

Where am I? 1 pt each ___ / 9

- 1. (A) ●
- 2. (A) ●
- 3. ● (B)
- 4. (A) ●
- 5. ● (B)
- 6. (A) ●
- 7. ● (B) (C)
- 8. (A) (B) ● (D)
- 9. ● (B) (C) (D)

Populate This ___ / 16

- 10. [3] Overgrazing, Deforestation, Overcultivation, Monocropping, Urbanization [1 ea, max 3]
- 11. [1] **Metapopulations**
- 12. [2] **Matrix quality** refers to the **condition** and **permeability** [1] of the **landscape surrounding** [1] habitat fragments, influencing how easily species can move between them and how suitable the surrounding area is for supporting biodiversity.
- 13. [2] **Natural forms** of habitat fragmentation, like river formation or volcanic eruptions, can lead to long-term evolutionary adaptations, while **artificial fragmentation**, such as urban development or agriculture, often results in reduced biodiversity by isolating species and disrupting ecosystems.
- 14. [2] **Inbreeding depression is more likely to occur.** There is greater chance that an offspring will inherit identical alleles from both parents, thus increasing the chance that a harmful trait is expressed, possibly leading to genetic deformity, reduced fertility, lower survival rate, and susceptibility to disease.
- 15. [1] Less distance means **more** of the same (& vice versa)
- 16. [1] **Increased edge habitats:** Fragmentation creates more edge environments, which often favor invasive species that thrive in altered conditions. **Isolation of native species:** populations are smaller, making them more vulnerable to competition from invasive species. **Easier dispersal:** Fragmented landscapes can provide more pathways and corridors for invasive species to spread, while native species may have more difficulty dispersing across fragmented areas.
- 17. ● (B) (C) (D)
- 18. (A) (B) (C) (D) ● (F)
- 19. (A) (B) ● (D)
- 20. (A) ● (C) (D)
- 21. (A) ● (C) (D)

Here Comes The Sun ___ / 22

- 22. [2] using land for both solar energy production and agricultural activities, promoting ecological benefits by optimizing land use, preserving biodiversity, and reducing carbon emissions.
- 23. [2] conducting environmental impact assessments, using minimal-disturbance mounting systems, and selecting locations that avoid sensitive ecosystems.
- 24. [3] In photovoltaic (PV) cells, **sunlight [+1]** hits the **semiconductor material, typically silicon [+1]**. The PV cell consists of two layers of silicon: one positively charged (p-type) and the other negatively charged (n-type). When sunlight strikes the cell, it excites electrons in the n-type layer, **causing them to flow [+1]** toward the p-type layer, producing a **direct current (DC) [+1]** which is then converted into alternating current (AC) using an inverter for use in homes or businesses.
- 25. [2] Latitude impacts irradiation by determining the **angle [+1] and intensity [+1] of sunlight** a location receives; areas closer to the equator receive more direct sunlight year-round, resulting in higher solar irradiance, while higher latitudes receive less direct sunlight, especially during winter months. Solar farms are often geographically distributed in regions closer to the equator or in areas with higher sun exposure to maximize energy production.
- 26. [3] Solar panels are an example of active solar energy, which require mechanical or electrical components to convert sunlight into usable electricity. **Active solar energy:** systems that use external devices (e.g. pumps, fans, batteries, inverters, etc.) to collect, store, and distribute solar energy. **Passive solar energy** involves using natural building design elements (e.g. windows, walls, insulation) to harness and store solar energy without mechanical assistance.
- 27. [3] Examples: installing south-facing windows, using thermal mass materials, adding skylights, incorporating reflective roofing, and utilizing passive solar heating systems. [accept reasonable answers, 1 pt each max 3]
- 28. [2] Solar farms can **slightly increase local temperatures** due to the heat absorbed and re-radiated by the panels, which can reduce surface albedo and affect microclimates.
- 29. [2] **Adjustable arrays** are generally more efficient because they can track the sun's movement, optimizing the angle of incidence and increasing energy capture throughout the day.

30. [3] **Pros of rooftop solar:** Uses existing infrastructure, saving land space, Reduces electricity bills directly for homeowners, Can be installed without large-scale land requirements. **Cons of rooftop solar:** Limited energy production capacity compared to large solar farms, Roof space availability may restrict installation size, Installation and maintenance costs can be higher for individual homes.

Numbers Game ___ / 34

31. [2] $r = r_{\max} \times (1 - P/K) = 0.1 \times (1 - 0.8) = 0.02$

2% per year [1 pt for correct equation, 1 for correct #]

32. [2] Growth rate = population increase/population $\times 100 = 5\%$

Growth rate with carrying capacity =
 $0.05 \times (1 - 1000/1200) = 0.83\%$
0.83% of 1000 individuals

33. [3] Disease transmission, Competition for food availability, Competition for nesting space, Competition for mates, Territorial disputes, etc.
 [1 pt for each correct answer, max 3]

34. [1] Doubling time $\approx 70 / \text{annual growth rate} \rightarrow$
 annual growth rate $\approx 70 / \text{doubling time}$
Growth Rate $\approx 70/5 = 14\%$

35. [2] Percentage Decrease =
 $(1000 - 750) / 1000 \times 100 = 25\%$.
 Something like a natural disaster.

36. (A) (C) (D)

37. (A) (B) (D)

38. (A) (C) (D)

39. $500 \times (1 + 0.20)^3 = 864$
 [1 for correct equation, 1 for correct number]

40. [2] Understanding population dynamics helps conservation plans by guiding strategies to manage both the growth of vulnerable gull species through habitat protection and the control of harmful gull species through population regulation, ensuring balanced ecosystems and reducing negative impacts on other wildlife.

41. (A) (D) (E)

42. [2] The chemicals responsible for acid rain and the creation of photochemical smog both originate from industrial processes, vehicle emissions, and power plants. **Nitrogen oxides** form two major components of photochemical smog: **ground level ozone** (which is a result of nitrogen oxides reacting with oxygen in the presence of sunlight) and **peroxyacetyl nitrate** (as a result of reaction between nitrogen oxides and hydrocarbons/volatile organic compounds). **Sulfur dioxide** converts into sulfuric acid (H_2SO_4) to form acid rain, and can contribute to particulate matter, or "sulfurous smog."

43. [3] Acid rain can corrode metals, stone, and concrete, leading to deterioration of buildings, bridges, and other infrastructure. This results in higher maintenance costs and damage to historic landmarks. [1 for any of these]

44. [3] Biomagnification is the process by which the concentration of pollutants increases as they move up the food chain [1], while bioaccumulation refers to the buildup of toxins in an individual organism over time [1]; acid rain can contribute to this process by introducing harmful substances like mercury into the environment, which then accumulate and magnify through ecosystems [1]

45. [1] They allow the market to determine the most cost-effective pollution reduction methods

46. (A) (C) (D)

47. (A) (C) (D)

48. (A) (B) (D)

49. (A) (B) (D)

50. (A) (C) (D)

51. (A) (C) (D)

52. [1] PES schemes provide financial incentives for landowners to conserve forests, protect biodiversity, improve carbon sequestration, and maintain ecosystem services like clean water. This helps balance economic growth with environmental protection.

53. [2] **Externalities** occur when the costs (or benefits) of a good or service are not reflected in the market price and are instead imposed on others. [1] **Example:** pollution, where a company emits pollutants into the air or water, harming public health and the environment without bearing full costs of that damage. [1]
[accept other reasonable answers]

Ducking and Weaving / 12

54. [1] Upwelling brings nutrient-rich deep waters to the surface, supporting the growth of plankton, which attracts small fish. These fish are a food source for seabirds, leading to feeding frenzies.

55. [1] Offshore wind power is more effective because there is less friction from the land, resulting in stronger and more consistent winds over the ocean.

56. [2] Wind turbines can be designed with larger, slower-moving blades, or by placing turbines in areas with fewer bird migration routes to reduce the likelihood of collisions. Can be built higher or with one blade painted a color.
[1 pt for each correct answer, max 3]

57. HAWT [1], due to higher efficiency [1]

58. [1] Wave energy is limited by high costs, technological challenges, reliance on specific geographical locations, which makes it less scalable compared to other types like wind and solar. [1 pt for any correct answer]

59. [1] Endocrine disruptor.

60. (A) (C) (D)

61. (A) (C) (D)

62. (A) (C) (D)

63. (A) (B) (C)