Circle the correct (best) terms inside the brackets:

1) Soils are [*consolidated / unconsolidated*] [*natural / artificial*] bodies at the earth's surface. Soils contain mineral and organic material, which are [*undifferentiated / differentiated*], by [*weathering / accumulation*] from their parent materials. Soils are [*capable / incapable*] of supporting plants.

2) Saturated flow is more rapid in [*coarse / fine*] textured soils because matric potential is [*greater / less*] and gravimetric potential is [*greater / less*]. Unsaturated flow is more rapid in [*course / fine*] textured soils because the cross-sectional area of water-filled pores and films is [*greater / less*]. Therefore, fine texture soils are a barrier to downward flow in [*saturated / unsaturated*] soils and course texture soils are a barrier to upward flow in [*saturated / unsaturated*] soils.

3) pH is a measure of [H^+ / OH^-] concentration in the soil solution. As the concentration of this ion increases the pH of the soil solution [*increases / decreases*].

4) The five Soil Forming Factors are a concept that defines soils as forming from [*parent material / biota*], upon which are [*relief / weathering*], [*biota / rain*], [*transformations / climate*] act upon over [*parent material / time*].

Please sign your name: _____

Circle the most correct answer for each of the following:

The most abundant element in the earth's continental crust is:
(a) silica
(b) aluminum
(c) iron
(d) magnesium

Unweathered rock-forming minerals are:
(a) primary minerals
(b) secondary minerals
(c) saprolite
(d) coarse fragments

The most abundant cation in highly weathered soil (eg Oxisols) is:
(a) silica
(b) aluminum
(c) iron
(d) magnesium

Metamorphic rocks are formed:
(a) in intense heat followed by cooling
(b) under intense pressure
(c) under heat and pressure
(d) in the earth's core

Sedimentary rocks are formed:
(a) in intense heat followed by cooling
(b) under intense pressure
(c) under heat and pressure
(d) in the earth's core

A physical process leading to soil structure formation is:
(a) wetting and drying
(b) transport by water
(c) colluvial deposition
(d) heating and cooling

Please sign your name: _____

The climate effects soil formation in two dramatic ways. These are through:
(a) temperature and acidity
(b) temperature and moisture
(c) moisture and biota
(d) relief and humidity

The body of material from which soils are formed is termed:
(a) climate
(b) parent material
(c) biota
(d) relief

The terms “granular, angular and subangular blocky, prismatic, massive, etc.” refer to:
(a) structural size
(b) structural shape
(c) aggregate development
(d) particle shape

By volume, total pore space in mineral soils is approximately:
(a) 5%
(b) 25%
(c) 45%
(d) 50%

The most abundant product of aerobic organic decomposition is:
(a) O_2
(b) CO_2
(c) CH_2O
(d) Organic acids

Respiration in soil:
(a) raises CO_2 in the soil pores
(b) raises organic matter content in the soil
(c) raises O_2 in the soil pores
(d) raises soil pH

Please sign your name: _____

Which of the following are most important to **saturated** water flow and gas exchange?

(a) micropores and macropores
(b) interaggregate pores (between peds)
(c) intraaggregate pores (within peds)
(d) a really good attitude

Water moves in soils:

(a) from areas of low water potential to areas of high water potential
(b) from areas of high water potential to areas of low water potential
(c) from areas of more negative water potential to less negative water potential
(d) always in a downward direction

Volumetric water content (θ) is:

(a) volume of water / volume of pores
(b) volume of water / volume of soil
(c) volume of water / mass of soil
(d) volume of water / volume of soil solids

The direction of water movement in soils is determined by:

(a) gravimetric potential
(b) matric potential
(c) solute potential
(d) total potential

A plant may not be able to extract water from wet soil due to:

(a) low matric potential
(b) low gravimetric potential
(c) high solute potential in the soil
(d) high pressure potential in the soil

As the surface area of a soil increases, the matric potential of a soil:

(a) decreases
(b) stays the same
(c) increases
(d) varies

Please sign your name: _____

The characteristic of water that is partly responsible for capillary rise is:

(a) matrix potential
(b) adhesion
(c) soil texture
(d) solute potential

As the bulk density of a soil increases:

(a) the volume of macropores increase
(b) the rate of saturated water flow increases
(c) the rate of saturated water flow decreases
(d) the volume of micropores decreases

Soil color is a good indicator of:

(a) pH and organic matter
(b) drainage and texture
(c) weathering and pH
(d) organic matter and drainage

Which soil will have the better water holding capacity?

(a) a clay with few macropores
(b) a loam with good structure
(c) a loam with poor structure
(d) a sand with many macropores

Which soil will have the more plant available water?

(a) a clay with few macropores
(b) a loam with good structure
(c) a loam with poor structure
(d) a sand with many macropores

Sediment transport is driven by:

(a) wind, water, ice and gravity
(b) car
(c) illuviation/eluviation processes
(d) climate, relief, texture and erosion

Please sign your name: _____

Solar radiation is predominately
(a) long wave
(b) short wave
(c) long and short wave
(d) heat

Earth emits predominately:
(a) long wave radiation
(b) short wave radiation
(c) long and short wave radiation
(d) heat

Global warming associated with clouds is due to:
(a) long wave radiation adsorption
(b) short wave radiation adsorption
(c) long and short wave radiation adsorption
(d) heat

The wavelength of the majority of solar radiation interacts with surfaces and is converted to:
(a) molecular rotation
(b) molecular vibration
(c) electron excitation
(d) ionization

The amount of heat transferred (heat conductivity) will be greatest in a:
(a) dry clay soil
(b) dry sand soil
(c) wet clay soil
(d) wet sand soil

Soils will warm up quicker in the spring with:
(a) mulch on a hot sunny day
(b) no mulch on a hot sunny day
(c) mulch on a hot rainy day
(d) no mulch on a hot rainy day

Please sign your name: _____

Moisture is the most important factor for two of the Soil Orders. These are:
(a) Andisols and Vertisols
(b) Alfisol and Ultisols
(c) Histosols and Aridisols
(d) Gellisols and Mollisols

Mollisols have an associated mollic epipedon with a high accumulation of bases and good structure. These soils form:
(a) under intense weathering and moisture
(b) in cool and moist forests
(c) in grasslands with high organic matter
(d) with at least 20-30% organic matter

Isomorphic substitution accounts for the:
(a) net neutral charge associated with phylosilicate colloids
(b) predominantly negative charge associated with phylosilicate colloids
(c) intermediate weathering associated with kaolinite
(d) predominantly positive charge associated with phylosilicate colloids

The building blocks of minerals are tetrahedral and octahedral crystalline structures formed into sheets. They are made up primarily by:
(a) Si and O in the tetrahedra and Al, Mg and O in the octahedra
(b) Si and O in the octahedra and Al, Mg and O in the tetrahedra
(c) Al and O in the tetrahedra and Si, Mg and O in the octahedra
(d) Al and O in the octahedra and Si, Mg and O in the tetrahedral

The shrink/swell behavior of the 2:1 smectite and vermiculite clays is due to interlayer bonding. Smectites are more expansive than vermiculites due to:
(a) A neutral charge in the tetrahedral layer
(b) predominate isomorphic substitution in the octahedral layer
(c) A neutral charge in the octahedral layer
(d) predominate isomorphic substitution in the tetrahedral layer

Please sign your name: _____

The five Soil Forming Factors are _____, _____, _____, _____ and _____.

A Histosol is made predominately of organic matter. What two Soil Forming Factors are the most important in the formation of a Histosol?

_____ and _____

Radiation arriving from the sun may be *transmitted* to the earth's surface. Some of that radiation is _____ by dust and other particles in the atmosphere and some may be *reflected* by surfaces. The remainder will be _____ by surfaces and transformed into alternate forms of energy.

An Entisol and an Oxisol are soils which represent the two ends of soil development and can differ in ages by millions of years. What *soil forming <u>processes</u>* accounts for these differences and which soil is older?

_____ and _____

The volume of soil is made up of four components. They are _____, _____, _____ and _____.

Capillary rise is the product of two forces. These forces are _____ and _____.

Please sign your name: _____

1) Match the parent material with the most likely means of delivery or location. Write the letter in the space provided.

_____ Loess	A. Ice
_____ Glacial Till	B. in place weathering
_____ Alluvium	C. Wind
_____ Varving	D. Stream outwash
_____ Residual Material	E. Glacial lake

2) Fill in the blanks to complete the following a sentence concerning the five soil forming factors.

Soils are formed from _____, acted upon by _____, _____ and _____ over a period of _____.

3) Reduced (anaerobic) soil conditions have three potential consequences to the soil which we can identify in the field. List two of the three in the space provided.

_____ and _____

Please sign your name: _____

Circle the most correct answer for each of the following:

The most abundant element in the earth's continental crust is:

(e) silica
(f) aluminum
(g) iron
(h) magnesium

Unweathered rock-forming minerals are:

(e) primary minerals
(f) secondary minerals
(g) saprolite
(h) coarse fragments

Metamorphic rocks are formed:

(e) in intense heat followed by cooling
(f) under intense pressure
(g) under heat and pressure
(h) in the earth's core

Igneous rocks are formed:

(i) in intense heat followed by cooling
(j) under intense pressure
(k) under heat and pressure
(l) in the earth's core

A physical process leading to soil structure formation is:

(e) colluvial deposition
(f) wetting and drying
(g) heating and cooling
(h) transport by water

Please sign your name: _____

The relief effects soil formation in two dramatic ways. These are through:

(e) temperature and aspect
(f) temperature and biota
(g) slope and biota
(h) slope and aspect

The terms “granular, angular and subangular blocky, prismatic, massive, etc.” refer to:

(e) structural size
(f) structural shape
(g) aggregate development
(h) particle shape

Texture refers to:

(i) silt, organic matter and clay
(j) sand, silt and organic matter
(k) clay, sand and silt
(l) organic matter, clay and sand

By volume, total mineral content in mineral soils is approximately:

(e) 5%
(f) 25%
(g) 45%
(h) 50%

As the bulk density of a soil decreases:

(e) the volume of macropores decreases
(f) the rate of saturated water flow increases
(g) the rate of saturated water flow decreases
(h) the volume of micropores increase

Please sign your name: _____

Bulk density (D_B) is a measure of:

(e) volume of pores / volume of soil
(f) volume of solids / volume of soil
(g) mass of solids / volume of soil
(h) mass of soil water / volume of soil

Illuviation and eluviation are examples of what soil forming process?

(i) addition
(j) loss
(k) translocation
(l) transformation

Leaching is an example of what soil forming process?

(m) addition
(n) loss
(o) translocation
(p) transformation

Soil color is a good indicator of:

(e) pH and organic matter
(f) drainage and texture
(g) weathering and pH
(h) organic matter and drainage

Sediment transport is driven by:

(e) wind, water, ice and gravity
(f) car
(g) illuviation/eluviation processes
(h) soil forming processes

Please sign your name: _____

Disturbance is the most important factor of what two of the Soil Orders?

(e) Andisols and Entisols
(f) Alfisol and Ultisols
(g) Histosols and Aridisols
(h) Gellisols and Mollisols

Mollisols have an associated mollic epipedon with a high accumulation of bases and good structure. These soils form:

(e) under intense weathering and moisture
(f) in cool and moist forests
(g) in grasslands with high organic matter
(h) with at least 20-30% organic matter

Ultisols can be highly productive soils with good properties for a variety of landuses. The soils form:

(a) under intense weathering and moisture
(b) in cool and moist forests
(c) in grasslands with high organic matter
(d) with least 20-30% organic matter

Soils formed under very hot and wet climates are:

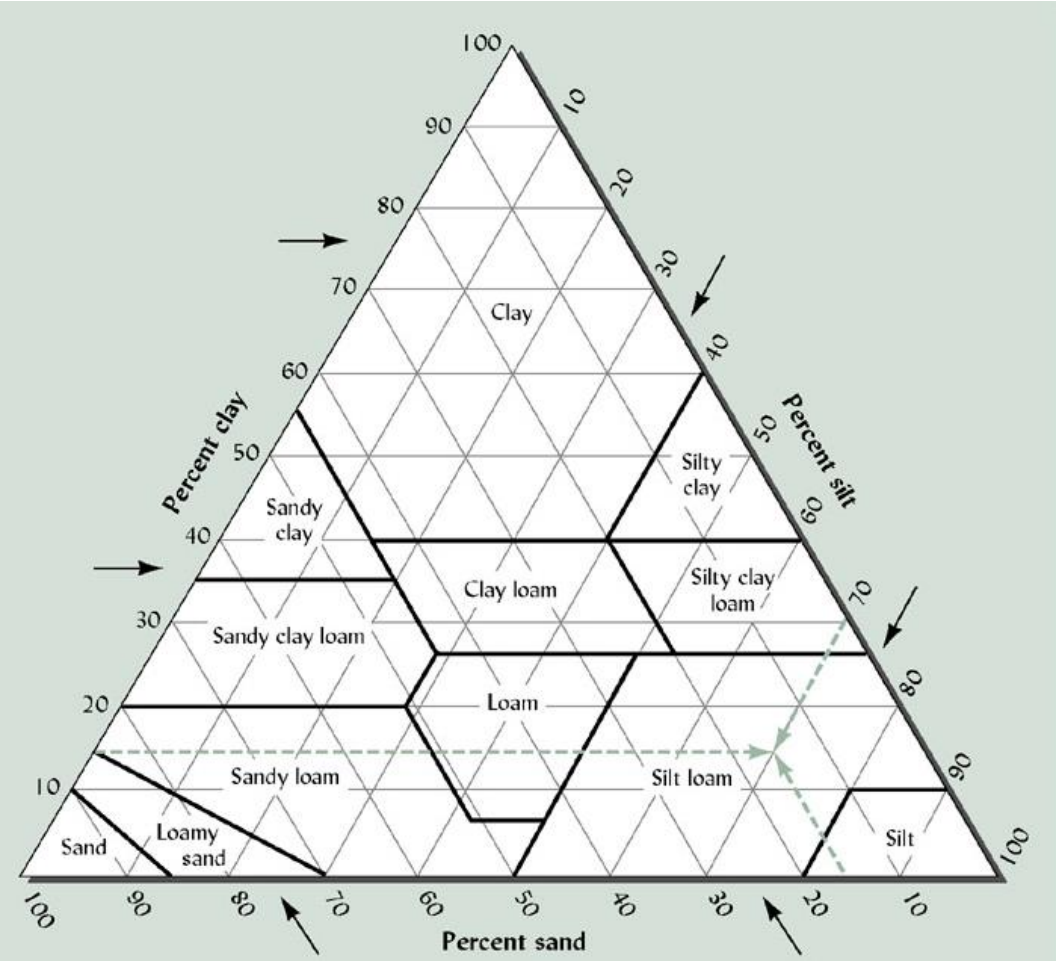
(a) Aridisols
(b) Histosols
(c) Vertisols
(d) Oxisols

Please sign your name: _____

Fill in the blanks:

Refer to the Textural Triangle at the bottom of this page

	Clay	Silt	Sand	Texture
Soil A	10%	_____	73%	_____
Soil B	_____	60%	_____	Silt Loam
Soil C	_____	20%	42%	_____



When hand texturing soils A and C, name three clues that you would use to identify these soils?

_____

_____

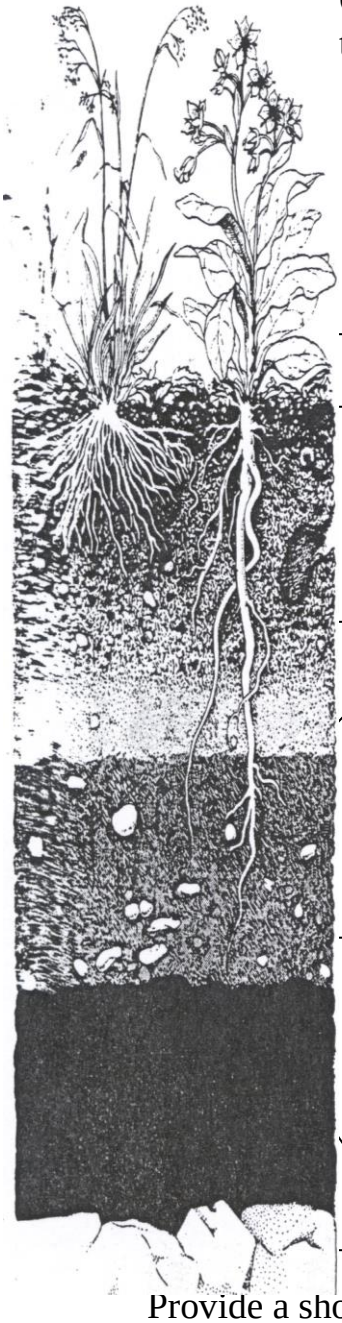
_____

As opposed to course fragments, what is the maximum diameter of an individual grain of the fine earth fragment (soil) in millimeters?

_____

What is the maximum diameter of a **Clay** particle in μm or mm? _____

Please sign your name: _____



On the profile below fill in the Master Horizon letter nomenclature to the appropriate numbered horizon. Use all of the provided letters.

A, B, C, E, O and R

Then provide a **short** definition to the right of the appropriate horizon in the space provided. (write on back of page if necessary)

1

2

3

4

5

6

Provide a short definition of the following subscripts. w, p, t and x

w:

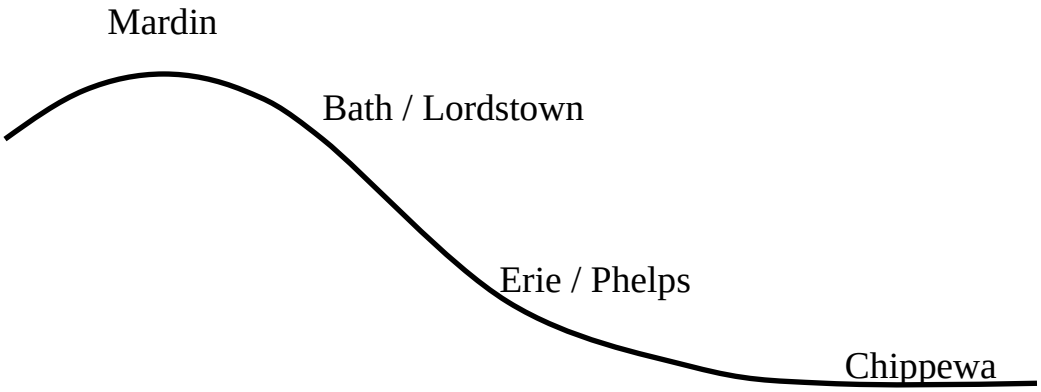
t:

x:

p:

Please sign your name: _____

Landscape position plays an important part in soil association concepts. In the following diagram the four soil are positioned approximately where they are in the landscape. What expectations would you have in relative soil depth and relative drainage for each position on the slope.



Reminder: Include relative depth and expected drainage in your answer.

Mardin:

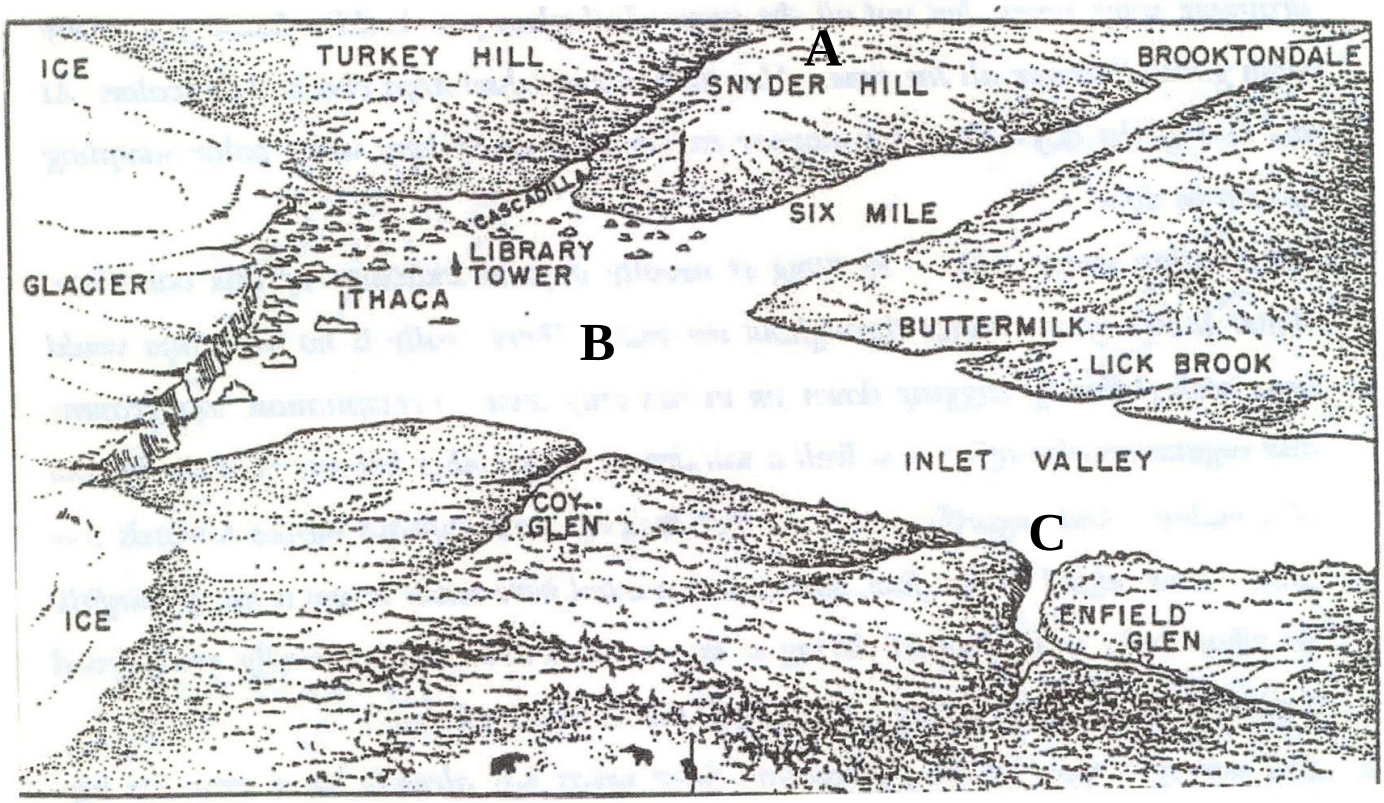
Bath / Lordstown:

Erie / Phelps:

Chippewa:

.

Please sign your name: _____



List what type of parent material you probably would find at the three locations (A, B and C), and describe the source of these materials.

A

B

C

Please sign your name: _____

Circle the best correct answer for each of the following:

1) Prolonged **saturated** subsurface water flow is most rapid in
   (a) coarse textures because matric potential is strong and gravimetric potential is weak
   (b) fine textures because matric potential is strong and gravimetric potential is strong
   (c) coarse textures because matric potential is weak and gravimetric potential is weak
   (d) fine textures because matric potential is weak and gravimetric potential is strong

2) Prolonged **unsaturated** subsurface water flow is most pronounced in
   (a) coarse textures because matric potential is strong
   (b) fine textures because matric potential is strong
   (c) coarse textures because matric potential is weak
   (d) fine textures because matric potential is weak

3) Unweathered rock-forming minerals are:
   (i) primary minerals
   (j) secondary minerals
   (k) saprolite
   (l) coarse fragments

4) The most abundant cation in the earth's continental crust is:
   (e) silica
   (f) aluminum
   (g) iron
   (h) oxygen

5) Metamorphic rocks are formed:
   (m) by intense heat followed by cooling
   (n) under intense pressure
   (o) under heat and pressure
   (p) in the earth's core

Please sign your name: _____

6) A physical process leading to soil structure formation is:
(i) wetting and drying
(j) transport by water
(k) colluvial deposition
(l) heating and cooling

7) Soils are unconsolidated and natural bodies at the earth's surface that contain mineral and organic material, which are
(a) undifferentiated by weathering from their parent materials
(b) differentiated by accumulation from their parent materials
(c) differentiated by weathering from their parent materials
(d) undifferentiated by accumulation from their parent materials

8) The climate effects soil formation in two dramatic ways. These are through:
(i) temperature and acidity
(j) temperature and moisture
(k) moisture and biota
(l) relief and humidity

9) The terms "granular, angular and subangular blocky, prismatic, massive, etc." refer to:
(m) structural size
(n) structural shape
(o) aggregate development
(p) particle shape

10) By volume, total solid materials in mineral soils is approximately:
(i) 5%
(j) 25%
(k) 45%
(l) 50%

Please sign your name: _____

11) Which of the following are most important to **saturated** water flow and gas exchange?

(e) micropores and macropores
(f) interaggregate pores (between peds)
(g) intraaggregate pores (within peds)
(h) a really good attitude

12) Volumetric water content (θ) is:

(q) volume of water / volume of pores
(r) volume of water / volume of soil
(s) volume of water / mass of soil
(t) volume of water / volume of soil solids

13) Sediment transport is driven by:

(i) wind, water, ice and gravity
(j) car
(k) illuviation/eluviation processes
(l) climate, relief, texture and erosion

14) Water moves in soils: (low = near zero Ψ and high = more – or + Ψ)

(e) from areas of low water potential to areas of high water potential
(f) from areas of high water potential to areas of low water potential
(g) from areas of more negative water potential to less negative water potential
(h) always in a downward direction

15) As the surface area per volume of a soil increases, the matric potential of a soil:

(e) decreases
(f) stays the same
(g) increases
(h) varies

Please sign your name: _____

16) As the bulk density of a soil decreases:
(i) the volume of macropores increase
(j) the rate of saturated water flow increases
(k) the rate of saturated water flow decreases
(l) the volume of micropores decreases

17) Soil color is a good indicator of:
(i) pH and organic matter
(j) drainage and texture
(k) weathering and pH
(l) organic matter and drainage

18) Soil texture is a good indicator of:
(a) organic matter and drainage
(b) weathering and pH
(c) drainage and mineralogy
(d) mineralogy and pH

19) Which soil will have the better water holding capacity?
(e) a clay with few macropores
(f) a loam with good structure
(g) a loam with poor structure
(h) a sand with many macropores

20) Which soil will have the more plant available water?
(e) a clay with few macropores
(f) a loam with good structure
(g) a loam with poor structure
(h) a sand with many macropores

Please sign your name: _____

21) Moisture is the most important factor for which two of the Soil Orders.
(i) Andisols and Vertisols
(j) Alfisol and Ultisols
(k) Histosols and Aridisols
(l) Gellisols and Mollisols

22) Mollisols have an associated mollic epipedon with a high accumulation of bases and good structure. These soils form:
(i) under intense weathering and moisture
(j) in cool and moist forests
(k) in grasslands with high organic matter
(l) with at least 20-30% organic matter

23) Illuviation and eluviation are examples of which soil forming process?
(a) addition
(b) loss
(c) translocation
(d) transformation

24) Leaching is an example of what soil forming process?
(a) addition
(b) loss
(c) translocation
(d) transformation

25) Organic matter decomposition is an example of which two soil forming process?
(a) addition
(b) loss
(c) translocation
(d) transformation

Please sign your name: _____

29) The five Soil Forming Factors are _____, _____, _____, _____ and _____.

30) Concerning weathering, (1) which type of weathering process changes minerals from their original composition to a new composition and (2) which type of weathering process simple reduces the particle size of rock?

_____ and _____

31) An Entisol and an Oxisol are soils which represent the two ends of soil development and can differ in ages by millions of years. Name **one soil forming process** that predominately accounts for the differences and which **soil is more developed**?

_____ and _____

32) Capillary rise is the product of two forces. These forces are

_____ and _____

Circle the correct (best) terms inside the brackets:

Please sign your name: _____

1) Soils are [*consolidated / unconsolidated*] [*natural / artificial*] bodies at the earth's surface. Soils contain mineral and organic material, which are [*undifferentiated / differentiated*], by [*weathering / accumulation*] from their parent materials. Soils are [*capable / incapable*] of supporting plants.

2) Saturated flow is more rapid in [*coarse / fine*] textured soils because matric potential is [*greater / less*] and gravimetric potential is [*greater / less*]. Unsaturated flow is more rapid in [*course / fine*] textured soils because the cross-sectional area of water-filled pores and films is [*greater / less*]. Therefore, fine texture soils are a barrier to downward flow in [*saturated / unsaturated*] soils and course texture soils are a barrier to upward flow in [*saturated / unsaturated*] soils.

3) The five Soil Forming Factors are a concept that defines soils as forming from [*parent material / biota*], upon which are [*relief / weathering*], [*biota / rain*], [*transformations / climate*] act upon over [*parent material / time*].

4) Match the parent material with the most likely means of delivery or location. Write the letter in the space provided.

_____ Loess	A. Ice
_____ Glacial Till	B. in place weathering
_____ Alluvium	C. Wind
_____ Residual Material	D. Water

Please sign your name: _____

Circle the most correct answer for each of the following:

7) The most abundant element in the earth's continental crust is:
   (i) silicon
   (j) aluminum
   (k) iron
   (l) magnesium

8) Unweathered rock-forming minerals are:
   (m) primary minerals
   (n) secondary minerals
   (o) saprolite
   (p) coarse fragments

9) Sedimentary rocks are formed:
   (q) in intense heat followed by cooling
   (r) under intense pressure
   (s) under heat and pressure
   (t) in the earth's core

10) A physical process leading to soil structure formation is:
   (m) wetting and drying
   (n) transport by water
   (o) colluvial deposition
   (p) heating and cooling

11) The climate effects soil formation in two dramatic ways. These are through:
   (m) temperature and acidity
   (n) temperature and moisture
   (o) moisture and biota
   (p) relief and humidity

12) Soil color is a good indicator of:
   (m) pH and organic matter
   (n) drainage and texture
   (o) weathering and pH
   (p) organic matter and drainage

Please sign your name: _____

13) The body of material from which soils are formed is termed:
(e) climate
(f) parent material
(g) biota
(h) relief

14) The terms “granular, angular and subangular blocky, prismatic, massive, etc.” refer to:
(q) structural size
(r) structural shape
(s) aggregate development
(t) particle shape

15) By volume, total pore space in mineral soils is approximately:
(m) 5%
(n) 25%
(o) 45%
(p) 50%

16) Illuviation and eluviation are examples of what soil forming process?
(u) addition
(v) loss
(w) translocation
(x) transformation

17) Leaching is an example of what soil forming process?
(a) addition
(b) loss
(c) translocation
(d) transformation

18) Which of the following are most important to **saturated** water flow and gas exchange?
(i) micropores and macropores
(j) micropores
(k) macropores
(l) a really good attitude

19) Water moves in soils:

Please sign your name: _____

(i) from areas of low water potential to areas of high water potential
(j) from areas of high water potential to areas of low water potential
(k) from areas of more negative water potential to less negative water potential
(l) always in a downward direction

20) Volumetric water content (θ) is:
(a) volume of water / volume of pores
(b) volume of water / volume of soil
(c) volume of water / mass of soil
(d) volume of water / volume of soil solids

21) The direction of water movement in soils is determined by:
(e) gravimetric potential
(f) matric potential
(g) solute potential
(h) total potential

22) A plant may not be able to extract water from wet soil due to:
(e) low matric potential
(f) low gravimetric potential
(g) high solute potential in the soil
(h) high pressure potential in the soil

23) As the surface area of a soil increases, the matric potential of a soil:
(i) decreases
(j) stays the same
(k) increases
(l) varies

24) The characteristic of water that is partly responsible for capillary rise is:
(e) gravitational potential
(f) adhesion
(g) soil texture
(h) solute potential

Please sign your name: _____

25) As the bulk density of a soil increases:
(m) the volume of macropores increase
(n) the rate of saturated water flow increases
(o) the rate of saturated water flow decreases
(p) the volume of micropores decreases

26) Which soil will have the better water holding capacity?
(i) a clay with few macropores
(j) a loam with good structure
(k) a loam with poor structure
(l) a sand with many macropores

27) Which soil will have the more plant available water?
(i) a clay with poor structure
(j) a loam with good structure
(k) a loam with poor structure
(l) a sand with good structure

28) Sediment transport is driven by:
(m) wind, water, ice and gravity
(n) car, bus, boat or airplane
(o) illuviation/eluviation processes
(p) climate, relief, texture and erosion

31) Connections: Write a short essay describing the relationship(s) between the following three terms in a coherent, logical fashion.

Temperature Moisture Organic Matter

Please sign your name: _____