READING PASSAGE 3

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

Music: Language We All Speak

A Music is one of the human species' relatively few universal abilities. Without formal training, any individual, from Stone Age tribesman to suburban teenager, has the ability to recognise music and, in some fashion, to make it. Why this should be so is a mystery. After all, music isn't necessary for getting through the day, and if it aids in reproduction, it does so only in highly indirect ways. Language, by contrast, is also everywhere — but for reasons that are more obvious. With language, you and the members of your tribe can organise a migration across Africa, build reed boats and cross the seas, and communicate at night even when you can't see each other. Modern culture, in all its technological extravagance, springs directly from the human talent for manipulating symbols and syntax.

Scientists have always been intrigued by the connection between music and language. Yet over the years, words and melody have acquired a vastly different status in the lab and the seminar room. While language has long been considered essential to unlocking the mechanisms of human intelligence, music is generally treated as an evolutionary frippery — mere "auditory cheesecake", as the Harvard cognitive scientist Steven Pinker puts it.

B But thanks to a decade-long wave of neuroscience research, that tune is changing. A flurry of recent publications suggests that language and music may equally be able to tell us who we are and where we're from — not just emotionally, but biologically. In July, the journal *Nature Neuroscience* devoted a special issue to the topic. And in an article in the 6 August issue of the *Journal of Neuroscience*, David Schwartz, Catherine Howe and Dale Purves of Duke University argued that the sounds of music and the sounds of language are intricately connected.

To grasp the originality of this idea, it's necessary to realise two things about how music has traditionally been understood. First, musicologists have long emphasised that while each culture stamps a special identity onto its music, music itself has some universal qualities. For example, in virtually all cultures, sound is divided into some or all of the 12 intervals that make up the chromatic scale — that is, the scale represented by the keys on a piano. For centuries, observers have attributed this preference for certain combinations of tones to the mathematical properties of sound itself.

Some 2,500 years ago, Pythagoras was the first to note a direct relationship between the harmoniousness of a tone combination and the physical dimensions of the object that produced it. For example, a plucked string will always play an octave lower than a similar string half its size, and a fifth lower than a similar string two-thirds its length. This link between simple ratios and harmony has influenced music theory ever since.

C This music-is-math idea is often accompanied by the notion that music, formally speaking at least, exists apart from the world in which it was created. Writing recently in *The New York Review of Books*, pianist and critic Charles Rosen discussed the long-standing notion that while painting and sculpture reproduce at least some aspects of the natural world, and writing describes thoughts and feelings we are all familiar with, music is entirely abstracted from the world in which we live. Neither idea is right, according to David Schwartz and his colleagues. Human musical preferences are fundamentally shaped not by elegant algorithms or ratios but by the messy sounds of real life, and of speech in particular – which in turn is shaped by our evolutionary heritage. “The explanation of music, like the explanation of any product of the mind, must be rooted in biology, not in numbers per se,” says Schwartz.

Schwartz, Howe and Purves analysed a vast selection of speech sounds from a variety of languages to reveal the underlying patterns common to all utterances. In order to focus only on the raw sounds, they discarded all theories about speech and meaning, and sliced sentences into random bites. Using a database of over 100,000 brief segments of speech, they noted which frequency had the greatest emphasis in each sound. The resulting set of frequencies, they discovered, corresponded closely to the chromatic scale. In short, the building blocks of music are to be found in speech.

Far from being abstract, music presents a strange analogue to the patterns created by the sounds of speech. “Music, like visual arts, is rooted in our experience of the natural world,” says Schwartz. “It emulates our sound environment in the way that visual arts emulate the visual environment.” In music we hear the echo of our basic sound-making instrument — the vocal tract. The explanation for human music is simpler still than Pythagoras’s mathematical equations: we like the sounds that are familiar to us — specifically, we like the sounds that remind us of us.

This brings up some chicken-or-egg evolutionary questions. It may be that music imitates speech directly, the researchers say, in which case it would seem that language evolved first. It’s also conceivable that music came first and language is in effect an imitation of song — that in everyday speech we hit the musical notes we especially like. Alternatively, it may be that music imitates the general products of the human sound-making system, which just happens to be mostly speech. “We can’t know this,” says Schwartz. “What we do know is that they both come from the same system, and it is this that shapes our preferences.”

D Schwartz's study also casts light on the long-running question of whether animals understand or appreciate music. Despite the apparent abundance of "music" in the natural world — birdsong, whale song, wolf howls, synchronised chimpanzee hooting — previous studies have found that many laboratory animals don't show a great affinity for the human variety of music making.

Marc Hauser and Josh McDermott of Harvard argued in the July issue of Nature Neuroscience that animals don't create or perceive music the way we do. The fact that laboratory monkeys can show recognition of human tunes is evidence, they say, of shared general features of the auditory system, not any specific chimpanzee musical ability. As for birds, those most musical beasts, they generally recognise their own tunes — a narrow repertoire — but don't generate novel melodies like we do. There are no avian Mozarts.

But what's been played to animals, Schwartz notes, is human music. If animals evolve preferences for sound as we do — based upon the soundscape in which they live — then their "music" would be fundamentally different from ours. In the same way our scales derive from human utterances, a cat's idea of a good tune would derive from yowls and meows. To demonstrate that animals don't appreciate sound the way we do, we'd need evidence that they don't respond to "music" constructed from their own sound environment.

E No matter how the connection between language and music is parsed, what is apparent is that our sense of music, even our love for it, is as deeply rooted in our biology and in our brains as language is. This is most obvious with babies, says Sandra Trehub at the University of Toronto, who also published a paper in the *Nature Neuroscience* special issue.

For babies, music and speech are on a continuum. Mothers use musical speech to "regulate infants' emotional states", Trehub says. Regardless of what language they speak, the voice all mothers use with babies is the same: "something between speech and song". This kind of communication "puts the baby in a trance-like state, which may proceed to sleep or extended periods of rapture". So if the babies of the world could understand the latest research on language and music, they probably wouldn't be very surprised. The upshot, says Trehub, is that music may be even more of a necessity than we realise.

一、人物与观点对照表

人名	观点要点（可作匹配线索）	证据定位
Steven Pinker（哈佛认知科学家）	将音乐视为进化上的“装饰品”（非核心适应），称其为“**auditory cheesecake**（听觉奶酪蛋糕）”。匹配线索：**音乐=进化的“奢侈品/甜点”**。	“music is generally treated as an evolutionary frippery — mere ‘auditory cheesecake’, as … Steven Pinker puts it.”
David Schwartz（杜克大学）	核心立场：**音乐偏好根植于生物学与人类语音**，而非纯粹数学比率；音乐**模拟/回响**了人类声道产生的语音模式；音乐与语言可能出自**同一声音系统**。	“must be rooted in biology, not in numbers per se,”；“Music … is rooted in our experience of the natural world … echo of our … vocal tract.”；“they both come from the same system.”
Catherine Howe（杜克大学）	与 Schwartz、Purves 共同论证：**音乐声音与语言声音存在精细联系**；其团队用 **10 万＋语音片段**统计，发现**语音频率分布≈半音阶**。	“argued that the sounds of music and the sounds of language are intricately connected.”；“Using a database of over 100,000 … corresponded closely to the chromatic scale.”
Dale Purves（杜克大学）	同上，与 Schwartz、Howe 合作者：**音乐基石可在语音中找到**；强调**音乐—语言的生物学共源**。	“the building blocks of music are to be found in speech.”；“they both come from the same system.”
Charles Rosen（钢琴家与评论家）	介绍**传统观点**：音乐**抽离于自然/日常世界**，不同于绘画/雕塑/文字对自然或心理的再现（注意：他在文中**阐述并引出**该观点，随后被 Schwartz 等**反驳**）。匹配线索：**音乐=抽象、脱离现实**（传统说法）。	“music is entirely abstracted from the world in which we live.”（Rosen 讨论的长期观点）
Pythagoras（毕达哥拉斯）	早期**音乐—数学比率理**论：和谐与发声体**几何比例**相关（半长=低八度；2/3 长=纯五度）。匹配线索：**简单整数比与和谐**。	“a plucked string … an octave lower … half its size, and a fifth … two-thirds its length.”
Marc Hauser & Josh McDermott（哈佛）	**动物不以人类方式创造/知觉音乐**；猴子识别人类曲调仅反映**听觉系统通用特征**；鸟类识别**自种曲调但不创作新旋律，“没有鸟中莫扎特”**。匹配线索：**动物≠人类式音乐**。	“animals don’t create or perceive music the way we do … recognition … evidence … general features … There are no avian Mozarts.”
（Schwartz 对动物音乐的补充）	若动物的声音偏好也源自其**自身声景**，它们的“音乐”应与人类不同；要证伪动物的“音乐欣赏”，需看其对**基于本物种声景**构成的“音乐”**是否无反应**。匹配线索：**物种特定声景→特定“音乐”**。	“If animals evolve preferences … based upon the soundscape … a cat’s idea of a good tune would derive from yowls and meows … need evidence that they don’t respond to ‘music’ constructed from their own sound environment.”
Sandra Trehub（多伦多大学）	婴儿视角：**音乐与言语在连续体上**；母亲以**介于言语与歌唱之间的“音乐化言语”**来**调节婴儿情绪**，使其**入定/入睡或欣喜**；由此**音乐或许更为必需**。匹配线索：**婴儿—母语调—必要性**。	“For babies, music and speech are on a continuum … ‘something between speech and song’ … ‘puts the baby in a trance-like state’ … ‘music may be even more of a necessity’.”

> 备注：Schwartz–Howe–Purves 三人组既提出**音乐—语言精细联系**，又用**语音统计→半音阶**的证据支撑**“音乐偏好根植语音/生物学”**这一方向。

二、段落主旨梳理（A–E）

段落	主旨一句话	关键要点（备考提示）	证据定位
A	音乐**普遍存在却非生存必需**；与语言的“必需性/工具性”形成对照；传统上（如 Pinker）音乐被视为**进化“甜点”**。	① 音乐的“普遍—神秘”vs 语言的“功能—必要”；② 研究地位差异：语言=解锁智力关键；音乐=“auditory cheesecake”。	普遍性与对比：；“auditory cheesecake”：
B	**近十年神经科学**促成观念转变：音乐与语言或同样揭示**我们的生物学本质**；提出**音乐—语言紧密相连**的论点，并回顾**音乐的跨文化共性**与**数学比率传统**。	① 新证据与专题：**Nature Neuroscience** 特刊；② 杜克团队主张“音乐声与语言声**精密关联**”；③ **半音阶的跨文化普遍性**；④ 传统“数学决定和谐”回顾（为下段伏笔）。	新研究与主张：；共性/半音阶：；毕达哥拉斯比率：
C	**反驳“两大传统”**（音乐=数学；音乐=抽象）：Schwartz 等主张**音乐偏好源自语音/生物学**；实证显示**语音频率分布≈半音阶**；音乐**模拟**我们的声道与声景。	① 否定“纯数学/纯抽象”解释；② **10 万+语音片段**统计→半音阶；③ **“像视觉艺术模拟可视世界，音乐模拟可听世界”**；④ 引出“先有语言还是先有音乐”的**进化次序**问题。	反驳与生物学根基：；语音→半音阶：；“模拟/声道”与偏好：；进化先后：
D	**动物与音乐**：Hauser & McDermott 认为动物**不以人类方式**创造/知觉音乐；Schwartz 补充：应以**物种自身声景**构造“音乐”再检验。	① 猴子识别人类曲调≠“音乐能力”，只是**听觉系统通用性**；② 鸟类**曲库有限、难创新（“无鸟中莫扎特”）**；③ 若以**本物种声景**编曲，或见不同结果。	动物观点与“无鸟中莫扎特”：；物种声景检验：
E	**婴儿与母婴互动**证明音乐—语言**深植于生物学/大脑**：母亲用**介于言语与歌唱**的声调调节婴儿情绪，音乐可能**更为必需**。	① 音乐—语言在婴儿处于**连续体**；② **“音乐化言语”**让婴儿入定/入睡或欣喜；③ “音乐或许**更为必需**”。	生物学根植与婴儿证据：，