中國銀行(香港)呈獻:
Bank of China (Hong Kong) Presents:
國家發展成就系列
National Development and Achievements Series

臻至完美
APPROACHING PERFECTION

運動與科學的交匯 The Intersection of Sports and Science

趣味習作 Activity Sheet

教師指南
Teachers' Guide

在參觀是次專題展覽後,鼓勵學生分享他們在運動日誌中所記錄的觀察;教師可分享相關展品知識,深化對運動科學的理解。

After visiting the special exhibition, students are encouraged to share observations recorded in their Progress Tracker, while teachers can share knowledge related to exhibits to deepen understanding of the sports science.

任務一:躍網體驗
Mission 1: Experiencing the Jump Serve!

學習錦囊 Knowledge Quest

跳躍的力量

在排球運動中,跳躍高度會影響攻防表現。沙灘排球的場地由鬆軟的沙地構成,其支撐力遠低於硬地。為了提升跳躍效率,運動員以「全腳掌蹬地」起跳,避免腳掌陷入沙中,從而有效地產生反作用力。

排球的空氣動力學

展品中的排球雖被繩索固定,無法呈現運動中的動態,但在實際扣球或跳發時,球體通常會向前旋轉。這種旋轉改變了球體周圍的氣流分布:球體上方的氣流因與旋轉方向相反而減速,形成高壓;下方氣流則因順向旋轉而加速,形成低壓。這種壓力差促使空氣將球「壓向下方」,造成球體急速下墜,形成強烈的攻擊效果。

The Power of Jumping

In volleyball, jump height is important for both offense and defense. The beach volleyball court consists of soft sand, which offers far less support than solid ground. To maximise jumping efficiency, athletes take off flat-footed to prevent their feet from sinking into the sand, thereby effectively generating powerful reaction force.

The Aerodynamics of Volleyball

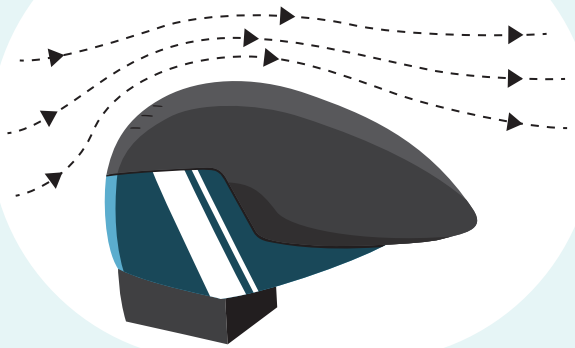
Although the volleyball in the exhibit is tethered and cannot demonstrate dynamic movement, in actual spikes or serves, the ball typically spins forward (topspin). This spin alters the airflow around the ball: the air on top moves against the spin, slowing down and creating high pressure; while the air below moves with the spin, accelerating and creating low pressure. This pressure difference "pushes" the ball downward, resulting in a sharp drop and creating a potent attacking effect.

任務二：風洞探秘
Mission 2: Unveiling the Wind Tunnel

試調整展品內頭盔的角度，並記錄氣流在頭盔表面上的流動情形。

Adjust the angle of the helmet in the exhibit, and record how the air flows over its surface.

參考答案
Suggested Answer



學習錦囊 Knowledge Quest

風阻是影響單車手表現的關鍵因素之一，最常用作評估和降低風阻的指標是阻力係數與迎風面積。為了減少風阻，單車頭盔多採用流線型設計，以有效引導氣流順暢流動，降低阻力。單車運動員通常採取低頭伏身的姿勢，將肘部靠近身體，並調整把手和座位高度，務求減少迎風面積。

Wind resistance is one of the key factors affecting a cyclist's performance. The most commonly used indicators for evaluating and reducing wind resistance are the drag coefficient and the frontal area. To reduce wind resistance, cycling helmets often feature a streamlined design to effectively guide airflow, thereby reducing drag. Cyclists typically adopt a tucked position and adjust the handlebar and saddle height to minimise the frontal area.

任務三：劍尖之舞
Mission 3: Sword Dance

根據展品的指示學習劍擊運動的揮劍技巧。
畫出／描述你所學到的技巧重點。

Follow the instructions of the exhibit to learn the sword-wielding skills of fencing. Draw or describe the key points of the skills you have learned.

參考答案
Suggested Answer

弓步是進攻的主要步法之一，運動員提起前腳並大步跨前，屈膝90度，後腳伸直推動身體。

Lunge is one of the main footwork of attack in fencing. The fencer takes a large step forward with the front foot, bending the font knee to a 90-degree angle. At the same time, the back leg extends fully, driving the body forward with power.

學習錦囊 Knowledge Quest

運動員在蹬腿時會把後腳的底部緊貼地面，以增加接觸面，從而提升蹬腿所產生的反作用力，間接增強爆發力，提升進攻速度。

When pushing off, fencers keep the entire sole of the rear foot flat against the ground to increase contact area, thereby enhancing the reaction force. This force boosts explosive power and improves attacking speed.

任務四：營養滿分
Mission 4: Nutrition Optimisation

選擇三種有助提升運動表現的食物，並記錄其主要營養成分。

Choose three foods that can enhance athletic performance, and record their primary nutritional components.

參考答案
Suggested Answer

食物 Food	主要營養成分 Primary nutritional components
牛油果 Avocado	脂肪 Fats
全麥麵包 Whole wheat bread	碳水化合物 Carbohydrates
煎蛋 Fried egg	蛋白質及脂肪 Proteins and fats

學習錦囊 Knowledge Quest

食物中各類營養對運動員提升表現至關重要，有策略地攝取營養可提升耐力與加速恢復。
以下為三大營養素的功能：

Nutrients from food are essential for athletic performance, and strategic consumption can enhance endurance and recovery. Below are the functions of the three main nutrients:

營養成分 **Nutritional Components**	**功能** **Functions**
碳水化合物 Carbohydrates	主要能量來源，分解後的碳水化合物會以不同形式儲存在身體各部位： • **肌肉**：以肌糖形式儲存，為肌肉活動提供能量 • **肝臟**：以肝糖形式儲存，維持血糖穩定 • **血液**：以血糖形式存在，為腦部運作提供能量 對於進行耐力運動的運動員而言，攝取高品質的碳水化合物有助於延長體力、維持穩定表現。 Primary source of energy. After being broken down, carbohydrates are stored in the body as follows: • **Muscles:** Stored as muscle glycogen, providing energy for muscle activity. • **Liver:** Stored as liver glycogen, helping to maintain stable blood sugar levels. • **Blood:** Circulates as blood glucose, supplying energy for brain function. For endurance athletes, consuming carbohydrate-rich foods helps prolong stamina and maintain stable performance.
蛋白質 Proteins	建造、修補肌肉和細胞，有助提升耐力運動員的表現。 Build and repair muscles and cells, improving the performance of endurance athletes.
脂肪 Fats	為持續時間較長的中低強度耐力運動提供穩定的能量。 Provide a stable energy source for prolonged, low-to-moderate intensity endurance exercise.

任務五：體適能大挑戰
Mission 5: Physical Fitness Challenge

挑戰兩項體適能動作，並記錄其正確姿勢。

Challenge yourself with two fitness test items and record the correct posture while performing them.

參考答案
Suggested Answer

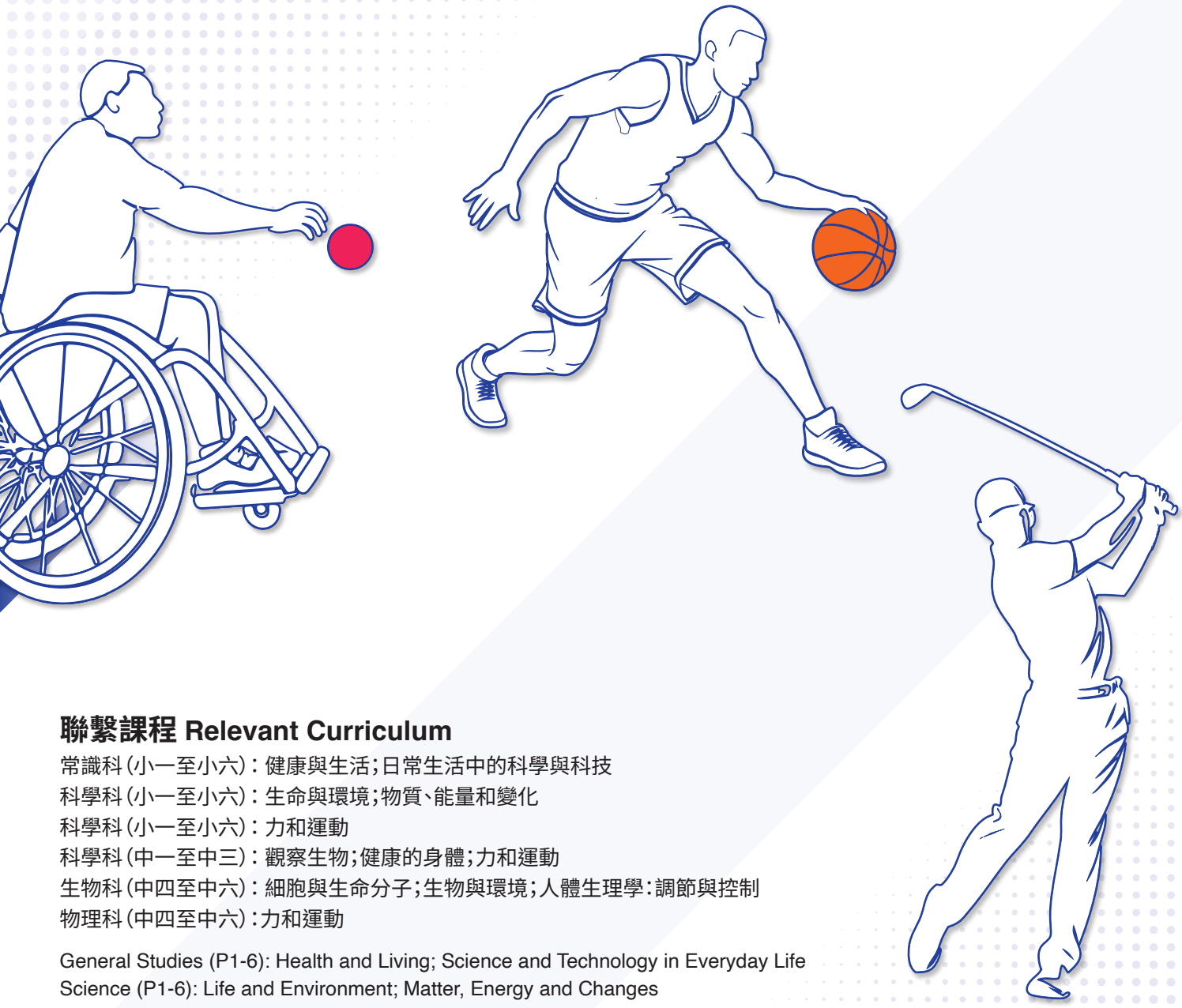
坐地體前伸
Sit and reach test

仰卧起坐
Sit-up

學習錦囊 Knowledge Quest

人體有三種主要的肌肉類型：骨骼肌、平滑肌和心肌。其中，骨骼肌是我們身體中最常見的肌肉類型，人體共有600多條骨骼肌，約佔全身重量的30%至40%。骨骼肌附着在骨骼上，透過肌腱連接，負責支撐身體結構並產生運動，是我們能夠行走、奔跑、跳躍等動作的關鍵。骨骼肌屬於「隨意肌」，也就是我們可以有意識地控制的肌肉，通常需要由大腦發出神經訊號來指揮其收縮與放鬆。體適能測試有助我們了解肌肉的功能狀態，也能作為訓練成效的指標。透過持續的運動訓練，如重量訓練、有氧運動或伸展活動，骨骼肌能逐漸增強其力量、耐力與柔軟度，進而提升健康與生活品質。

Human body has three main types of muscle: skeletal muscle, smooth muscle, and cardiac muscle. Skeletal muscle is the most common type in our body, with over 600 skeletal muscles that account for approximately 30% to 40% of total body weight. Skeletal muscles are attached to our bones by tendons and are responsible for the body support and movement, making them crucial for actions such as walking, running, and jumping. Skeletal muscle is classified as "voluntary muscle". We can control the muscles consciously, typically relying signals from the brain to command contraction and relaxation. Fitness challenges help us understand the functional status of muscles and can serve as an indicator of training effectiveness. Through regular training, such as resistance training, aerobic exercise, or stretching activities, we can enhance our skeletal muscles' strength, endurance, and flexibility, thus contributing to better health and quality of life.



聯繫課程 Relevant Curriculum

常識科(小一至小六):健康與生活;日常生活中的科學與科技
科學科(小一至小六):生命與環境;物質、能量和變化
科學科(小一至小六):力和運動
科學科(中一至中三):觀察生物;健康的身體;力和運動
生物科(中四至中六):細胞與生命分子;生物與環境;人體生理學:調節與控制
物理科(中四至中六):力和運動

General Studies (P1-6): Health and Living; Science and Technology in Everyday Life
Science (P1-6): Life and Environment; Matter, Energy and Changes
Science (S1-3): Looking at Living Things; Healthy Body; Force and Motion
Biology (S4–6): Cells and Molecules of Life; Organisms and Environment; Human Physiology: Regulation and Control
Physics (S4-6): Force and Motion