Ministry of Education and Technical Education
Central Administration for General Education
Science Consultant office



Biosphere



Atmosphere

INTEGRATED SCIENCE

2026/2027

First Academic Term

1st Year of Secondary stage



Geosphere



Hydrosphere

Review

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Preparation

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أ/ عمرو مالي احمد

رئيس الإدارة المركزية التعليم العام
والمشرف على مستشاري المواد الدراسية
د/ هالة عبد السلام خفاجي

مستشار العلوم
د/ عزيزة رجب خليفة

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Homework

First: Choose the correct answer

1) As the depth of water increases, the intensity of light below the water surface …….. **1 mark**

A) Increases gradually
B) Decreases gradually
C) Decreases then increases
D) Increases then decreases

2) Which of the following represents the correct order of the light zones in ocean water according to their depth, from top to bottom? **1 mark**

A) Twilight zone – Dark zone – Sunlit zone
B) Dark zone – Sunlit zone – Twilight zone
C) Sunlit zone – Twilight zone – Dark zone
D) Twilight zone – Sunlit zone – Dark zone

3) While liquids resist compression and therefore keep an almost constant volume, gases are characterized by …….. **1 mark**

A) Their inability to flow like fluids
B) Being easily compressed and occupying any space in which they exist
C) Keeping a fixed shape and a definite volume under any pressure
D) Increasing their resistance to external pressure as the volume of the space decreases

4) During the penetration of the different colors of the spectrum into ocean water, which of the light colors has its energy absorbed first near the surface (at a depth of about 10 cm)? **2 marks**

A) Orange and blue
B) Red and blue
C) Orange and red
D) Red and yellow

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5) If you know that water pressure increases at a rate of 1 atm for every 10 meters below the surface, what is the total pressure acting on an organism at a depth of 30 meters (knowing that the atmospheric pressure at the surface Pa = 1 atm)? 2 marks

A) 3 atmospheres (atm)
B) 4 atmospheres (atm)
C) 31 atmospheres (atm)
D) 11 atmospheres (atm)

6) The water pressure at a certain depth in sea water is greater than its pressure at the same depth in fresh lake water. This is directly due to …….. 2 marks

A) The increase in the surface area exposed to pressure in sea water
B) The decrease in the weight of the liquid column acting in seas and oceans
C) The higher temperature of fresh lake water compared to seas
D) The increase in the density (ρ) of sea water due to the proportion of salts and plankton in it

7) Deep-sea fish have developed unique adaptations in their cell membranes to withstand the enormous pressure and to prevent the cells from being damaged and crushed. This is achieved through …. 2 marks

A) Increasing the levels of unsaturated fatty acids to maintain the fluidity and stability of the membranes
B) Covering the cell membranes with a thick, hard, calcareous layer that resists the movement of water currents
C) Reducing the internal fluids and relying entirely on compressed gases to generate an opposing pressure
D) Converting the entire skeleton into hard, inflexible bones that prevent cell permeability

8) In the polar regions, the decrease or complete absence of solar radiation during the winter periods leads to a disturbance in the aquatic ecological balance as a result of …….. 2 marks

A) Autotrophic organisms turning into predators that feed on tuna fish
B) Excessive growth of algae and aquatic plants, which prevents the movement of fish
C) A great decrease in the rates of photosynthesis, which affects the availability of food for marine organisms
D) The Gulf Stream stopping and all layers of the ocean freezing down to the bottom

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Second: Essay Questions

درجة السؤال

Q9: Give reason: Algae, aquatic plants and phytoplankton are abundant in the surface layers of water. **1 mark**

Q10: Compare between bony fishes and cartilaginous fishes in terms of the material of the skeleton and the mechanical advantage of each, according to the scientific material. **2 marks**

	bony fishes	cartilaginous fishes
material of the skeleton		
mechanical advantage		

Q11: The body of a research submarine is completely submerged inside a liquid. Its surface area exposed to pressure equals 4 m^2, and the water pressure acting at that point equals 300,000 N/m^2. Calculate the total compressive force acting perpendicularly on the surface of the submarine, stating the law used and the unit. **2 marks**

Q12: Explain, based on your studied, how the Gulf Stream affects the ecological balance and biodiversity in Western Europe. **1 mark**

Q13: Living organisms in the middle depths (from 200 to 1000 meters) depend on unique biological mechanisms for balance. Explain how the "gas-filled swim bladder" works, giving an example from the book. **2 marks**

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Q14: **Explain physically and scientifically the difference in the penetration of light energy through the water surface when sunlight falls perpendicularly compared to when it falls obliquely.** **3 marks**

Q15: **Deduce how deep-sea fish (below 2000 meters), such as the ray fish, have biologically adapted to live under extremely high pressure despite not having gas bladders, and what biological alternatives do other organisms have at those depths?** **3 marks**

Q16: **Analyze the following scientific data: "Water absorbs the warm colors of the spectrum first at shallow depths, while only 1% of visible light – most of it in the blue range – reaches a depth of 100 meters." Explain this phenomenon, showing its relation to the nature of wavelengths.** **3 marks**

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Assessment

Model (A)

First: Choose the correct answer

1) **Aquatic plants and algae grow well in clear water down to a depth of 100 meters, while this depth is greatly reduced in turbid or muddy water. What is the most appropriate scientific explanation for this phenomenon?** — 2 marks

A) Suspended materials and sediments in turbid water absorb and scatter sunlight, which prevents the light needed for photosynthesis from reaching the depths.
B) Turbid water increases the salinity and density of the surface layers, which leads to a direct increase in water pressure and the crushing of algae cells.
C) Sediments block only infrared rays and not the visible spectrum, which affects the water temperature but does not affect photosynthesis.
D) The decrease in light intensity in turbid water speeds up cellular flotation, which pushes algae down to the abyssal depths, where they die.

2) **A diver dives into clear fresh lake water to search for biological samples until reaching a certain depth at which the pressure resulting from the water column alone is equal to 4 atmospheres (4 atm). Calculate the total pressure acting on the diver at this depth.** — 2 marks

A) 3 atmospheres (3 atm)
B) 4 atmospheres (4 atm)
C) 5 atmospheres (5 atm)
D) 14 atmospheres (41 atm)

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3) **Deep-sea fish living at depths exceeding 2000 meters below sea level have highly developed cellular adaptations to ensure that their cells are not damaged and their internal organs do not collapse. Which of the following represents this biochemical adaptation?** **2 marks**

A) **The cell membranes are completely replaced by a flexible, lightweight cartilaginous skeleton that completely prevents gases and oils from entering.**

B) **Their cell membranes contain high levels of unsaturated fatty acids, giving the membranes fluidity and stability under the enormous pressure.**

C) **Increased levels of saturated fatty acids in the structure of the membranes to increase the rigidity and dryness of the cell wall to prevent fluids from moving.**

D) **Relying on huge air swim bladders filled with high-pressure hydrogen gas to balance the external hydrostatic pressure.**

Second: Essay Questions

Q4: **Discuss in detail how solar radiation works as a vital and dynamic factor in maintaining the ecological balance within aquatic environments, showing its compound effect on the vital processes of organisms and on their thermal distribution, citing tuna and cod fish to illustrate the ecological difference.** **3 marks**

Q5: **A salmon dived to a depth of (200m) in the sea during its migration. Calculate the total pressure exerted on its body in (atm) units and in (N/m^2) units."** **3 marks**

Q6: **"Some deep-sea fish possess a bladder containing fluids instead of gases. Explain the biophysical significance of this physical substitution under extreme pressure?"** **3 marks**

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Model (B)

First: Choose the correct answer

1) When visible light penetrates the water column, it behaves in a precisely graded way that leads to the scattering of some colors and the absorption of others. Which of the following statements describes this behavior most accurately according to wavelengths? — 2 marks

A) Water absorbs the warm colors with long wavelengths, such as red and orange, in the first layers, while it scatters the cooler colors with short wavelengths, such as blue, which penetrates the deepest.
B) Water completely absorbs blue and violet in the first 10 centimeters from the surface, while red, which has high energy, penetrates to a depth exceeding 200 meters.
C) All seven colors of the spectrum have the same ability to penetrate, and water absorbs them completely all at once when a fixed depth of exactly 10 meters is reached.
D) Long warm waves are completely scattered in open water, which completely prevents surface plants from carrying out photosynthesis.

2) A bony fish is moving in highly dense salty water. If you know that water pressure increases at a rate of 1 atmosphere (1 atm) for every 10 meters of descent below the surface, what is the actual depth at which the fish is located when the total pressure acting on it equals 11 times the atmospheric pressure? — 2 marks

A) 10 meters
B) 90 meters
C) 100 meters
D) 110 meters

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3) **An environmental researcher is studying the movement balance of salmon during their migration and their change of depth between seas and rivers. What biological mechanism, granted by God to these organisms in their body structure, regulates buoyancy and mechanical balance under changing pressure conditions?** **2 marks**

A) **Using huge oily liver cells to absorb atmospheric gases directly from the water surface and pump them into the outer blood cells.**
B) **Relying on increasing the flexibility of their cell membrane by reducing the proportions of unsaturated fatty acids to resist freshwater currents.**
C) **Completely getting rid of the internal skeleton and replacing it with very low-density hydraulic fluids equal to river water.**
D) **Possessing gas-filled swim bladders (air sacs) that help them control their buoyancy and balance, and move between different depths.**

Second: Essay Questions

Q4: "Explain in detail the impact of seasonal variations in solar radiation intensity on the aquatic ecological balance in polar regions during winter, illustrating its effect on photosynthesis and food abundance? **3 marks**

Q5: Identify accurately and briefly the quantitative and physical differences in the absorption and penetration of the energy of infrared rays and the energy of visible light through the different depths of water (at a depth of 10 cm, a depth of 10 meters, and a depth of 100 meters). **3 marks**

Q6: Explain scientifically and physically: why does the water pressure acting on the body of a marine organism at a depth of 50 meters inside salty sea water differ from the pressure acting on it at the same depth (50 meters) inside still fresh lake water? **3 marks**

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Model (C)

First: Choose the correct answer

1) **Marine organisms are distributed vertically and horizontally in an unequal (uneven) manner within oceanic environments. What is the direct criterion for this unequal distribution?** — **2 marks**

A) Changes in the speed of marine radio waves
B) The geological depth level of benthic rocks only
C) Navigation movement and marine vessels
D) The varying needs of organisms for light and energy

2) **Sunlight falls on ocean water at different angles due to the motion of the Earth and the change of seasons. In which of the following cases is the amount of light energy penetrating the water surface at its maximum, and when is a larger amount reflected back to the atmosphere?** — **2 marks**

A) The penetrating amount is at its maximum when the rays fall obliquely at a very acute angle, and they are completely reflected when they fall perpendicularly.
B) The amount of penetrating light is very large when sunlight falls perpendicular to the surface, while the penetrating amount decreases and the reflected amount increases when it falls obliquely.
C) The angle of incidence of sunlight has no effect at all on penetration, and the same amount of light energy penetrates the surface throughout the hours of day and night.
D) Oblique rays penetrate ocean water to reach the abyssal dark zone immediately, while perpendicular rays are trapped in the first 10 cm.

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3) **A liquid (such as water) resists compression almost completely, which makes it keep a constant volume, while gases are easily compressed. How do the cells of deep-sea organisms make use of this physical property of liquids to survive under the crushing high pressure?** **2 marks**

A) **They have compact bodies, protein components, and internal fluids that withstand pressure, and some of them do not have gas bladders, to prevent their collapse, and their bladders contain fluids instead of gases.**

B) **Their cells absorb huge amounts of compressible gases to fill the swim bladder until the outer wall of the fish bursts.**

C) **They replace the internal fluids with completely dry, compressible air cells to reduce the size of the fish by 90% when descending to the bottom.**

D) **They depend on a skeleton made of pure calcium to absorb the pressure of the fluids and convert it into warm thermal energy for the cell.**

Second: Essay Questions

Q4: **Explain in detail the symbiotic and dynamic ecological relationship between solar radiation and the flourishing growth of coral reefs near the equator, showing the role of this radiation throughout the year in stimulating the microorganisms that live inside their tissues, and clarifying the physical properties of the water (temperature and depth) required for this coral flourishing.** **3 marks**

Q5: **Calculate accurately the value of the compressive force (F), in newtons, acting on a small exploration submarine whose surface area exposed to pressure equals 2 square meters (A = 2 m^2), if it is located at a point inside the sea where the water pressure equals 400,000 N/m^2, and state the law used.** **3 marks**

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Q6: **Explain scientifically and anatomically: why do cartilaginous fish such as sharks and rays have a flexible and lighter-weight movement advantage in the depths and aquatic environments compared to bony fish such as tilapia, and what is the nature of the tissue that forms their internal skeleton?** **3 marks**

***** End of Questions *****

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