**Mechanics of Movement Questions**

**Impulse**

**Heptathletes are required to complete the 200 metre sprint, as shown in Figure1.**

**A 200 metre runner must exert a large force in a short period of time to generate an impulse.**

**Sketch and label a graph to show the impulse generated during the acceleration phase of a 200 metre race.**

***(3 marks)***

*3 marks for 3 of:*

A. X Axis – (time)/milliseconds/seconds

B. Y Axis – (force)/Newton’s

C. Shape of graph – negative and positive components of force shown with negative first

D. Positive impulse clearly larger than negative impulse

E. Positive and negative (force) labelled

**Newtons Laws**

**Using ‘Newton’s First’ and ‘Second Laws of Motion’, explain how the swimmer dives off the starting blocks. *(4 marks)***

*4 marks for 4 of:*

1. Force is applied by the muscles

**Newton’s First Law of Motion/Law of inertia**

B. Performer will remain on the blocks unless a force is applied

C. Performer continues to move forwards with constant velocity until another force is applied

D. Water slows the swimmer

**Newton’s Second Law of Motion/Law of Acceleration**

E. Mass of swimmer is constant

F. Greater the force exerted on the blocks, the greater the acceleration/momentum

G. Force governs direction

**The final stage of an endurance race often involves a sprint finish.**

**Using Newton’s Second Law of Motion, explain how an athlete is able to accelerate towards the finish line. *(3 marks)***

*3 marks for 3 of:*

A. Mass of runner is constant

B. Force = Mass x Acceleration

C. Greater the force exerted on the floor, the greater the acceleration/ momentum/proportional

D. Force governs direction

E. Force provided by muscular contraction

F. Ground reaction force

**Projectiles**

**One event in the heptathlon is the shot put, as shown in Figure 2. This involves one powerful, explosive movement.**

**Name three factors that affect the distance the shot travels. *(1 mark)***

1. Height, Speed and Angle of release

**Copy Figure 4 and label your diagram (*person throwing a shot put showing a parabolic flight path)* to show the changing vertical and horizontal vectors at the following points:**

** The point of release**

** The highest point of flight**

** The point immediately before landing. *(3 marks)***

*3 marks for 3 of:*

**Point of release**

A. Positive vertical component

**Highest point**

B. No vertical component

**Before landing**

C. Negative vertical component

D. Equal horizontal component at all three points in flight

Vector arrows must be present and attached to the correct point on the

parabolic curve

**Angular Motion**

**Explain how a gymnast can alter the speed of rotation during flight**

A. Changing the shape of the body causes a change in speed

B. Change in moment of inertia leads to a change of angular velocity/speed/spin of rotation/ angular moment;

C. Angular momentum remains constant (during rotation)

D. Angular momentum = moment of inertia x angular velocity

E. Angular momentum - quantity of rotation/motion

F. Angular velocity - speed of rotation

G. Moment of inertia - spread/distribution of mass around axis/reluctance of the body to move

H. To slow down (rotation) gymnast increases moment of inertia

I. Achieved by extending body/opening out/or equivalent

J. To increase speed (of rotation) gymnast decreases moment of inertia

K. Achieved by tucking body/bringing arms towards rotational axis