READING PASSAGE 3

*You should spend about 20 minutes on **Questions 27-40**, which are based on Reading Passage 3 below.*

Movement Underwater

A Self-propelled motion is a fundamental ability in many organisms. From the beating flagella of tiny plankton keeping afloat near the ocean surface to the playful perfection of dolphins surfing the bow wave of a ship, marine creatures have adopted a huge variety of styles, speeds, and methods of movement. Each species has its own particular need for the evolutionary developments that have taken place, but the basic requirements are the same—finding food, avoiding predation, seeking a mate or a safe place to have young, or migrating to an area with more favorable conditions.

B The particular physical properties of water that most affect movement are density, viscosity (stickiness), and buoyancy. Seawater is about 800 times denser than air and nearly 100 times as viscous. Consequently, there is much more resistance to movement than on land, as anyone will know who has ever tried to wade through waist-deep water. However, with density comes much greater buoyancy, so that organisms need to spend relatively little energy to stay afloat. As they move through the ocean environment, organisms seek to make wave motion, currents, and natural turbulence work to their advantage, not to their detriment.

C Most fishes have swim bladders to help them offset the density of their bodies and so maintain neutral buoyancy with minimal effort. These small, gas-filled chambers contain specialized networks of blood vessels that can add or remove gases such as oxygen and carbon dioxide. The ability to remain indefinitely at a constant depth without expending energy is especially important for slow-moving fishes that seek food in the shallows, or for those that hunt and scavenge in kelp forests. Active swimmers, such as mackerel, skipjacks, and sharks, do not have swim bladders because they need to change depth more rapidly than they could regulate the gas content. These fishes must swim forever or they will sink.

D Many animals, especially the tiny zooplankton, have taken to a life of simply drifting near the surface, contentedly feeding on the microscopic phytoplankton and bacteria floating there. Although life among the plankton might seem easy, there is in fact a remarkable range of movement. Some tiny plankton only 1–2 mm in length actually travel long distances each day. Species that live below the level where sunlight reaches nightly swim hundreds of meters up to the surface to feed in the relative safety of darkness. At dawn, they sink back down in an effort to escape predators—a double journey equivalent to a person swimming 700 km a day.

E It has taken marine creatures millions of years of evolution to overcome the chief deterrent to motion through a dense medium such as water—that of drag resistance. Swimming efficiency has been achieved by minimizing the three types of drag created by friction, turbulence, and body form. To reduce surface friction, the body must be smooth and rounded. In addition, the scales of most fishes are coated with slime to lubricate their passage through water. To reduce the turbulent drag created as water flows around the moving shape, a rounded front end and tapered back end are required. To reduce form drag, the cross-sectional area of the body should be minimal—a pencil shape would be ideal. The combined shape, taking into account all three types of drag, is the streamlined torpedo form of a tuna, the fastest-swimming of all fishes.

F Speed is only one of three important aspects of swimming ability. Tuna, swordfish, and mackerel all specialize in fast, steady cruising, but there are many other fishes for whom sustained speed is less important, such as the barracuda. This formidable predator specializes in swift acceleration, and has a far higher success rate for its attacks than its steady-cruising cousins. The freshwater pike, which lurks in the shadows until its quarry is within striking distance and then lunges with great rapidity, achieves a remarkable 70–80 percent success rate. The third specialization is maneuverability, best demonstrated by the butterfly fishes. These have disk-shaped bodies that permit abrupt changes of track. Many fishes are generalists, being at least partly proficient in all three modes of movement.

G Almost all fishes swim by undulation. Strong W-shaped muscles along the side of the body progressively contract and relax in sequence, from head to tail and from side to side, creating a traveling horizontal wave. The body is thrown into a series of curves that press sideways and back against the water, producing a forward thrust. The narrow, elongated forms of eels and sea snakes allow easy undulation along their full length. In contrast, the more stubby and inflexible bodies of armor-plated trunkfish use only the swish of their short tail fins to move themselves through the water. Most other fishes combine elements of both methods, coordinating powerful strokes of the tail fins with subtle body undulations.

H A fish's fins also play a vital and versatile role. The vertically oriented dorsal and ventral fins on the back and belly control sideways motion, while up-and-down motion is controlled by the pectoral and pelvic fins on the fish's sides. Whereas the shape of the tail fin relates directly to speed—crescent-moon-shaped for fast cruising, broad and flat for acceleration—the style and arrangement of the other fins are crucial for maneuverability. Puffer fishes scull with tiny, oscillating pectoral fins, while butterfly fishes undulate their broad dorsal and ventral fins, twisting and turning with great precision through intricate coral reefs.

Questions 27–31

*Reading Passage 3 has eight paragraphs, **A–H**.*

Which paragraph contains the following information?

*Write the correct letter, **A–H**, in boxes **27–31** on your answer sheet.*

27 A strategy to avoid being attacked

28 How fish are able to keep afloat naturally

29 The physical process by which fish propel themselves ahead

30 A list of reasons why different creatures move from one place to another

31 How the medium of water both restricts and aids movement

Questions 32–35

Complete the table below.

*Choose **NO MORE THAN TWO WORDS** from the passage for each answer.*

*Write your answers in boxes **32–35** on your answer sheet.*

Specialisation	
Specialised ability	**Example fish species**
Ability to maintain the same **32** ________ over long distances	Swordfish
Rapid **33** ________	Barracuda
Sudden attack on prey following period of lying in wait	**34** ________
Rapid changes of direction	**35** ________

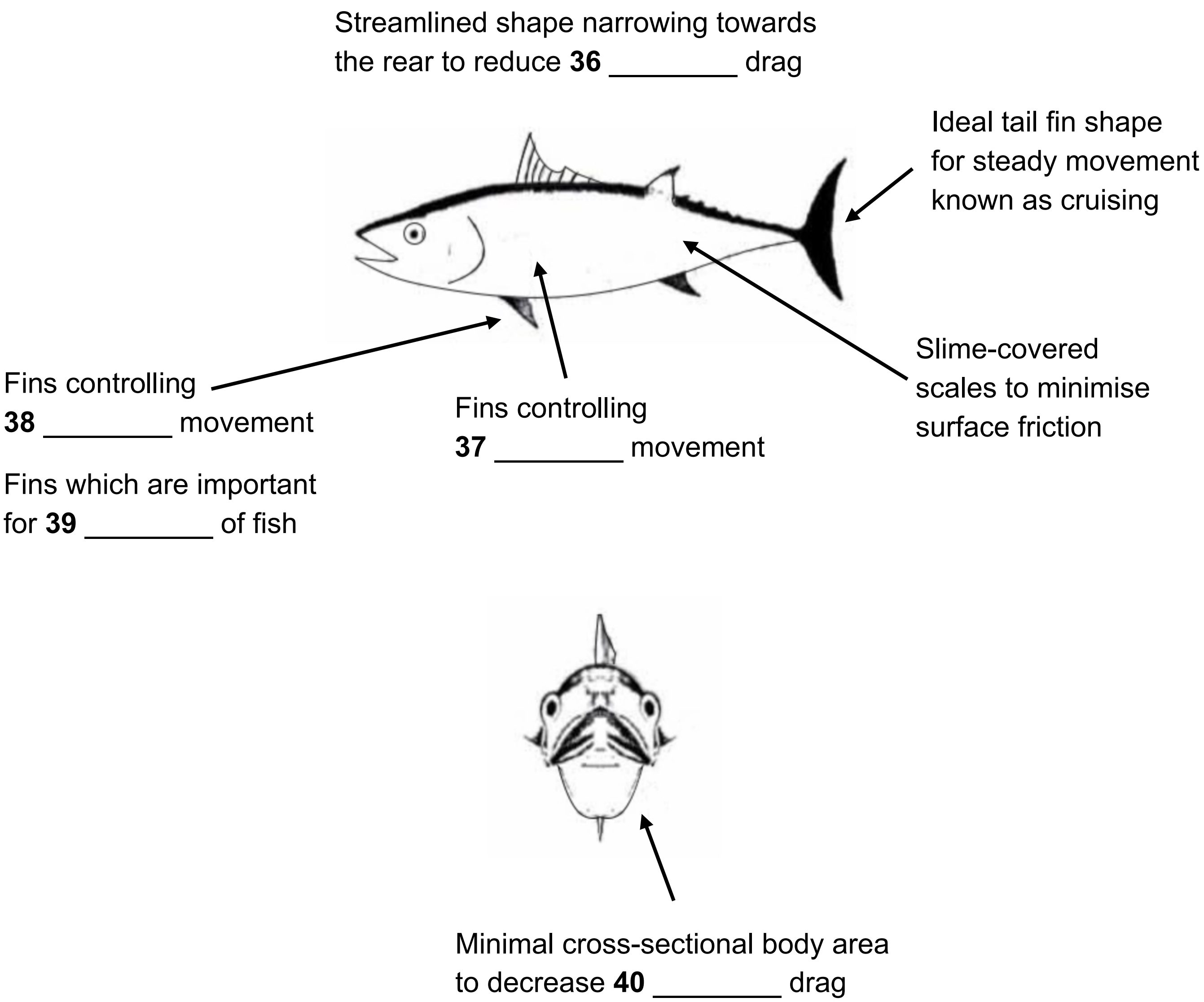
Questions 36–40

Complete the diagram below.

Choose ***NO MORE THAN TWO WORDS*** *from the passage for each answer.*

Write your answers in boxes ***36–40*** *on your answer sheet.*

Mobility, stability and combating different types of drag resistance



段落匹配 | Questions 27–31

题号	答案	题干翻译	精确定位（第 X 段英文原句）	定位句中译	解析（同义改写 & 排除）
27	**D**	一种避免被攻击的策略	**D 段**：“At dawn, they sink back down in an effort to **escape predators**—a double journey…”	“拂晓时，它们又沉回深处，**以躲避捕食者**——这是一段相当于人类日游 700 公里的双程旅途。”	题干的 *strategy to avoid being attacked* = 通过“夜晚上浮觅食，天亮下潜”来规避捕食者的攻击。其它段：A 讲迁移/求偶等动因；B 讲水的物理特性；C 讲鳔；G/H 讲推进与鱼鳍。故选 D。
28	**C**	鱼如何能够自然地保持漂浮	**C 段**：“Most fishes have **swim bladders**… maintain **neutral buoyancy** with minimal effort.”	“大多数鱼拥有**鱼鳔**，以极小代价维持**中性浮力**。”	“keep afloat naturally” 对应 “maintain neutral buoyancy”。C 段专述鱼鳔如何调节气体实现自然悬浮。
29	**G**	鱼推进自身向前的物理过程	**G 段**：“…creating a traveling horizontal wave… producing a **forward thrust**.”	“（肌肉）形成水平行进波……产生**向前的推力**。”	题干的 *physical process* 即“体侧肌肉按序收缩放松→体轴成波→对水产生反作用力→前进”。其它段虽提到速度/形态，但唯 G 段详述推进机制。
30	**A**	不同生物从一处移动到另一处的各种原因清单	**A 段**：“…the basic requirements are the same—**finding food, avoiding predation, seeking a mate… migrating** to an area with more favorable conditions.”	“基本需求相同——**觅食、避敌、求偶/育幼、迁移**至条件更佳的区域。”	直接列举“为何而动”的清单式原因，完美对应题干。
31	**B**	水这种介质如何既限制又帮助运动	**B 段**：“…much more **resistance** to movement… However, with density comes much greater **buoyancy**… organisms seek to make… **turbulence work to their advantage**…”	“水对运动的**阻力更大**……然而更高的密度带来更大的**浮力**……生物试图让**波浪/洋流/湍流**为己所用。”	“restricts”= 阻力/黏度；“aids”= 浮力 + 借势波流。B 段兼述两面性。

流程图填空 | Questions 32–35

（每空 不超过两个词）

题号	答案	题干翻译	精确定位（第 X 段英文原句）	译文	解析
32	**speed**	具备在长距离上保持同一**速度**的能力（剑鱼）	**F 段**：“Tuna, **swordfish**, and mackerel all specialize in **fast, steady cruising**.”	“金枪鱼、剑鱼、鲭鱼都擅长**快速而稳定的巡航**。”	“steady cruising” 的本质是“保持恒定**速度**”进行远距离巡航，故填 *speed*。
33	**acceleration**	**快速加速**（梭鱼）	**F 段**：“the barracuda… specializes in **swift acceleration**.”	“梭鱼专长于**迅速加速**。”	题干 “Rapid ___” 与原文 “swift acceleration” 同义替换。
34	**freshwater pike** *(或 pike)*	伏击后突然攻击猎物（潜伏一段时间）	**F 段**：“The **freshwater pike**, which **lurks**… then **lunges** with great rapidity…”	“淡水狗鱼先潜伏，待猎物进入攻击距离便迅猛突袭。”	题干描述与句中 “lurks → lunges” 的伏击突袭链条完全一致。允许写成 *pike*（单词）或 *freshwater pike*（两词）。
35	**butterfly fishes**	**迅速改变方向**	**F 段**：“The third specialization is **maneuverability**, best demonstrated by the **butterfly fishes**… permit **abrupt changes of track**.”	“第三种专长是**机动性**，蝶鱼最能体现，可突然改变航向。”	“rapid changes of direction” = “abrupt changes of track”。故填物种 *butterfly fishes*。

图示填空 | Questions 36–40

（每空 不超过两个词）

题号	答案	题干/图示提示中译	精确定位（第 X 段英文原句）	译文	解析
36	**turbulent**	流线型、后部收窄以减少 — 阻力	**E 段**：“To reduce the **turbulent drag**… a rounded front end and **tapered back end** are required.”	“要减少**湍流阻力**，需要前端圆钝、后端**渐缩**。”	“narrowing towards rear（后部收窄）” 对应 “tapered back end”，故为 *turbulent*（湍流）阻力。
37	**up-and-down**	控制上下运动的鳍	**H 段**：“**up-and-down motion** is controlled by the **pectoral and pelvic fins**…”	“**上下运动由胸鳍和腹鳍控制**。”	图中对应侧面的胸/腹鳍。写法按题干连字符 *up-and-down*。
38	**sideways**	控制**横向/侧向**运动的鳍	**H 段**：“The vertically oriented **dorsal and ventral fins**… control **sideways motion**.”	“**背鳍与腹（臀）鳍**控制**侧向运动**。”	与 37 互补；图中指向背/腹（竖直取向）鳍。
39	**maneuverability**	对鱼类的**机动性**很重要的鳍	**H 段**：“the style and arrangement of the other fins are crucial for **maneuverability**.”	“其他鱼鳍的样式与组合对**机动性**至关重要。”	直接原词。美式拼写 *maneuverability*；若用英式 *manoeuvrability*，按原文以美式为准。
40	**form**	最小横截面积以减少 — 阻力	**E 段**：“To reduce **form drag**, the cross-sectional area of the body should be minimal.”	“要减少**形状阻力**，身体的横截面积应尽可能小。”	“cross-sectional body area minimal → reduce **form** drag”。