SC20F Exam Review

Dynamics of Ecosystems

1. What is meant by an ecosystem.

   A community and its abiotic environment.

2. Where does all of the energy in an ecosystem originally come from?

   The sun

3. What is the difference between biotic and abiotic factors?

   biotic: living
   abiotic: non-living

4. Distinguish between consumers and producers.

   Consumers: animals that eat plants or other animals

   Producers: convert radiant energy into chemical energy for ecosystems

5. Consider the following food chain:

   Algae → Plankton → Smelt → Perch → Walleye → Northern Pike → Bald Eagle

   (a) What is meant by a food chain?

   A food chain is a sequence showing the feeding relationships and energy flow between species.

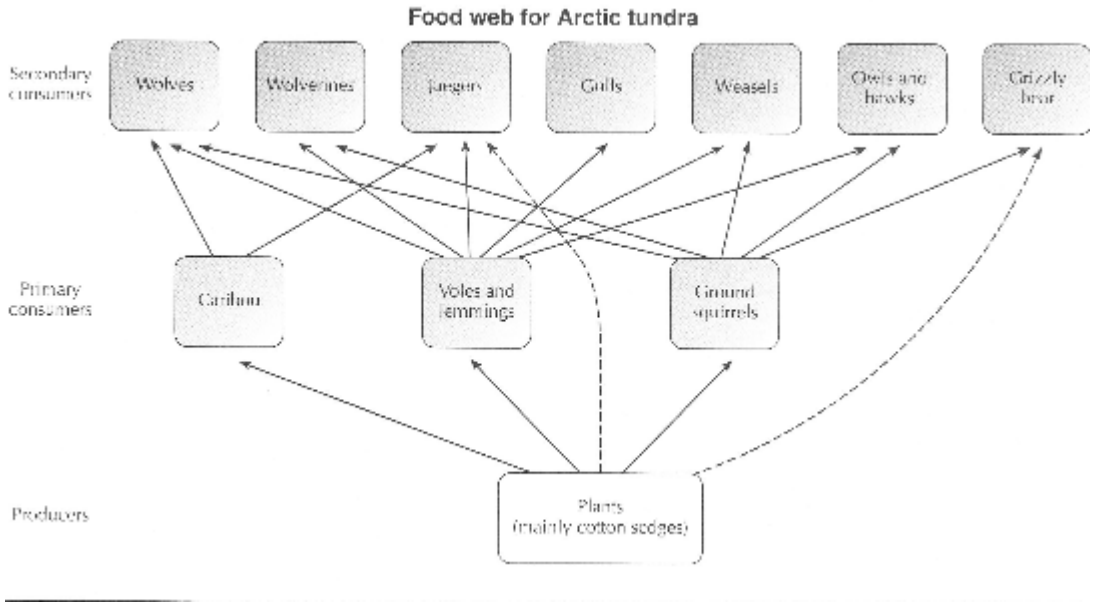
   (b) What is meant by the trophic level of an organism?

   Trophic level refers to an organism's position in a food chain

   (c) In what trophic level are the algae?

   producer

6. Construct a food web for the Arctic tundra using the following information.
   - Plants (mainly cotton Sedges) eaten by caribou, voles, lemmings, ground squirrels, jaegers, grizzly bears
   - caribou are eaten by wolves, jaegers
   - voles and lemmings are eaten by wolves, wolverines, jaegers, gulls weasels, owls, hawks
   - ground squirrels are eaten by wolves, wolverines, weasels, owls, hawks, and grizzly bears



7. Explain what is meant by the carbon cycle. Use the words photosynthesis and cellular respiration in your answer. You may use a diagram.

plants absorb carbon dioxide from the atmosphere
carbon dioxide (and water) are converted to carbohydrates by photosynthesis
consumers eat the plant absorbing the carbohydrates
carbohydrates (and oxygen) are converted to carbon dioxide by cellular respiration

8. This question is about the nitrogen cycle.

(a) How does a plant get the nitrogen that it needs to grow?

nitrogen from the air is converted to nitrates by bacteria that live in the nodules of legumes
plants absorb the nitrates through their roots

(b) What would be a potential problem of over fertilization?

excess nitrogen could run-off into rivers and lakes providing more nitrogen for aquatic plant life
the aquatic plants could grow large enough to crowd out the other organisms that live in that habitat

9. Define biomagnification and give an example of how it works.

increase in concentration of a pollutant from one link in a food chain to another

10. What is meant by the carrying capacity of an environment?

The carrying capacity is the largest population of a species that an environment can support

11. Explain how each of the following factors affect the carrying capacity of an environment:

(a) materials and energy

Populations are limited by amount of usable energy from the sun, as well as the supply of water, carbon, and other essential materials.

(b) food chains

Populations are limited by the amount of food available and the number of predators.

(c) competition

Each organism has the same needs as other organisms (food, water, space). They will compete with each other for these needs.

(d) density

Different species have different needs for space depending on their size, environment and way of life. Overpopulation of a species will result in things like disease, fighting, and low birth rates resulting in a decrease of population.

12. State and explain what happens when a population reaches and exceeds the carrying capacity.

The death rate within the population increases causing the population to decrease.

13. Factors that affect population density are either density-dependent or density-independent. Define each of these terms and provide an example of each.

(a) Density Dependent factor

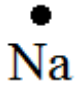
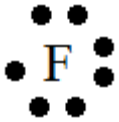
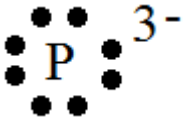
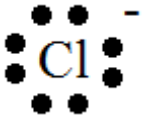
Factors that increase in significance as a population grows

(b) Density Independent factor

the effect on population size does not depend on how many individuals there are in the population

Chemistry In Action

14. Draw an electron dot diagram for each of the following:

(a) Sodium	(b) Magnesium	(c) Fluorine	(d) Sulfur
			
(e) Neon	(f) K^+	(g) P^{3-}	(h) Cl^-
			

15. Name the following compounds:

    (a) KCl *potassium chloride*

    (b) $CaBr_2$ *calcium bromide*

    (c) PbO *lead(II) oxide*

    (d) $CuCl_2$ *copper(II) chloride*

    (e) C_3H_6 *tricarbon hexahydride*

    (f) SiO_2 *silicon dioxide*

16. Write the chemical formula for each of the following compounds.

(a) magnesium sulfide *MgS*

(b) nitrogen trioxide *NO_3*

(c) lead(IV) sulfide *PbS_2*

(d) copper(II) oxide *CuO*

(e) magnesium nitride *Mg_3N_2*

(f) dicarbon tetrahydride *C_2H_4*

17. Write a balanced chemical equation for each of the following reactions and indicate the type of reaction.

(a) __2__Na + _____Cl_2 → __2__NaCl

synthesis

(b) __2__Al + __3__$CuCl_2$ → __2__Cu + __3__$AlCl_3$

single displacement or single replacement

(c) _____H_2O_2 → _____H_2 + _____O_2

decomposition

(d) _____C_3H_8 + __5__O_2 → __3__CO_2 + __4__H_2O

combustion

(e) __2__$NaC_2H_3O_2$ + _____$Cu(NO_3)_2$ → _____$Cu(C_2H_3O_2)_2$ + __2__$NaNO_3$

double displacement or double replacement

18. List 2 properties of acids and 2 properties of bases.

Acids	Bases
Taste sour *Corrode metal*	*Taste bitter* *Feel slippery*

19. Identify 2 common household acids and 2 common household bases.

Acids	Bases
Fruit juices *Carbonated beverages* *Car battery*	*Soap* *Window cleaner* *Drain cleaner* *Quinine*

20. What is the purpose of an indicator?

An indicator shows whether a substance is an acid or a base.

21. Explain how you can use red and blue litmus paper to determine whether a liquid is an acid or a base.

Place both red and blue litmus papers into the liquid. If both of the papers turn red, then the liquid is an acid. If both papers turn blue, then the liquid is a base.

22. What are the reaction products when an acid is combined with a base?

a salt and water

In Motion

23. Frank can run 120 m in 12 s.

(a) What is his average speed in m/s?

$$v = \frac{\Delta d}{\Delta t}$$
$$v = \frac{120m}{12s}$$
$$v = 12m/s$$

(b) Assuming he can run at this average speed for 30 minutes, how far will he travel?

$$30 \text{ minutes} = 30 \times 60 = 180s$$
$$v = \frac{\Delta d}{\Delta t}$$
$$10m/s = \frac{\Delta d}{180s}$$
$$d = 1800m$$

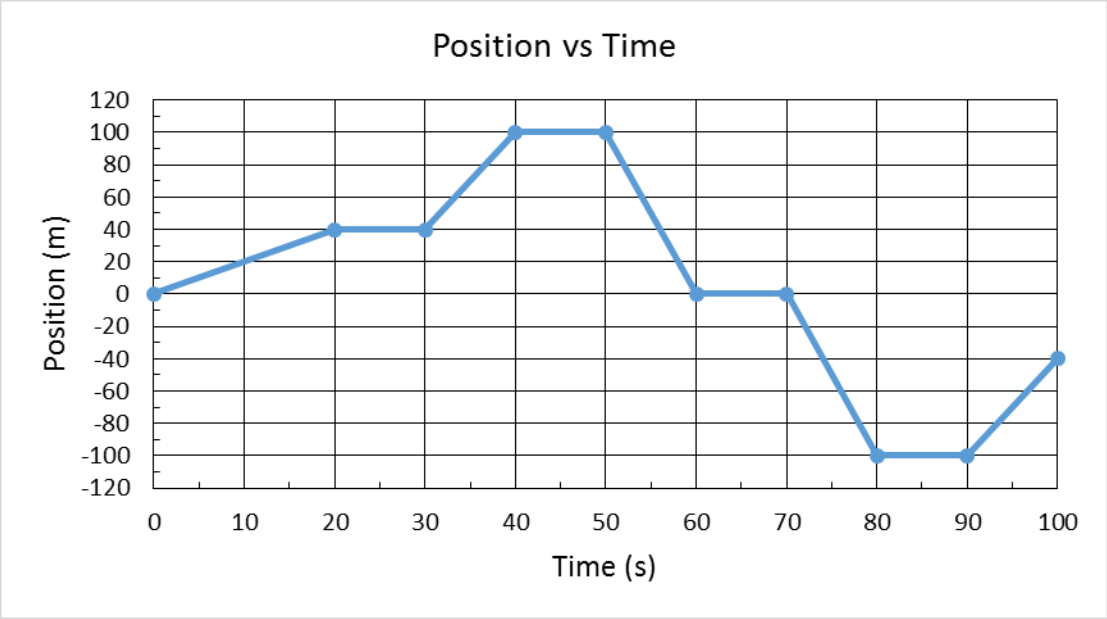
(c) Assuming he can run at this average speed for an extended period of time, how long would it take him to run a distance of 200 km?

$$200km = 200 \times 1000 = 200\,000m$$
$$v = \frac{\Delta d}{\Delta t}$$
$$10m/s = \frac{200\,000m}{t}$$
$$t = 20\,000s$$

24. Fred Flintstone can accelerate his car from 2.5 m/s to 15 m/s in a time of 10 seconds. Calculate the acceleration of the car.

$$\vec{a} = \frac{\vec{v}_2 - \vec{v}_1}{\Delta t}$$
$$\vec{a} = \frac{15m/s - 2.5m/s}{10s}$$
$$\vec{a} = 1.25m/s^2$$

25. Consider the following position-time graph for a duck walking along a road. The positive direction is towards the East.



(a) How far does the duck travel in the trip?

40 + 60 + 100 + 100 + 60 = 360 m

(b) Calculate the displacement of the duck over the entire trip?

$\Delta\vec{d} = -40 - 0 = -40m$ *or* $40m$ *west*

(c) Describe the motion (speed and direction) of the duck during the following time intervals:

(i) 0 - 20 s

moving forward (east) at a constant velocity

(ii) 40 - 50 s

stationary

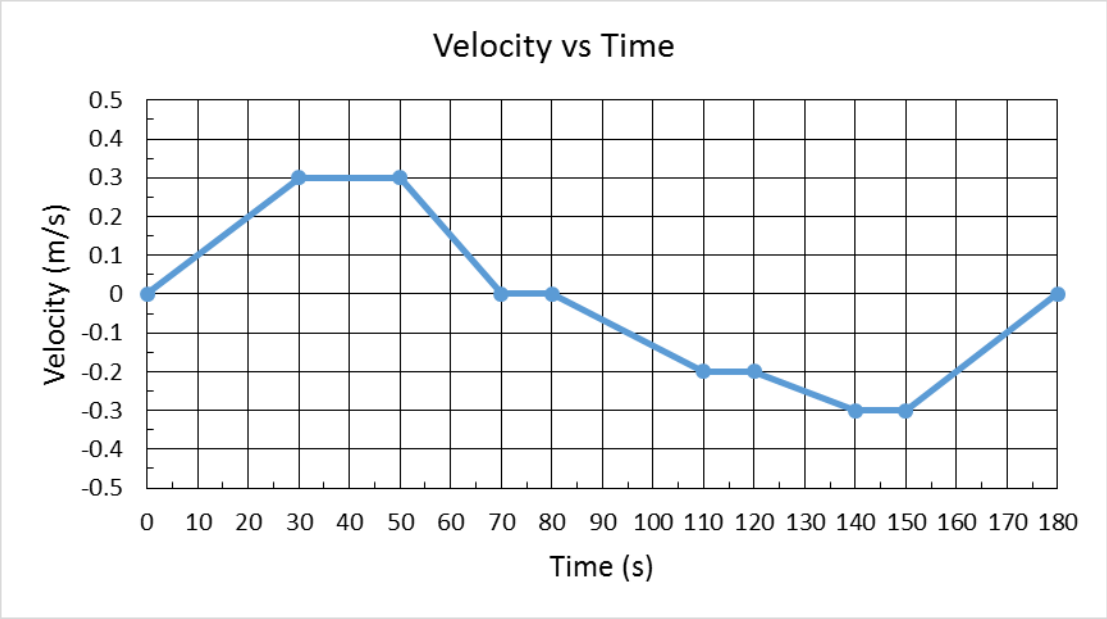
(iii) 70 - 80 s

moving backwards (west) at a constant velocity

(d) What is the velocity of the duck from 50 – 60 s?

$\vec{v} = \dfrac{\Delta\vec{d}}{\Delta t} = \dfrac{0-100}{10} = -10m/s$ *or* $10m/s$ *west*

26. Consider the following velocity-time graph to answer the following questions.



(a) Describe the motion of Billy the Badger (speed, direction) during the following time intervals:

(i) 0 – 30 s

speeding up while traveling forward (north)

(ii) 30 – 50 s

moving forward (north) at a constant velocity

(iii) 50 – 70 s

slowing down while traveling forward (north)

(iv) 150 – 180 s

slowing down while traveling backward (south)

(b) Calculate the badger's acceleration from 120 – 140 seconds.

$$\vec{a} = \frac{\vec{v}_2 - \vec{v}_1}{\Delta t} = \frac{-0.3m/s - -0.2m/s}{20s} = -0.005m/s^2$$

27. In your own words, describe Newton's three laws of motion.

First Law *an object at rest remains at rest and an object in motion remains in motion, unless acted upon by an external unbalanced force.*
Second Law *Force is proportional to mass and acceleration*
Third Law *To every action there is an equal and opposite reaction* *Forces come in pairs*

28. Define momentum and give an example.

Momentum is a property that depends on the mass and the velocity of the object

all moving objects have momentum
the more massive and object, the more momentum
if two objects have the same mass, the faster object has more momentum

29. A deer runs out in front of a car traveling 100 km/h on an icy road (k=0.25). If the deer is 250 m away, will the car stop in time?

$$100\,\tfrac{km}{h} \times \frac{1000}{3600} = 27.8\,\tfrac{m}{s}$$

$$d = kv^2$$

$$d = (0.25)(27.8)^2$$

$$d = 193m$$

Yes, the car will stop in time.

30. Explain how reaction time changes the amount of time required to stop a vehicle.

While you are reacting, the car continues to move forward
someone with a short reaction time will be able to stop sooner than someone with a longer reaction time

31. A car is traveling with a speed of 50 km/h on dry pavement (k = 0.06). The driver has a reaction time of 1.2 s. Calculate the total stopping distance of the car.

$$50\,\tfrac{km}{h} \times \frac{1000}{3600} = 13.9\,\tfrac{m}{s}$$

Reaction Distance

$$v = \frac{d}{t}$$

$$13.9 = \frac{d}{1.2}$$

$$d = 16.7m$$

Braking Distance

$$d = kv^2$$

$$d = (0.06)(13.9)^2$$

$$d = 11.6m$$

Total Stopping Distance = 16.7 + 11.6 = 28.3 m

32. Choose one safety feature on a car and explain how it works to reduce injury to the passengers.

(any reasonable response based on the information in the notes and handout)

Weather Dynamics

33. What is the most abundant gas in the atmosphere?

    nitrogen

34. Which layer of the atmosphere is closest to the earth?

    troposphere

35. Explain what is meant by the hydrosphere.

    all of the water on the earth

36. Explain each of the following:

    (a) ozone layer

    layer near the top of the stratosphere containing a high concentration of ozone

    (b) high pressure system

    air is pushing down

    (c) low pressure system

    air is rising up

    (d) Coriolis effect

    the apparent bending of the motion of the wind due to the rotation of the earth

    (e) albedo

    the ratio of sun light reflected to the amount of sun light absorbed

    (f) jet stream

    fast moving wind in the upper atmosphere that forms between areas of warm and cooler air – they steer storms

(g) prevailing winds

the direction the wind tends to blow in an area
(in Winnipeg the prevailing winds are from the west)

(h) Fujita scale

scale used to measure the strength of a tornado

37. What would the weather be like in Winnipeg during the weather pattern known as El Niño?

Winnipeg would experience warmer than normal winter weather.

38. The following question is about extreme weather events.

(a) Explain how a thunderstorm forms.

warm moist air rises
clouds form as warm air carrying moisture rises within cooler air
as the warm air rises, it cools
the moist water vapor begins to condense
as the moisture condenses, energy is released keeping the air warmer than its surroundings, so that it continues to rise
if enough instability is present, the process will continue long enough until cumulonimbus clouds form

(b) How could you stay safe in a thunderstorm?

seek shelter in an enclosed building or car
if outside, lie flat
in a forest, crouch down by small low lying bushes
(any other reasonable statement)

(c) Explain how a tornado forms.

the air in the updraft of a thunderstorm starts to spin
small cyclones of air in the updraft intensify
the air pressure in the center of the cyclone is lower causing it to spin faster and narrower
a funnel cloud appears

(d) What should you do in the event of a tornado?

go to the basement
go to a designated tornado shelter
stay away from windows and outside walls
(any other reasonable statement)

(e) What conditions are required for Environment Canada to label a snow storm a blizzard?

heavy falling or blowing snow
winds exceeding 40 km/h
visibility reduced to less than 400 m
for at least 4 hours