

Question	Concept	Answers	Misconception
1.	Population growth under ideal conditions, i.e. unlimited resources including space.	GRAPH and explanation. The population will increase exponentially (rapidly).	CORRECT ANSWER The population will double (or triple etc.) each year.
		GRAPH and explanation. The population will increase linearly (steadily).	The population will increase by the same number (e.g. 5 individuals) each year.
		GRAPH and explanation. The population will remain the same size.	The population will remain the same size because there will be as many individuals born as dying each year.
		GRAPH and explanation. The population will first increase rapidly and then level off.	Any rapidly growing population will eventually level off even if there are unlimited resources.
2.	Birth and death rates are constant for a population that is growing exponentially.	GRAPH. Birth and death rate increase exponentially as population density increases.	Birth and death rate both have to increase exponentially for a population that grows exponentially.
		GRAPH. Birth rate increases exponentially as population density increases, while death rate stays constant.	Birth has to increase exponentially for a population to grow exponentially, while death rate may stay the same.
		GRAPH. Birth and death rate stays constant.	CORRECT ANSWER A population with constant birth and death rate will grow exponentially. This is one of the assumptions of exponential growth.
		GRAPH. Birth rate increases linearly as population density increases, while death rate stays constant.	Birth has to increase (but not necessarily exponentially) for a population to grow exponentially, while death rate may stay the same.
	A population with a birth rate that decreases with population density is negatively affected by intraspecific competition.	GRAPH. Birth rate is high and stays constant as population density increases.	A birth rate that is high and stays constant as population density increases indicates intraspecific competition.
		GRAPH. Birth rate is low and stays constant as population density increases.	A birth rate that is low and stays constant as population density increases indicates intraspecific competition.
		GRAPH. Birth rate decreases as population density increases.	CORRECT ANSWER A population with a birth rate that decreases with population

			density is negatively affected by intraspecific competition.
		GRAPH. Birth rate increases as population density increases.	A birth rate that increases as population density increases indicates intraspecific competition.
3.	The relationship between per capita growth rate and population density for a population that experience logistic growth.	GRAPH. Per capita growth rate increases linearly with population density and levels off at carrying capacity.	Per capita growth rate is low at low population densities, increases linearly with increasing density and levels off when the population is stable. Students pick this graph because the shape mimics the logistic growth curve.
		GRAPH. Per capita growth rate increases linearly with population density.	Per capita growth rate is low at low population densities and increases linearly with increasing density.
		GRAPH. Per capita growth rate is high at low densities and stays high until the density gets higher. Then decreases linearly as the population approaches carrying capacity.	Per capita growth rate stays high until the density gets close to carrying capacity.
		GRAPH. Per capita growth rate is high at low densities and decreases linearly as the population approaches carrying capacity.	CORRECT ANSWER Per capita growth rate is high at low densities and decreases linearly towards zero as the population approaches carrying capacity.
4.	The per capita growth rate approaches zero as the population size approaches carrying capacity due to competition among individuals of the same species (intraspecific competition).	Other species use up most of the resources.	Populations reach carrying capacity due to competition with other species.
		The goat population has stopped reproducing	Individuals stop reproducing when they reach carrying capacity.
		The goats have used up most of the resources they rely on.	A population reaches carrying capacity when all their resources are gone.
		Competition among the goats inhibits further population growth	CORRECT ANSWER Populations reach carrying capacity due to competition among individuals of the same species.

		Environmental factors inhibit further population growth.	The reason populations stop growing at high densities can best be explained by environmental factors.
6.	When a population reaches carrying capacity its per capita growth rate is close to zero and therefore its birth rate equals the death rate. Understanding how populations behave at carrying capacity.	400 individuals/km ² (where the birth rate is 0).	Population density (or size) is used to indicate a population's carrying capacity. Individuals stop reproducing (birth rate is 0) when the population reaches carrying capacity.
		0.5 (the maximum birth rate).	Per capita birth rate is used to indicate a population's carrying capacity. A population reaches carrying capacity when recruitment (birth rate) is the highest.
		0.3 (the maximum growth rate).	Per capita growth rate is used to indicate a population's carrying capacity. A population reaches carrying capacity when the per capita growth rate is the highest.
		250 individuals/km ² (where birth rate equals death rate).	CORRECT ANSWER Population density (or size) is used to indicate a population's carrying capacity. A population reaches carrying capacity when the per capita growth rate is zero and therefore its birth rate equals the death rate.
		50 individuals/km ² (the population size at maximum growth rate).	Population density (or size) is used to indicate a population's carrying capacity. A population reaches carrying capacity when the per capita growth rate is the highest.
7.	A population is regulated if its death rate increases when its own population density increases.	The death rate increases when the density of introduced predators increases.	The death rate increases when the density of introduced predators increases.
		The death rate increases when the density of natural predators increases.	The death rate increases when the density of natural predators increases.
		The death rate decreases when the density of prey increases.	The death rate decreases when the density of prey increases.
		The death rate increases	CORRECT ANSWER

		when the density of its own population increases.	The death rate increases when the density of its own population increases.
8.	Data analysis. A population is regulated if its death rate decreases when its population density decreases.	The death rate increases as population density decreases.	Problems analyzing the data. Not graphing the data. The death rate increases as population density decreases.
		The death rate decreases as population density decreases.	CORRECT ANSWER
		The death rate stays the same (high) as population density decreases.	Regulation means that the death rate is constant (high). Mixes up a stable population size with a constant death/growth or birth rate.
		The death rate increases with time, but does not depend on population density.	Regulation means that the death rate increases with time.
9.	Graph interpretation. Per capita growth rate is zero at carrying capacity.	5 individuals/km ²	A population reaches carrying capacity when the per capita growth rate is the highest.
		15 individuals/km ²	
		25 individuals/km ²	A population reaches carrying capacity when the per capita growth rate is one
		35 individuals/km ²	
		45 individuals/km ²	CORRECT ANSWER A population reaches carrying capacity when the per capita growth rate is zero
10.	Graph interpretation. A population is regulated if birth rate decreases when the population density increases.	Birth rate decreases when the population density increases.	CORRECT ANSWER
		Survival rate increases when the population density increases.	A population is regulated if survival rate increases when the population density increases.
		Mortality rate decreases when the population density increases.	A population is regulated if mortality rate decreases when the population density increases.
		Mortality rate stays constant when the population density increases.	A population is regulated if mortality rate stays constant when the population density increases.

11.	Graph interpretation. The relationship between per capita growth rate and population density for a population that experience logistic growth.	Exponential population growth	The population size would increase exponentially with time.
		Population size increases linearly with time.	The population size would increase exponentially with time. Picking the graph based on the shape of the original graph.
		Population size decreases exponentially with time.	The population size would decrease exponentially. The population size would level off after some time. Students pick the graph based on the shape of the original graph.
		Logistic growth	CORRECT ANSWER The per capita growth rate is high in the beginning and decreases with increasing density or population size.
		Population size decreases linearly with time.	A decreasing population growth rate must mean a decreasing population size. Students pick the graph based on the shape of the original graph.
12.	A population with a birth rate that decreases and a death rate that increases with population density is negatively affected by intraspecific competition.	Birth and death rate decreases with population density.	A population where both birth and death rate decreases with population density is negatively affected by intraspecific competition.
		Birth and death rate are constant.	A population where both birth and death rate are constant is negatively affected by intraspecific competition.
		Birth rate increases and death rate decreases with population density	A population with a birth rate that increases and a death rate that decreases with population density is negatively affected by intraspecific competition.
		Birth rate decreases and	CORRECT ANSWER

		death rate increases with population density.	
13.	Graph interpretation. The change in population size from year to year, i.e. N_{t+1}/N_t is one at carrying capacity.	5 individuals/km ²	A population reaches carrying capacity when N_{t+1}/N_t is the greatest.
		15 individuals/km ²	
		25 individuals/km ²	CORRECT ANSWER A population reaches carrying capacity when N_{t+1}/N_t is one.
		35 individuals/km ²	
		45 individuals/km ²	A population reaches carrying capacity when N_{t+1}/N_t is zero.
14.	Graph interpretation. A population is regulated if mortality rate increases when the population density increases.	Mortality rate increases when the population density increases.	CORRECT ANSWER The positive relationship between mortality rate and population density is stronger than the negative relationship between birth rate and population density in D.
		Mortality rate decreases when the population density increases.	A population is regulated if mortality rate decreases when the population density increases.
		Survival rate increases when the population density increases.	A population is regulated if survival rate increases when the population density increases.
		Birth rate decreases when the population density increases.	A population is regulated if birth rate decreases when the population density increases. CORRECT , but the negative relationship between birth rate and population density is weaker than the positive relationship between mortality rate and population density in A.
15.	Graph interpretation. Birth rate increases with increasing population density (at low population densities) for a population that experiences an Allee effect. The death rate is normally not affected by the Allee effect.	Birth rate decreases and death rate increases when population density increases.	An Allee effect is regulating the population.
		Birth rate increases with increasing population density and death rate is decreasing.	Both birth and death rates are affected by the Allee effect. If birth rate increases the death rate must decrease.
		Birth and death rates are constant, but nearly equal which means that the per capita growth rate is close	A population that experiences an Allee effect has a per capita growth rate that is close to or below zero at low population

		to zero.	densities, but birth rates are not necessarily low at very low densities.
		Birth rate increases when population density increases at low densities while death rate is constant.	CORRECT ANSWER Birth rate increases when population density increases at low densities while death rate is constant or not affected (this means that the death rate could increase as well due to intraspecific competition).
16.	Data analysis. A population is regulated if the birth rate is decreasing with increasing population density.	The factors regulate because the birth rate does not vary with density.	The factors regulate because the birth rate does not vary with density.
		The factors do not regulate because the birth rate does not vary with density.	The factors do not regulate because the birth rate does not vary with density.
		The factors regulate because the birth rate increases with increasing density.	The factors regulate because the birth rate is density dependent.
		The factors do not regulate because the birth rate increases with increasing density.	CORRECT ANSWER The factors do not regulate because the birth rate increases with increasing density.
17.	Data analysis. A population is regulated if the mortality rate is increasing with increasing population density.	The factors regulate the population because the mortality rate does not vary with density.	The factors regulate the population because the mortality rate does not vary with density.
		The factors do not regulate the population because the mortality rate does not vary with density.	CORRECT ANSWER
		The factors regulate the population because the mortality rate increases with increasing density.	Incorrect analysis. Using the number of dead individuals rather than mortality rate (number of dead individuals/population density).
		The factors do not regulate the population because the mortality rate increases with increasing density.	The factors do not regulate the population because the mortality rate increases with increasing density.