correct? Circle the best response. (1.5 pts - 0.5 pt each)

1) Best Management Practices (BMP) for forestry activities refer to:

- a) the practice of clear cutting forested lands.
- b) the practice, or combination of practices, that are thought to be the most effective and practical means of preventing or reducing the impacts on the chemical, physical and biological integrity of both the aquatic and terrestrial environments.
- c) the practice of draining sensitive aquatic environments and clearing of forested lands.
- d) the practice thought to be the most effective and practical means of increasing the impacts on the chemical, physical and biological integrity of both the aquatic and terrestrial environments.

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2) There are many ecological functions of riparian zones. Undisturbed riparian buffers adjacent to forestry cut blocks help maintain:

- a) water quality.
- b) aquatic habitat.
- c) distinct vegetation.
- d) high quality terrestrial habitat for wildlife.
- e) all of the above.
- f) none of the above.

3) The time of year when harvesting and timber extraction occurs may be a key factor in minimizing the potential impacts caused by forestry operations. Skidding timber during wet periods of year such as spring thaw or fall rains increases the potential for:

- a) soil erosion.
- b) sedimentation.
- c) loss of productive land.
- d) all of the above.

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

T F Access roads for forest harvesting operations are considered the largest contributors of excess sediment entering a watercourse.

Answers:

- 1) b) (0.5 pt)
- 2) e) (0.5 pt)
- 3) d) (0.5 pt)
- 4) T (0.5 pt)

References:

- 1) Buffer Management Report, p 3
- 2) Buffer Management Report, p 7
- 3) Buffer Management Report, p 4
- 4) Buffer Management Report, p 2

Soils and Land Use (2 pts) – STOP 8

This question requires materials provided at the stop.

1) Using the flow chart provided, determine the texture of the soil samples labelled S-A and S-B.
(2 pts - 1 pt each)

S-A _____

S-B _____

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Answers:

1a) Clay (1 pt)

Partial marks: TBD

1b) Sandy Loam (1 pt)

Partial marks: TBD

References:

1a) and 1b) Soils and Land Use Document, p 22

Theme (2 pts) – STOP 8

1) In the diagram below, there are six (6) words or phrases that match the following descriptions of techniques and programs for people to grow their own food. Find them and write them next to their corresponding description. (2 pts - 1 pt for 4 answers and 0.5 pt for each additional one)

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

a) an area of land in the city or town that can be rented for growing food

_____ b) a controversial practice of raising one's own chicken in the city

_____ c) instead of growing food on the ground, use trellises, frames, and walls to take advantage of this type of space

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d) a way to recycle nutrients from your food scraps, lawn trimmings and other yard waste

e) use it to store rainfall so that you can water your garden later

f) Sustainable South Osborne Coop and Fort Whyte Alive offer programs for this segment of the youth population so they can learn about sustainable agriculture and life skills

Answers:

1a) community garden, b) backyard poultry, c) vertical, d) composting, e) rain barrel, f) marginalized (2 pts - 1 pt for 4 answers and 0.5 pt for each additional one)

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

References:

1) *Theme Document, p 54-57*

Wildlife (10 pts) – STOP 8

This question requires materials provided at the stop.

1) Using the keys provided, identify the three (3) skulls labelled W-A, W-B, and W-C. (6 pts - 2 pts each)

W-A _____

W-B _____

W-C _____

2) Calculate the dental formula for the skull labelled W-A. (3 pts)

3) Construct a food web consisting of the three (3) animals represented by the skulls in question 1 PLUS one (1) other species. Label each trophic level. (1 pt)

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Answers:

1) W-A: wolf, W-B: white-tailed deer, W-C: goose (6 pts - 2 pts each)

Partial marks: W-A: coyote (1 pt), W-B: caribou or elk (1 pt), W-C: duck (1 pt)

2) $3/3, 1/1, 4/4, 2/3 = 42$ (3 pts - 1 pt for upper jaw, 1 pt for multiplying the number by two (representing left and right sides of jaw), and 1 pt for correct total)

3) The wolf can eat both the white-tailed deer and the goose (looks like a triangle). Include a plant as a fourth portion of the food web. Wolves are secondary consumers, both white-tailed deer and geese are primary consumers, and the plants would be primary producers. (1 pt - 0.5 pts for correct food web, 0.5 pts for trophic levels labeled correctly)

References:

1) Provincial training; Wildlife Document, p 20-24

2) Wildlife Document, p 17-20

3) Wildlife Document, p 30-32; Mammals of Manitoba, p 17, 26; Birds of Manitoba, p 12

STOP 9

Aquatic Ecology (2 pts) – STOP 9

This question requires materials provided at the stop.

Note the laminated sheet labelled A-A: Exclusion showing photos of remnants of two wire livestock fences. These photos were taken on April 29th, 2014, near Stop 9 and Stop 10. If it has not been removed since then for safety reasons, you will still be able to see the remnant located near this stop. Note that both these fence segments appear to run directly into the nearby stream bed, a condition that was common many years ago. Today, this practice is discouraged, but may still occur in some places. Current guidelines call for livestock to be excluded from waterways by fencing installed at least 10 metres from the high water mark or top of the bank.

1) List two (2) concerns for farmers and their livestock when livestock are not excluded from waterways. (1 pt - 0.5 pt each)

2) List two (2) problems for the stream ecosystem that can occur if livestock are not excluded from the stream. (1 pt - 0.5 pt each)

Answers:

1) Any 2 of the following: dangerous footing for livestock; livestock may have difficulty reaching the water to drink; udders may get mud-caked and affect nursing of calves; increased mastitis in milking cows; contaminated drinking water; less productivity of livestock; risk of disease transfer between animals. (1 pt - 0.5 pt each)

2) Any 2 of the following: increased sediment in water; siltation of spawning beds; habitat destruction for aquatic species, stream bed modification; flow alteration; increased turbidity; reduced biodiversity; reduced productivity. (1 pt - 0.5 pt each)

References:

1) Shorelines, p 4-5.

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Forestry (10 pts) – STOP 9

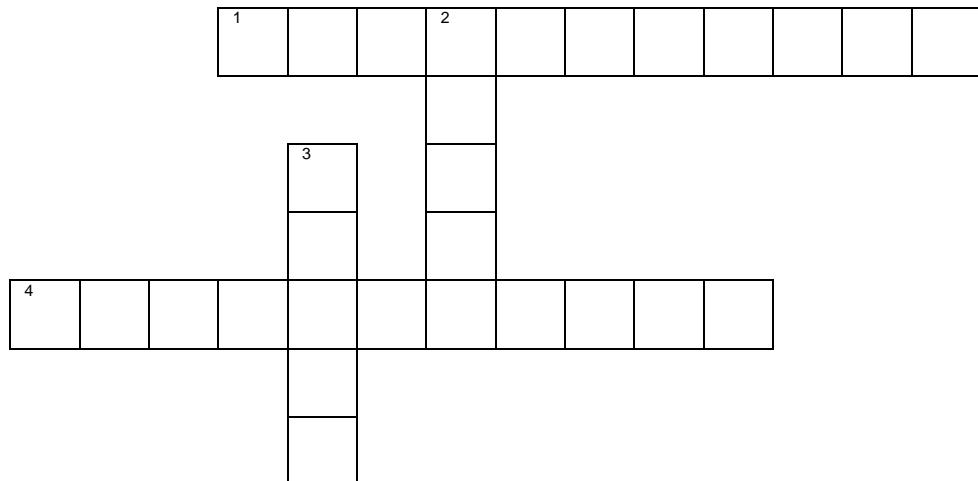
This question requires materials provided at the stop.

1) Certification plays an important role in the Canadian forestry industry.

a) What is CERTIFICATION? (1 pt)

b) How does certification give companies a market advantage? (1 pt)

2) Complete the following crossword (4 pts - 1 pt each)



Across:

1. Credible certification standards conform to nationally accepted standards for _____ forest management. (1 pt)
4. The table legs at this site, labelled F-A, show that they have been certified by the Forest _____ Council. (1 pt)

Down:

2. Forests are increasingly being well managed through _____-party certification. (1 pt)
3. The process in forest certification that indicated that the table legs labelled F-A have been tracked from when the wood was harvested, through the market, and to the consumer is called _____-of-custody. (1 pt)

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

The goals of forest certification include:

- T F Increased scientific knowledge
- T F Increased traditional ecological knowledge
- T F Making economic prosperity a priority
- T F Enforcing parks and wildlife regulations

Which of the following is correct? Circle the best response.

4) How many large forestry companies are there in Manitoba at this time? (1 pt)

- a) 2
- b) 4
- c) 6
- d) 8

5) How many of those companies are certified forest operations? (1 pt)

- a) 2
- b) 4
- c) 6
- d) 8

Answers:

1a) Certification is primarily about providing objective evidence of sustainable forestry management (1 pt)

1b) By providing an independent assurance of responsible forest management practices, certification helps consumers choose. Companies that can provide third-party audits have the added value of providing certainty, accountability and verifiability to retailers and consumers who want to give preference to products from well-managed forests (1 pt)

2) Across: 1) Sustainable, 4) Stewardship; Down: 2) Third, 3) Chain (4 pts - 1 pt each)

3) T, T, F, F (2 pts - 0.5 pt each)

4) a) (1 pt)

5) a) (1 pt)

References:

1) *Certification and Canada's Forests*, p 5

2) *What Buyers Need to Know: Certification and Canada's Forests*, 1) p 9; 2) p 1; 3) p 5; 4) p 7

3) *Priorities for Manitoba's Forests*, p 8: *Certification and Canada's Forests*, p 9

4) and 5) *Forestry Certification*

Soils and Land Use (2 pts) – STOP 9

- 1) What is a SOIL HORIZON? (2 pts)

Answers:

1) a layer of soil (1 pt) running approximately parallel to the land surface and differing from vertically adjacent layers (0.5 pt) in terms of physical, chemical and biological properties (0.5 pt) such as color, structure, texture, pH, etc.

References:

- 1) *Soil Management Guide, p 17*

Theme (2 pts) – STOP 9

Forest values are commonly encountered in the agricultural landscape, as can be seen in this wooded cattle pasture. Conversely, agriculture can be complementary to forestry, as in using livestock grazing to manage aspen competition with softwood saplings on Crown grazing leases. Agriculture and forestry teaming up to yield positive benefits is known as Agroforestry.

- 1) Name one (1) SPECIFIC sustainable agricultural practice that is represented by this treed ravine. (0.5 pt)
- 2) Give one (1) example of the benefits of the woody vegetation found in this agricultural landscape for EACH component of sustainable agriculture. (1.5 pts - 0.5 pt each)

Answers:

1) Any 1 of the following: habitat preservation, riparian buffer, sustaining native pollinator habitat, supporting deep-rooted species in or next to riparian areas, perennial pasture, appropriate land use for steep or wet land (NOT exclusion) (0.5 pt)

2) Any 1 of the following for each (1.5 pts - 0.5 pt each):

ECONOMIC - firewood; fencing materials; livestock well-being; shade and windbreak for livestock; reduce erosion of adjacent crop lands by reducing wind; provision of ecological goods and services; pollination services (pollinator refuge/habitat); small mammal control (refuge for foxes and coyotes and nesting for raptors); pest insect control (bird, bat, and large insect refuge); water regulation in summer (by transpiring water)

ENVIRONMENTAL- support genetic and ecosystem diversity; ecosystem health and function; provision of ecological goods and services; air quality - reduce wind erosion locally; habitat/nesting for flora and fauna; carbon sequestration; soil retention - reduced water erosion; water quantity regulation (through transpiration)

SOCIETY/CULTURE - educational opportunities; aesthetic pleasures - picturesque; sense of natural areas and heritage; quality of life - a place to have lunch, walk, run; research opportunities

References:

- 1) *Theme Document, p 14-16, 18, 34-40, 44; Companion Document, p 52, 53, 81-84, 89-91, 113*

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Wildlife (2 pts) – STOP 9

This question requires materials provided at the stop.

- 1) Listen to the wildlife calls on the iPod. Identify the species whose calls were played. (2 pts - 0.5 pt each)

Sound A _____

Sound B _____

Sound C _____

Sound D _____

Answers:

- 1) A: Spring Peeper, B: Western Meadowlark, C: Elk, D: Boreal Owl (2 pts - 0.5 pt each)

References:

- 1) *Wildlife Calls*

STOP 10

Aquatic Ecology (10 pts) – STOP 10

This question requires materials provided at the stop.

- 1) What is a RIPARIAN AREA? (1 pt)

- 2) The first step in assessing riparian health is to determine the extent of your sample area (polygon). Circle the best answer from the *italicized* choices in brackets for each of the blanks to make the following sentence true. (2 pts - 1 each)

Ideally, the length of the site should include [*one (1) / two (2) / four (4)*] meander cycle(s) or be [*ten (10) / 100 / 200*] metres long.

- 3) Deep-binding root mass is an important feature of a healthy riparian area.

a) Name one function that deep-binding root mass provides in a riparian area. (1 pt)

b) You will see flagging marking off a segment along the stream. In this segment, describe the evidence you see of the presence or absence of deep-binding root mass? (2 pts)

- 4) When a channel becomes incised, it cannot access its floodplain to release excess water. Using the guide to Rosgen's Incision Stages labelled A-A, determine the stream channel incision at this site.

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Which of the following is correct? Circle the best answer. (2 pts)

Stage 1 Stage 2 Stage 3 Stage 4

5) You have been provided with a Riparian Health Assessment field sheet, labelled A-B, that has been completed for a fictional site.

a) Based on this assessment, you determine that the site is _____ . Which of the following is correct? Circle the best response. (1 pt)

Unhealthy Healthy with Problems Healthy

b) Based on this assessment, recommend one management practice that the landowner can put in place to improve the health of the riparian area (1 pt)

Answers:

1) Any 1 of the following: Riparian areas are transitional between the aquatic and upland areas (or between land and water); "wetter than dry" but "drier than wet"; have abundance of water, either on the surface or close to the surface; characterized by vegetation that responds to, requires and survives well in abundant water; characterized by saturated soil that supports water-loving plants. (1 pt)

Partial marks: 0.5 pt, land adjacent to (or beside) water.

2 two; 200 (2 pts - 1 pt each)

3a) Any 1 of the following: Dissipate energy; resist erosion; trap sediment; bind substrate together; stabilize. (1 pt)

3b) In this question, I just want to see that they are aware of the environment around them. They can argue that there is insufficient root mass, based on the fact that the stream bank is eroded, trees along the bank have toppled, and the majority of the vegetation is non-native grasses with a short root system. They could also argue that there is good root mass, based on the fact that in the three metres adjacent to the streambank, there is a large number of woody species, and even though some trees are toppled, their roots are still providing some stabilization (2 pts)

Partial marks: 1 pt, for noting either the toppled tree or the prevalence of short rooted grass species

4) Stage 1 (2 pts)

Partial marks: 1 pt, Stage 2

5a) Healthy with Problems (1 pt)

5b) Any 1 of the following: Plant additional native vegetation; prevent the spread of invasive species by weeding; plant native trees and shrubs; restrict livestock access in the riparian area; set up watering sites away from the water; etc. (1 pt)

References:

1) Managing the Water's Edge, p 7; Protecting your Shorelands, p 1-8

2) Managing the Water's Edge, p 21-23

3) Managing the Water's Edge, p 53

4) Managing the Water's Edge, p 65-69

5) Managing the Water's Edge; Protecting your Shorelands

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Forestry (2 pts) – STOP 10

- 1) Complete the word search of Forestry terms. (2 pts)

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

Word Bank

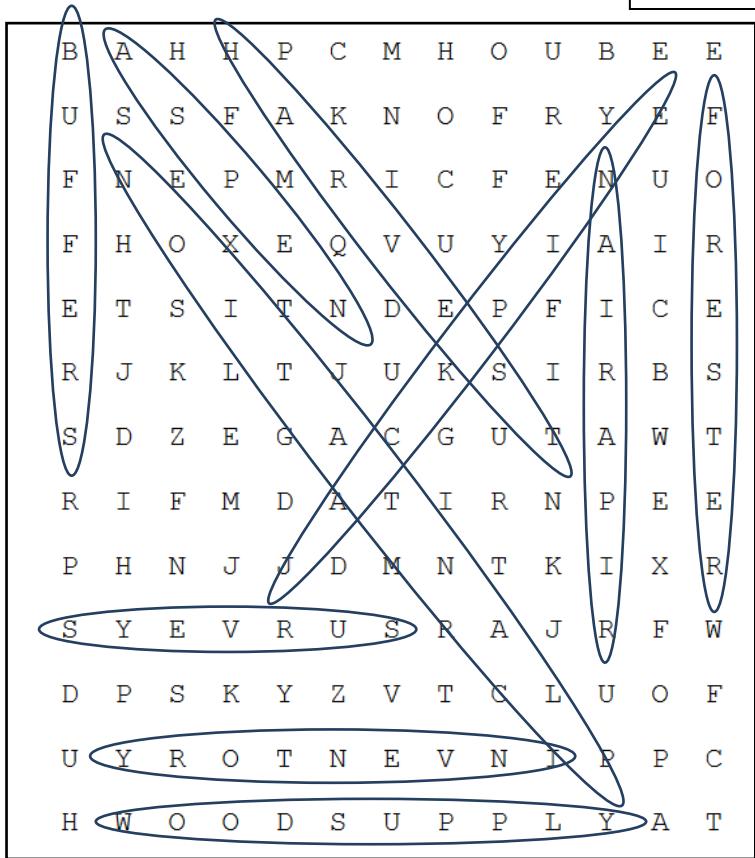
<i>aspen</i>	<i>forester</i>	<i>inventory</i>	<i>plantation</i>	<i>surveys</i>
<i>buffers</i>	<i>harvest</i>	<i>jack pine</i>	<i>riparian</i>	<i>wood supply</i>

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Answers:

- 1) 10 words as shown (2 pts)



Partial marks: 0.5 pt for 4-5 words, 1 pt for 6-7 words, 1.5 pts for 8-9 words

References:

- 1) Common knowledge

Soils and Land Use (2 pts) – STOP 10

- 1) Define SOIL EROSION. (0.5 pt)
- 2) What type of erosion can be seen at this stop? (0.5 pt)
- 3) List two specific practices to avoid or reduce this type of erosion. (1 pt - 0.5 pt each)

Answers:

- 1) *The wearing of the earth's surface. Surface soil material is removed in the process.* (0.5 pt)
- 2) *water* (0.5 pt)
- 3) *Any 2 of following: maintaining a protective cover on the soil (vegetation rip rap etc), creating a barrier to the water, modifying the landscape to control runoff amounts and rate, reducing the steepness of slopes and breaking the slope into shorter sections, increasing water infiltration rates, improving aggregate stability or any example of the above* (1 pt - 0.5 pt each)

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References:

1), 2) and 3) Erosion

Theme (2 pts) – STOP 10

- 1) One (1) of the following statements is false. Circle the letter of that statement. (1 pt)
 - a) Many ecosystem functions are considered to be ecosystem services, which means that they support human life and activity, either directly or indirectly.
 - b) Agricultural ecosystems benefit from ecosystem services, but they also contribute their own ecosystem services.
 - c) Direct profit per acre from annual crops is greater than direct profit per acre from grazing or hay production. That is the primary reason for converting Manitoba grasslands to cropland.
 - d) Non-market value of an ecosystem good or service can be estimated by considering the costs that society would incur if that good or service no longer existed.
 - e) In recent years, economists in Manitoba have developed a complete list of the dollar values of ecosystem goods and services in our agricultural regions.
- 2) Describe why that statement is incorrect. (1 pt)

Answers:

- 1) e) is incorrect (1 pt)
- 2) Any 1 of the following ideas: more Manitoba-specific data needs to be collected in order to develop a complete and accurate list of values for ecological goods and services; completeness and accuracy of the values for goods and services will be improved by filling in data gaps; recent estimates of ecological goods and services are missing some data such as medicinal, genetic, ornamental, water supply, biological value, sociocultural benefits, etc.; not all agricultural landscapes have undergone valuation of ecological goods and services; goods and services are variable in different landscapes and it is not cheap and easy to gather data for all ag landscapes in Manitoba; there is a very wide range in overall value that accounts for fluctuations and variability in market values of forage, hay, pasture rental, fertilizer, carbon credits, and people's willingness to pay for habitat conservation (as an example of a study for grasslands, the estimate of total value lies between \$702 million and \$2518 million per year - a spread of \$1216 million!); other reasonable answers (NOT enough to say that "The list of values for ecological goods and services is NOT complete (NOR accurate)") (1 pt)

References:

- 1) Theme Document, p 16, 17, 19; Companion Document, p 25-30
- 2) Companion Document, p 28-30

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Wildlife (2 pts) – STOP 10

This question requires materials provided at the stop.

- 1) Using the field guides and binoculars provided, identify the four wildlife species labelled W-A, W-B, W-C, and W-D. (2 pts - 0.5pt each)

W-A _____

W-B _____

W-C_____

W-D_____

Answers:

- 1) TBD (2 pts - 0.5 pt each)

References:

- 1) *Mammals of Manitoba, p 2-3; Birds of Manitoba, p 3-6*

STOP 11

Aquatic Ecology (2 pts) – STOP 11

This question requires materials provided at the stop.

We Canadians use large quantities of water in many sectors of our society, particularly for power generation, manufacturing, municipal and domestic activities, agriculture, and mining. Note the laminated diagram labelled A_A: Water Use, which shows the totals and relative amounts of water used in Canada by each of these five sectors. However, there are differences from region to region.

- 1) Which one of these five sectors uses the largest volume of water in the Prairie Provinces, including Manitoba? (1 pt)
- 2) What specific activity accounts for more than 90% of all water used by this sector? (0.5 pt)
- 3) What is the primary reason that this activity uses so much water? (0.5 pt)

Answers:

- 1) Agriculture (1 pt)
- 2) irrigation (0.5 pt)
- 3) Either of the following: much of this water is lost to evaporation; very little is recycled or returned to its source. (0.5 pt)

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References:

- 1) - 3) *Aquatic Ecology Document: Water Use-Withdrawal Uses, p 56-58, 62*

Forestry (10 pts) – STOP 11

This question requires materials provided at the stop.

- 1) Using the Field Guide to the Native Trees of Manitoba, identify the specimens labeled F-A, F-B, F-C and F-D. (4 pts - 1 pt each)

F-A _____

F-B _____

F-C _____

F-D _____

- 2) The tree cookie sample provided was harvested at the Brandon Research and Development Center in 2013. Using the equipment provided, determine the age of this tree when it was harvested. (2 pts)

_____ yrs

- 3) All tree-ring research must adhere to certain principles or scientific rules.

- a) Which of the following is/are among these principles? Circle the best answer. (1 pt)

- i) The Principle of Limiting Factors
- ii) The Principle of Aggregate Tree Growth
- iii) The Principle of Site Selection
- iv) The Principle of Crossdating
- v) All the above

- b) Define one (1) of the above Principles. (1 pt)

- 4) Define a tree ring. (1 pt)

- 5) Name the two (2) components that make up a tree ring. (1 pt - 0.5 each)

Answers:

- 1) *TBD on site (4 pts - 1 pt each)*

- 2) *TBD on site (2 pts)*

Partial marks:

3a) v)

3b) Any 1 of the following (1 pt):

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THE PRINCIPLE OF LIMITING FACTORS: As used in dendrochronology, this principle states that rates of plant processes are constrained by the primary environmental variable(s) that is most limiting. For example, precipitation is often the most limiting factor to plant growth in arid and semiarid areas. In these regions, tree growth cannot proceed faster than that allowed by the amount of precipitation, causing the width of the rings (i.e., the volume of wood produced) to be a function of precipitation. In some locations (for example, in higher latitudes and elevations), temperature is often the most limiting factor.

THE PRINCIPLE OF AGGREGATE TREE GROWTH: This principle states that any individual tree-growth series can be "decomposed" into an aggregate of environmental factors, both human and natural, that affected the patterns of tree growth over time.

THE PRINCIPLE OF SITE SELECTION: This principle states that sites useful to dendrochronology can be identified and selected based on criteria that will produce tree-ring series sensitive to the environmental variable being examined. For example, trees that are especially responsive to drought conditions can usually be found where rainfall is limiting, such as rocky outcrops, or on ridgecrests of mountains.

THE PRINCIPLE OF CROSSDATING: This principle states that matching patterns in ring widths or other ring characteristics (such as ring density patterns) among several tree-ring series allow the identification of the exact year in which each tree ring was formed. For example, one can date the construction of a building, such as a barn or Indian pueblo, by matching the tree-ring patterns of wood taken from the buildings with tree-ring patterns from living trees. Crossdating is considered the fundamental principle of dendrochronology,

- 4) A layer of wood cells produced by a tree or shrub in one year. (1 pt)
- 5) Usually consisting of thin-walled cells formed early in the growing season (called earlywood) and thicker-walled cells produced later in the growing season (called latewood). The beginning of earlywood formation and the end of the latewood formation form one annual ring, which usually extends around the entire circumference of the tree. (1 pt - 0.5 pt each)

References:

- 1) Field Guide
 - 2) Regional and Provincial training
 - 3), 4) and 5) Principles of Dendrochronology
- Also, ThinkTrees MFA YouTube videos

Soils and Land Use (2 pts) – STOP 11

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

- T F Weathering is a type of erosion.
- T F Soils can form faster when parent materials are more permeable.
- T F Soil layering and soil zone are considered when defining a soil series, but parent material is not.
- T F All soils initially form through the breakdown of rock at the Earth's surface.

Answers:

- 1) F, T, F, F (2 pts – 0.5 pts each)

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References:

- 1) *Soils and Land Use Document, p 24; From the Surface Down, p 7; Newdale Soil Series, p 1*

Theme (2 pts) – STOP 11

- 1) Circle the letters of the four (4) scenarios which are true about modern agriculture. (2 pts - 0.5 pt each)

- a) Organic farming as we know it developed in response to rapid mechanization and accelerated availability and use of chemical fertilizers and pesticides.
- b) Advances in agriculture have reduced health risks to farm workers and minimized the risk of crop failure.
- c) Since 1951 the total population of Manitoba has increased, but the number of people living on farms has decreased by almost two-thirds.
- d) In order to avoid change, mainstream agriculture has increased its efforts to resist the sustainability movement.
- e) Continued misuse and abuse of soil, water, and biological diversity could subject modern civilization to some of the same stressors that contributed to the demise of ancient civilizations such as the Roman Empire.
- f) Consumers are frustrated with the slow uptake of sustainable agriculture and thus are no longer interested in knowing where their food comes from.

Answers:

- 1) a), b), c), e) (2 pts - 0.5 pt each)

References:

- 1) *Theme Document, p 10-13; Companion Document, p 5, 6, 109*

Wildlife (2 pts) – STOP 11

This question requires materials provided at the stop.

- 1) Identify the wildlife species whose tracks are labeled W-A, W-B and W-C. (1.5 pts - 0.5 pt each)

W-A _____

W-B _____

W-C _____

- 2) Measure the straddle of the tracks labeled W-C. (0.5 pt)

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Answers:

- 1) W-A: Raccoon, W-B: Canada Goose, W-C: White-tailed Deer (1.5 pts - 0.5 pt each)
- 2) ~20 cm (0.5 pt)

References:

- 1) W-A: *Mammals of Manitoba*, p 35
- W-B: *Animal Tracks*, p 6
- W-C: *Mammals of Manitoba*, p 56
- 2) *Mammals of Manitoba*, p 56

Aquatic Ecology (2 pts) – STOP 12

This question requires materials provided at the stop.

- 1) Using the Key to Manitoba's Sport Fish, provided at this stop, identify each fish by its common name. (2 pt - 1pt each)

A-A _____

A-B _____

Answers:

- 1) A-A: TBD; A-B: TBD

References:

- 1) *Key to Manitoba's Sport Fish; Fish Anatomy; Field Training*

Forestry (2 pts) – STOP 12

This question requires materials provided at the stop.

Locate the flagged tree labelled F-A.

- 1) Define SNAG. (1 pt)
- 2) Identify one benefit and one problem associated with snags. (1 pt - 0.5 pts each)

Answers:

- 1) Dead standing trees (1 pt)
- 2) Any 1 of the following benefits: used by wildlife for cover, feeding, reproduction, preening, lookouts, bridgeways and hibernating (0.5 pt)
Problem: safety hazard for loggers (0.5 pt)

References:

- 1) *Forestry Document*, p 29
- 2) *Pre-Harvest Surveys*, p 13

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Soils and Land Use (10 pts) – STOP 12

This question requires materials provided at the stop.

- 1) Refer to the Brandon Research Station Map.
 - a) What kind of soil survey is this map? (1 pt)
 - b) Justify your answer. (1 pt)
- 2) Find L.S.D 6-34-10-19W on the map.
 - a) What does the W stand for in this context? (1 pt)
 - b) What does L.S.D. stand for in this context? (1 pt)
- 3) Find the largest soil polygon in L.S.D. 6-34-10-19W.
 - a) What is the map unit?(1 pt)
 - b) What is/are the full name(s) of the soil series and their respective percentage(s) in the polygon? (2 pts)
 - c) What is/are the limitation(s) for this polygon? (2 pts)
 - d) What is the drainage status of this polygon? (0.5 pt)
 - e) What is the surface texture of this polygon? (0.5 pt)

Answers:

- 1a) Detailed (1 pt)
1b) Either of: scale is 1:10000 OR it says in the report (1 pt)
2a) west of the first or prime meridian (1 pt)
2b) legal sub-division (1 pt)
3a) SCK5/xcxx-WHL3/1cxx-SCK2/1cxx (1 pt)
3b) Stockton (0.5 pt) 70%(0.5 pt), Wheatland (0.5 pt)30%(0.5 pt)
Note: Must write out name in full - no acronyms!
3c)slightly eroded (1 pt) and either very gently sloping or slope of 2-5% (1 pt);
Partial marks: 0.5 pt for just eroded or erosion; 0.5 pt for just slope
3d) well drained (0.5 pt)
3e) loamy fine sand (0.5 pt)
Note: LFS not an acceptable answer

References:

- 1) Provincial training
- 2) Understanding Western Canada's Land Surveying System pp. 2-5
- 3) Provincial training

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Theme (2 pts) – STOP 12

- 1) Local and innovative food producers face some unique challenges in producing food and getting it to local markets. Briefly describe two (2) of these challenges. (1 pt - 0.5 pt each)
- 2) Briefly describe one (1) positive and one (1) negative outcome of "Open Food Day" (ie. the government promoted event where consumers can visit agricultural producers). (1 pt - 0.5 pt each)

Answers:

- 1) Any 2 of the following: strict quotas for eggs, milk, poultry; kitchen regulations for adding value to food (ie. baking, jams, preserves, sausage); regulations for storage and handling facilities; accessibility and cost of government-inspected slaughter facilities; time needed to go off-farm during production season to market food (small operations have difficulty sparing someone to do this); regulations geared to large industrial operations or facilities may not be feasible for smaller ones; limited funding and staffing of government units to give support to these kinds of operations; government promotes the idyllic/nostalgic image of small and innovative farms while giving most financial support to larger operations
- 2) Any 1 of the following POSITIVES: opportunity to find new markets among the public for ag products or agri-tourism; consumers gain knowledge of where their food comes from; demonstrates to farmers and government the public interest in the connection of their food to the people who produce it

Any 1 of the following NEGATIVES: public gets skewed view of Manitoba ag industry - most farms that participate are small/innovative farms, while the Province's greatest production comes from large farms OR by giving the public an image of the nostalgic or idyllic farm, it masks the local farmers' day-to-day challenges; the government uses this to represent MB agriculture while not substantiating it with adequate financial support

References:

- 1) and 2) Theme Document, p 53-54; Companion Document, p 138-140

Wildlife (2 pts) – STOP 12

- 1) Define ADAPTATION. (0.5 pt)
- 2) Define ACCLIMATION. (0.5 pt)
- 3) Briefly describe how two (2) specific adaptations of an owl are advantageous to it. (1 pt)

Answers:

- 1) Adaptation is any behavioural, morphological, or physiological trait that is a result of natural selection. This inherited characteristic should enhance an organism's ability to survive and reproduce in their environment.

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2) Acclimation is the short-term response of an individual to different or changing natural environments. (0.5 pt)

3) Strong talons, strong beaks, special wing structure (to fly silently), large eyes, increased ability to turn head, etc. All increase its effectiveness as a predator (hunting in the night, sneaking up on prey, etc.). (1 pt - 0.5 pt for each adaptation with advantage).

References:

1) Wildlife Document, p 25

2) Wildlife Document, p 26

3) Birds of Manitoba, p 16-21

STOP 13

Aquatic Ecology (2 pts) – STOP 13

This question requires materials provided at the stop.

1) Using the Key to Macroinvertebrate Life in the River, identify the invertebrates labelled A-A and A-B. Give the common name. (2 pts - 1 pt each)

A-A _____

A-B _____

Answers:

1) A-A: TBD; A-B: TBD

References:

1) Regional Training

Forestry (2 pts) – STOP 13

This question requires materials provided at the stop.

1) Define AFFORESTATION. (1 pt)

2) Consider the tree labeled F-A at this stop and the tree in the photo labeled F-B. Which tree is likely to sequester more carbon? Explain why. (1 pt).

Answers:

1) Afforestation is the conversion of land from unproductive uses back to forests. (1 pt)

2) The tree labeled at the stop is likely to sequester more carbon. (0.5 pt) 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. In rural and afforestation areas, however, litter is not removed, so we assume a typical added component of carbon stored in the soil. (0.5 pt)

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References:

- 1) *What Trees can do to Reduce Atmospheric CO₂, p 5*
- 2) *What Trees can do to Reduce Atmospheric CO₂, p 8*

Soils and Land Use (2 pts) – STOP 13

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

- T F The amount of water held in the soil between field capacity and permanent wilting point is defined as air dry moisture.
- T F In the spring, soils along creeks in the spring in Manitoba are commonly at saturation point .
- T F Overirrigation of potato fields can result in loss of fertility through leaching.
- T F The letter which designates a droughty soil for Agriculture Capability is I.

Answers:

- 1) F, T, T, F (2 pts - 0.5 pts each)

References:

- 1) *Soil Management Guide, p 43, 43, 52, 39*

Theme (10 pts) – STOP 13

- 1) List two (2) natural ecological processes that supply nitrogen compounds to plants in this agricultural ecosystem. (2 pt - 1 pt each)
- 2) List two (2) ecological processes that release purified water from this pasture into the environment. (2 pt - 1 pt each)
- 3) Why does this agricultural ecosystem need natural or human-caused nutrient additions? (1 pt)
- 4) List two (2) ecological processes of the carbon cycle that take place in this pasture to make sunlight and carbon dioxide useful for beef production. (2 pt -1 pt each)
- 5) Circle the object or material found at this station that DOES NOT contain phosphorus. (1 pt)

rock	living plants	wood
dead plants	mineral soil	air
	soil organic matter	

- 6) This site has a lot of live perennial vegetation and dead plant residue covering the soil surface. Describe briefly what happens to water infiltration and runoff when this amount of cover is on the soil. (2 pts - 1 pt each)

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Answers:

- 1) Any 2 of the following: atmospheric N fixation (lightning) and deposition; biological fixation of atmospheric nitrogen (bacteria associated with legumes); biological fixation of ammonium to nitrate in organic matter (nitrification or immobilization) (2 pts - 1 pt each)
- 2) Any 2 of the following: evaporation; transpiration; percolation; subsurface flow; healthy vegetation redirecting overland flow into infiltration, subsurface flow, or percolation; soil microorganisms use materials from the water (2 pts - 1 pt each)
- 3) Either of: nutrients leave the system (cattle eat grass and then are moved into a different field or barn and then sold); or they are leached, volatilized, eroded, or washed away) (1 pt)
- 4) Any 2 of the following: photosynthesis, consumption (of plants by cattle), respiration (or metabolism of consumed or stored carbon compounds) (2 pts - 1 pt each)
- 5) air (1 pt)
- 6) Infiltration increases because vegetation and residue are stopping or slowing down runoff (2 pts - 1 pt for each process).

References:

- 1) Theme Document, p 26, 27
- 2) Theme Document, p 21, 22
- 3) Theme Document, p 23, 24
- 4) Theme Document, p 24, 25
- 5) Theme Document, p 27, 28
- 6) Theme Document, p 21

Wildlife (2 pts) – STOP 13

Adaptations that help animals survive in (or prepare for) cold temperatures and the presence of snow and ice can be grouped in three categories: anatomical, physiological and behavioural. Write the letter of the category that best matches each of the examples in the blanks below. Each category will be used at least once. (2 pts - 0.5 pt each).

- A ANATOMICAL
B PHYSIOLOGICAL
C BEHAVIOURAL

- ____ 1) A small rodent is seen quickly disappearing down a previously dug burrow in the snow.
____ 2) A weasel is seen with white fur pursuing a shrew while on top of the snow.
____ 3) A Canada goose is standing on the ice of a partially frozen pond.
____ 4) A beaver is seen moving leafy branches into a pond and sticking them leafy-side up in the mud.

Answers:

- 1) C; 2) A; 3) B; 4) C (2 pts - 0.5 pt each)

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References:

- 1) *Wildlife In Winter*, p 3
- 2) *Wildlife In Winter*, p 6
- 3) *Wildlife In Winter*, p 3-5
- 4) *Wildlife In Winter*, p 3

STOP 14

Aquatic Ecology (2 pts) – STOP 14

This question requires materials provided at the stop.

- 1) Using the Photo Field Guide to the Freshwater Mussels of Ontario (tagged pages only), identify the mussel provided at this stop. (1 pt)
- 2) On March 27th, 2013 this species was added to Schedule 1 of the Species at Risk Act (SARA) as endangered. Define ENDANGERED under the SARA. (1 pt)

Answers:

- 1) mapleleaf mussel (1 pt)
- 2) a wildlife species that is facing imminent extirpation or extinction (1 pt)

References:

- 1) *Training*
- 2) *Fish Species at Risk in Manitoba*, p 10

Forestry (2 pts) – STOP 14

This question requires materials provided at the stop.

- 1) Identify the forest pests labeled F-A and F-B in the case. (1 pt)

F-A _____

F-B _____

- 2) Which tree species is most vulnerable to an attack from each pest. (1 pt)

F-A _____

F-B _____

Answers:

- 1) F-A: Forest Tent Caterpillar, F-B: Spruce Budworm
- 2) F-A: Trembling aspen, F-B: balsam fir/white spruce or red spruce

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References:

- 1) and 2) Forest Tent Caterpillar and Spruce Budworm

Soils and Land Use (2 pts) – STOP 14

Fill in the blanks with the appropriate word.

1) Soil _____ is the squeezing together of soil particles, reducing the space available for air and _____. (1 pt - 0.5 pt each)

2) The process described above increases the _____ of the soil, which _____ infiltration of water, soil air movement, seedling emergence and root growth and ultimately reduces yield. (1 pt - 0.5 pt each)

Answers:

- 1) compaction; water (1 pt - 0.5 pt each)
2) density; reduces (or equivalent) (1 pt - 0.5 pt each)

References:

- 1) and 2) Soil Management Guide, p 109

Theme (2 pts) – STOP 14

1) Circle the main motivation that agricultural producers have for reducing their use of fossil fuels. (0.5 pt)

economic environmental social/cultural

2) State one (1) practice or technology that agricultural producers can use to reduce the amount of energy needed for their operations. (0.5 pt)

3) State one (1) practice or technology that agricultural producers can use to take advantage of renewable energy resources. (0.5 pt)

4) State one (1) other practice or technology that agricultural producers can use for either of the above reasons. (0.5 pt)

Answers:

- 1) economic (0.5 pt)
2) Any 1 of the following: upgrade machinery; keep machinery in working order; fluorescent/neon/LED lights; insulate or ventilate buildings; reduce mileage - sell locally or buy inputs/feed/equipment from local sources; use practices that build soil fertility or prevent disease and pest problems (crop and grazing rotation, manure, compost, reduce tillage); finish livestock on pasture; keep livestock out of feedlot as long as possible; calve/lamb/kid later in the spring instead of winter; reduce fertilizer and chemical overlap or underapplication using GPS; use

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motion sensors/timers for lights or stock waterers; other reasonable answers related to reducing energy use (0.5 pt)

- 3) Any 1 of the following: greenhouses or high tunnels to trap heat; generate energy or heat from windmills, solar panels, hot water tanks, geothermal installations, gravity; enable passive ventilation of buildings and greenhouses; manufacture fuels from manure, plant waste, biomass, oilseeds; other reasonable answers related to renewable energy production (0.5 pt)
- 4) Any 1 other answer from 2) or 3) (0.5 pt)

References:

- 1) - 4) Theme Document, p 42, 43

Wildlife (10 pts) – STOP 14

This question requires materials provided at the stop.

- 1) Using the key provided, identify each animal to the most specific taxonomic level the key allows. (9 pts - 1.5 pts each)

W-A _____

W-B _____

W-C _____

W-D _____

W-E _____

W-F _____

- 2) Give an example of another species from the same phyla (larger group) for animals W-B and W-C. (1 pt - 0.5 pts each)

Answers:

1) W-A: Nematoda (1.5 pts)

W-B: Insecta (1.5 pts)

Partial marks: Arthropoda (0.5 pt)

W-C: Mollusca (1.5 pts)

W-D: Annelida (1.5 pts)

W-E: Platyhelminthes (1.5 pts)

W-F: Chelicerata (1.5 pts)

Partial marks: Arthropoda (0.5 pt)

2) W-B: Any 1 of the following: insects, crustaceans (lobsters and crabs), spiders, scorpions, and centipedes, etc. (0.5 pt)

W-C: Any 1 of the following: clams, snails, slugs, squid, and octopus, etc. (0.5 pt)

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References:

- 1) and 2) Provincial training, Wildlife Document, p 9-10

STOP 15

Aquatic Ecology (2 pts) – STOP 15

- 1) Note the wetland vegetation visible at ground level under and among the trees near this stop. Wetlands currently cover about 14% of Canada, and have been classified into five habitat types. List three (3) of these five wetland types. (1.5 pts - 0.5 pt each)
- 2) Wetlands have many important ecological functions, which vary somewhat according to these different habitat types. The small wetland near this stop is largely spring-fed and drains into a small stream that flows ever more rapidly into the much larger Assiniboine River valley. List one (1) ecologically significant function of the small wetland within this spring-wetland-stream ecosystem. (0.5 pt)

Answers:

- 1) Any 3 of the following: marshes; swamps; bogs; fens; shallow open water. (1.5 pts - 0.5 pt each)
- 2) Any 1 of the following: reservoir for storing and slowly releasing water; habitat for reptiles, amphibians and certain invertebrates; source of oxygen and water vapour; filtration of soil particles and other contaminants. (Note: the first two answers are probably most relevant in this system, but either of the second two will also be accepted.) (0.5 pt)

References:

- 1) Aquatic Ecology Document: Wetlands, p 23-24
2) Aquatic Ecology Document: Wetlands, p 21

Forestry (2 pts) – STOP 15

- 1) Wood plays an important part in people's lives worldwide. In the USA, each individual (man., woman, child) uses over 2,000 pounds of wood products a year. Name a product derived from each of the following tree components (2 pts - 0.5 pt each)

- a) SAP and GUM _____
- b) ROOTS _____
- c) TRUNK _____
- d) CORDWOOD _____

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Answers:

1a) Any 1 of the following: syrup, waxes, rubber gloves, toothpaste, turpentine, varnish, flavorings, paint, shoe polish, cosmetics, chewing gum, crayons, shampoos, rubber soles, printing ink, paint (0.5 pt)

1b) suntan oil, perfume (0.5 pt)

1c) cork, baseball bats, guitars, pianos, railroad ties, log cabins (0.5 pt)

1d) newspaper, rayon cloth, grocery bags, carpeting, wallpaper, tissues, magazines, maps, making tape, kites, charcoal, cellophane, photo film, books (0.5 pt)

References:

1) Common knowledge

Soils and Land Use (2 pts) – STOP 15

This question requires materials provided at the stop.

- 1) You submit a 230 gram soil sample to a laboratory for particle size analysis. You receive the report below. What is the texture of the soil? (2 pts)

Organic matter: 30 grams

Clay: 60 grams

Sand: 10 grams

Answers:

1) Silty Clay Loam (2 pt)

References:

1) Soils and Land Use Document, p 25-26; and Provincial training

Theme (10 pts) – STOP 15

- 1) What are the three (3) most important greenhouse gases that have been produced by agricultural operations at this research farm? (1.5 pts - 0.5 pt each)
- 2) Which of these greenhouse gases is the most potent? (0.5 pt)
- 3) Which two (2) nutrient cycles are most involved in emission or capture of greenhouse gases? (2 pts - 1 pt each)
- 4) What does this wetland and "cow burps" have in common, within the context of greenhouse gas emissions? (*Hint: Their relevant processes are anaerobic decomposition and enteric fermentation.*) (1 pt)
- 5) Which two (2) greenhouse gases are emitted from manure storage? (1 pt - 0.5 pt each)
- 6) Briefly describe two (2) ways in which this pasture acts as a carbon sink. (2 pts - 1 pt each)

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- 7) List two (2) practices described in the Soil Management Guide that can be used to turn a conventionally managed crop field into a crop field that acts as a "net carbon sink" (ie. more carbon is stored than is emitted). (2 pts - 1 pt each)

Answers:

- 1) *CO₂, CH₄, N₂O; OR carbon dioxide, methane, nitrous oxide (1.5 pts - 0.5 pt each)*
 - 2) *N₂O, or nitrous oxide is most potent (0.5 pt)*
 - 3) *nitrogen (N) cycle and carbon (C) cycle (2 pts - 1 pt each)*
 - 4) *both cow burps and wetlands emit methane (or CH₄). (1 pt)*
 - 5) *manure storages emit nitrous oxide (N₂O) and methane (CH₄). (1 pt - 0.5 pt each)*
 - 6) *Any 2 of the following: has perennial vegetation which manufactures OR stores carbon compounds; soil organic matter is added or conserved by vegetation growth and death OR by cows defecating and urinating OR by preventing exposure of topsoil to erosion and carbon metabolism; other reasonable answers pertaining to a pasture context (2 pts - 1 pt each)*
- Partial marks: 0.5 for listing without description*
- 7) *Any 2 of the following: practice conservation tillage (minimal or no-till) OR plant into last year's stubble instead of plowing it under; add perennial forages (or hay) into the crop rotation system; produce healthy or productive crops (more biomass to sequester carbon); reduce the use of summer fallow or chem fallow in the crop rotation; manage nitrogen for healthy crops and soil microbes (by cover crops, alfalfa in the rotation, strategic N application, applying compost or manure) (2 pts - 1 pt each)*

References:

- 1) *Companion Document, p 111*
- 2) *Companion Document, p 111*
- 3) *Theme Document, p 23-27*
- 4) *Companion Document, p 111*
- 5) *Companion Document, p 112*
- 6) *Companion Document, p 113*
- 7) *Companion Document, p 113-116*

Wildlife (2 pts) – STOP 15

- 1) Based on the following descriptions, classify each wildlife population with the appropriate International Union for Conservation of Nature (IUCN) Red List category. (1.5 pts - 0.5 pt each)
 - a) The worldwide population of the purple howler monkeys is only found in a remote area of eastern Africa. Despite the remoteness of its location its population has reduced by 75% in the last 10 years due to poaching. Currently there are only 200 individuals left in the wild.
 - b) The population of yellow bull frogs in northern Manitoba has declined by 30% in the last 20 years, possibly due to climate change. The total population size for northern Manitoba is now estimated at 21,000 individuals. Populations of yellow bull frogs in

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neighboring areas are stable to increasing as are global population estimates of this circum-boreal species.

- c) The specific habitat for the worldwide population three-toed tadpole has been lost due to agricultural development. This species is only found in zoos across the world and its population is stable.
- 2) Name a wildlife species found in Manitoba that is classified on the IUCN Red List (above Least Concern). (0.5 pt)

Answers:

- 1a) Endangered (0.5 pt)
1b) Near Threatened or Least Concern (0.5 pt)
1c) Extinct in the Wild (0.5 pt)
2) Any 1 of the following: Polar Bear, Beluga Whale, Bison (0.5 pt)

References:

- 1) Wildlife Document, p 39-40
2) Mammals of Manitoba Document, p 25-27, 48-51