Environmental Systems

Subject: Science
Grade: 12
Num Expectations: 59
Num Breakouts: 226

(a) Introduction.

(1) Environmental Systems. In Environmental Systems, students conduct laboratory and field investigations, use scientific methods during investigations, and make informed decisions using critical thinking and scientific problem solving. Students study a variety of topics that include biotic and abiotic factors in habitats, ecosystems and biomes, interrelationships among resources and an environmental system, sources and flow of energy through an environmental system, relationship between carrying capacity and changes in populations and ecosystems, natural changes in the environment, and human activities that impact the natural environment.

(2) Nature of science. Science, as defined by the National Academy of Sciences, is the "use of evidence to construct testable explanations and predictions of natural phenomena, as well as the knowledge generated through this process." This vast body of changing and increasing knowledge is described by physical, mathematical, and conceptual models. Students should know that some questions are outside the realm of science because they deal with phenomena that are not currently scientifically testable.

(3) Scientific hypotheses and theories. Students are expected to know that:

(A) hypotheses are tentative and testable statements that must be capable of being supported or not supported by observational evidence. Hypotheses of durable explanatory power that have been tested over a wide variety of conditions are inof ceivts (a)-1.9 (t)-3. (iv)-1.51 4 er10.006 (n3-2.5 (a)-1nd9

(vi) apply scientific practices to conduct experimental investigations

(vii) use engineering practices to design solutions to problems

(C) use appropriate safety equipment and practices during laboratory, classroom, and field investigations as outlined in Texas Education Agency-approved safety standards;

Breakouts

(i) use appropriate safety equipment during laboratory investigations as outlined in Texas Education Agency-approved safety standards

(ii) use appropriate safety equipment during classroom investigations as outlined in Texas Education Agency-approved safety standards

(iii) use appropriate safety equipment during field investigations as outlined in Texas Education Agency-approved safety standards

(iv) use appropriate safety practices during laboratory investigations as outlined in Texas Education Agency-approved safety standards

(v) use appropriate safety practices durin-4 0 TdB3 ()-7(g)- (ve)so1T2nt)-6.1 (dur)-4 (o)-3.7(o)-3.7(m)4.4 (i)-3.5 (nv)

(ii) evaluate engineering designs

(3) Scientific and engineering practices. The student develops evidence-based explanations and communicates findings, conclusions, and proposed solutions. The student is expected to:

(A) develop explanations and propose solutions supported by data and models consistent with scientific ideas, principles, and theories;

Breakouts

(i) develop explanations supported by data consistent with scientific ideas

(ii) develop explanations supported by data consistent with scientific principles

(iii) develop explanations supported by data consistent with scientific theories

(iv) develop explanations supported by models consistent with scientific ideas

(v) develop explanations supported by models consistent with scientific principles

(vi) develop explanations supported by models consistent with scientific theories

(vii) propose solutions supported by data consistent with scientific ideas

(viii) propose solutions supported by data consistent with scientific principles

(ix) propose solutions supported by data consistent with scientific theories

(x) propose solutions supported by models consistent with scientific

(4) Scientific and engineering practices. The student knows the contributions of scientists and recognizes the importance of scientific research and innovation on society. The student is expected to:

(A) analyze, evaluate, and critique scientific explanations and solutions by using empirical evidence, logical reasoning, and experimental and observational testing, so as to encourage critical thinking by the student;

Breakouts

(i) analyze scientific explanations and solutions by using empirical evidence so as to encourage critical thinking by the student

(ii) analyze scientific explanations and solutions by using logical reasoning so as to encourage critical thinking by the student

(iii) analyze scientific explanations and solutions by using experimental testing so as to encourage critical thinking by the student

(iv) analyze scientific explanations and solutions by using observational testing so as to encourage critical thinking by the student

(v) evaluate scientific explanations and solutions by using empirical evidence so as to encourage critical thinking by the student

(vi) evaluate scientific explanations and solutions by using logical reasoning so as to encourage critical thinking by the student

(vii) evaluate scientific explanations and solutions by using experimental testing so as to encourage critical thinking by the student

(viii) evaluate scientific explanations and solutions by using observational testing so as to encourage critical thinking by the student

(ix) critique scientific explanations and solutions by using empirical evidence so as to encourage critical thinking by the student

(x) critique scientific explanations and solutions by using logical reasoning so as to encourage critical thinking by the student

(xi) critique scientific explanations and solutions by using experimental testing so as to encourage critical thinking by the student

(xii) critique scientific explanations and solutions by using observational testing so as to encourage critical thinking by the student

(B) relate the impact of past and current research on scientific thought and society, including research methodology, cost-benefit analysis, and contributions of diverse scientists as related to the content; and

Breakouts

(i) relate the impact of past research on scientific thought, including research methodology

(ii) relate the impact of past research on scientific thought, including cost-benefit analysis

(iii) relate the impact of past research on scientific thought, including contributions of diverse scientists as related to the content

(iv) relate the impact of past research on society, including research methodology

(v) relate the impact of past research on society, including cost-benefit analysis

(vi) relate the impact of past research on society, including contributions of diverse scientists as related to the content

(vii) relate the impact of current research on scientific thought, including research methodology

(viii) relate the impact of current research on scientific thought, including cost-benefit analysis

(ix) relate the impact of current research on scientific thought, including contributions of diverse scientists as related to the content

(x) relate the impact of current research on society, including research methodology

(xi) relate the impact of current research on society, including cost-benefit analysis

(xii) relate the impact of current research on society, including contributions of diverse scientists as related to the content

(C) research and explore resources such as museums, planetariums, observatories, libraries, professional organizations, private companies, online platforms, and mentors employed in a science, technology, engineering, and mathematics (STEM) field in order to investigate STEM careers.

Breakouts

(i) research STEM careers

(ii) explore resources in order to investigate STEM careers

(5) Science concepts. The student knows the relationships of biotic and abiotic factors within habitats, ecosystems, and biomes. The student is expected to:

(A) identify native plants and animals within a local ecosystem and compare their roles to those of plants and animals in other ecosystems

(D) identify and describe how energy is used, transformed, and conserved as it flows through ecosystems.

Breakouts

(i) identify how energy is used as it flows through ecosystems

(ii) identify how energy is transformed as it flows through ecosystems

(iii) identify how energy is conserved as it flows through ecosystems

(iv) describe how energy is used as it flows through ecosystems

(v) describe how energy is transformed as it flows through ecosystems

(vi) describe how energy is conserved as it flows through ecosystems

(8) Science concepts. The student knows the relationship between carrying capacity and changes in populations and ecosystems. The student is expected to:

(A) compare exponential and logistical population growth using graphical representations;

Breakouts

(i) compare exponential and logistical population growth using graphical representations

(B) identify factors that may alter carrying capacity such as disease; natural disaster; available food, water, and livable space; habitat fragmentation; and periodic changes in weather;

Breakouts

(i) identify factors that may alter carrying capacity

(C) calculate changes in population size in ecosystems; and

Breakouts

(i) calculate changes in population size in ecosystems

(D) analyze and make predictions about the impact on populations of geographic locales due to diseases, birth and death rates, urbanization, and natural events such as migration and seasonal changes.

Breakouts

(i) analyze the impact on populations of geographic locales due to diseases

(ii) analyze the impact on populations of geographic locales due to birth rates

(iii) analyze the impact on populations of geographic locales due to death rates

(iv) analyze the impact on populations of geographic locales due to urbanization

(v) analyze the impact on populations of geographic locales due to natural events

(vi) make predictions about the impaccanalyt(a)2.9 (le)4.7(s)]TJ-0.003 Tc 0.003 Tw 3.052 e

(E) analyze the impact of natural global climate change on ice caps, glaciers, ocean currents, and surface temperatures.

Breakouts

(i) analyze the impact of natural global climate change on ice caps

(ii) analyze the impact of natural global climate change on glaciers

(iii) analyze the impact of natural global climate change on ocean currents

(iv) analyze the impact of natural global climate change on surface temperatures

(10) Science concepts. The student knows how humans impact environmental systems through emissions and pollutants. The student is expected to:

(A) identify sources of emissions in air, soil, and water, including point and nonpoint sources;

Breakouts

(i) identify sources of emissions in air including point sources

(ii) identify sources of emissions in soil including point sources

(iii) identify sources of emissions in water, including point sources

(iv) identify sources of emissions in air including nonpoint sources

(v) identify sources of emissions in soil including nonpoint sources

(vi) identify sources of emissions in water including nonpoint sources