Revision 2025

Edexcel A-Level Paper 1
Student Notes

spotlight session

Recommended	Essential	Recommended
Before the revision session	**During the revision session**	**After the revision session**
Complete the 2025 National Mock Exam	Complete the notes	Review with your teacher

The EverLearner

Hot Topic 9: Vascular shunt and venous return

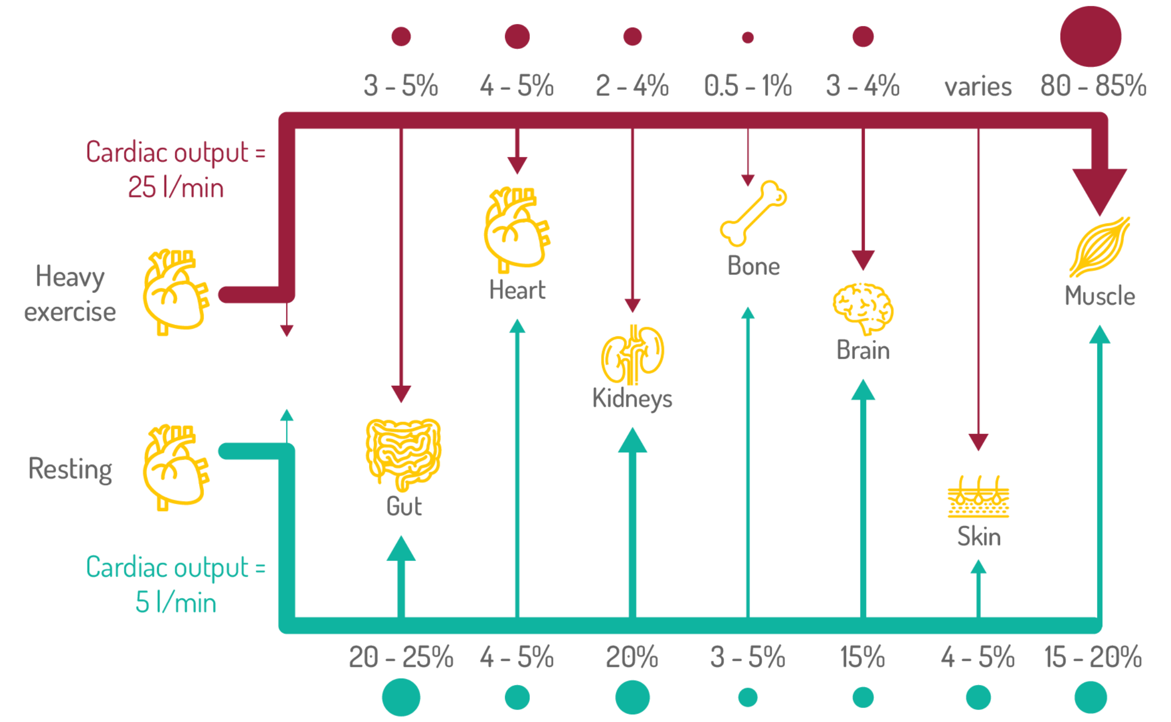
Complete this question:

7. Outline the process of venous return during exercise.

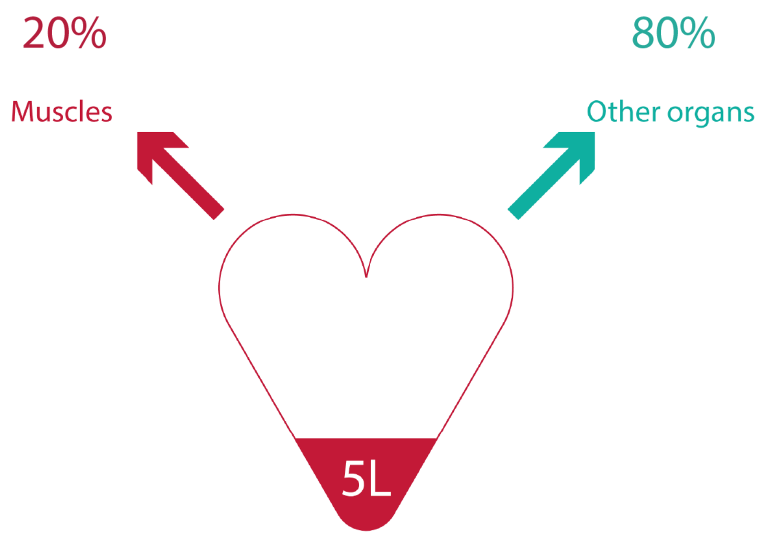
Venous return ____________________ due to the movement occurring via muscle contractions ______________________________. Furthermore, the deeper breathing helps by causing a ____________________ __________, forcing blood back to the heart. In addition, ____________________ ____________________ more blood back despite the low pressure and, finally, ______________________________ ____________.

Marks: **[4]**

Venous return during exercise and recovery					
General	Gravity	Smooth muscle within veins	Pocket valves within veins	Respiratory pump	Skeletal muscle pump
Venous return is the volume of blood returning to the right atrium.	Blood from the superior areas of the body return to the heart via the superior vena cava.	Pulses to increase blood pressure.	Prevent backflow of blood.	Action of the respiratory muscles contracting during inspiration causes an increased pressure in veins close to the heart.	Veins run through skeletal muscles.
Starling's law	During inversion, the opposite occurs. This can be applied to elevated leg shakes.	Lumen within veins which are normally large, becomes less and blood is forced back to the heart.	During diastole	Harder we breathe, the more the impact.	Action of muscular contraction causes an increase in blood pressure.
SV = venous return			Only positioned in veins		Jog back into position.
			More frequent in more distal (from the left ventricle) veins		Perform an active cool-down.



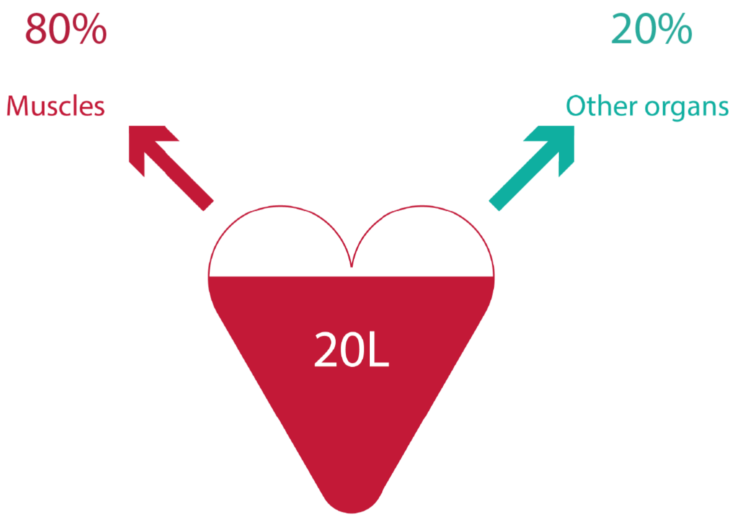
Adapted from Dahl et al. (2003)



At rest

- Q shunted through central capillary at the muscle to increase resistance to blood flow and redirect to the other organs.
- Q shifts from 80% to skeletal muscle down to 20% to skeletal muscle gradually.
- Arterioles leading to the working muscles vasoconstrict.
- Precapillary sphincter muscles leading to the capillary beds at the working muscles vasoconstrict.

- Arterioles leading to the other organs vasodilate.
- Precapillary sphincter muscles leading to the capillary beds at the other organs vasodilate.



Maximal exercise

- Arterioles leading to the working muscles vasodilate.
- Precapillary sphincter muscles leading to the capillary beds at the working muscles vasodilate.

- Vascular shunt occurs.
- Q shunted through central capillary to increase resistance to blood flow and redirect to the skeletal muscle.
- Arterioles leading to the other organs vasoconstrict.
- Precapillary sphincter muscles leading to the capillary beds at the other organs vasoconstrict.

Hot Topic 8: Bernoulli and Magnus forces

29. Using your knowledge of fluid mechanics, explain how a discus thrower can maximise the horizontal displacement of the discus.

Marks: **[8]**

The main factors are that the thrower needs to increase his release height, increase the release velocity and achieve the optimal angle of release, which, for a discus thrower, is <45°. Furthermore, he can present the discus with an angle of attack to achieve an aerofoil and then benefit from a Bernoulli lift force.

Summarise what the student did in paragraph 1:

The higher the release height, the greater the horizontal displacement of the centre of mass of the discus. In other words, if he drives his legs up and stretches with his throwing arm, the height will be greater. Because the flight path of the CoM is predetermined at release, this will increase the distance.

Summarise what the student did in paragraph 2:

The greater the release velocity, the greater the horizontal displacement. Applying Newton's second law helps here. The thrower needs to apply a greater force, for longer in the specific direction (angle of release) to maximise outgoing velocity. This large force helps to overcome the inertia of the discus and propel it forward with maximal velocity.

Summarise what the student did in paragraph 3:

The angle of release needs to be <45° because the release height is greater than the landing height. This is the case because discus is measured in horizontal, not vertical displacement.

Summarise what the student did in paragraph 4:

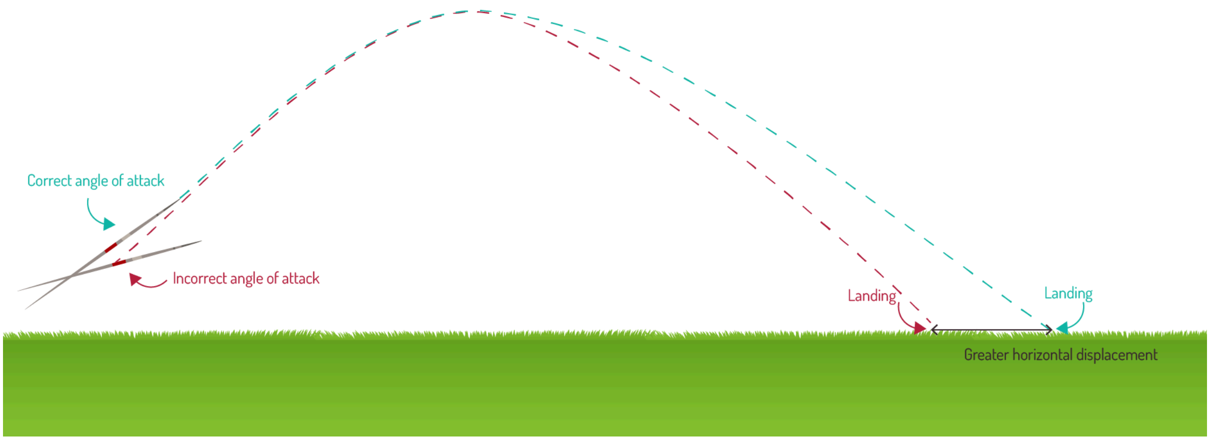
Finally, the thrower needs the angle of attack to create the aerofoil. As a result, the air travelling over the discus will have further to travel than underneath. Therefore, it will travel faster than the air beneath. This means that the air above will experience lower pressure than the air below and a pressure differential will exist. This will cause a Bernoulli lift force on the discus, which will then elongate the horizontal displacement, moving the flightpath from parabolic to non-parabolic. The further the discus travels, the higher the finishing position of the thrower in the competition.

Summarise what the student did in paragraph 5:

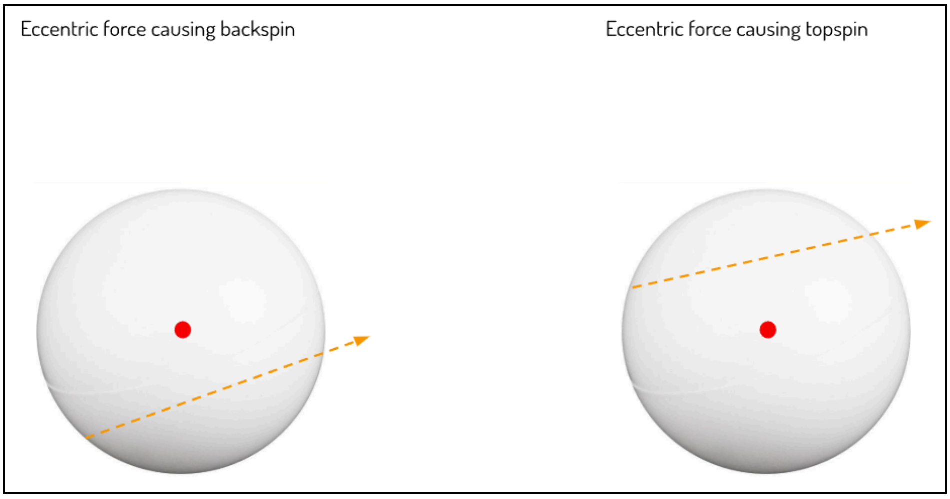
In conclusion, the points above all express what the thrower must do. However, I would advise them to apply these points with good technical coaching involved in the process because, if they try and release very high, they may lose force. If they try and be very technical and accurate with the release angle, they may lose their angle of attack and so on. There are many variables and only truly great throwers will nail every single one of them on a thrower. This could explain why some throwers suggest that they only truly "hit" one or two "perfect" throws throughout a career.

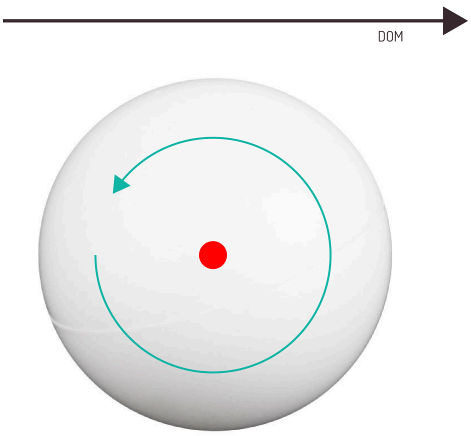
What is the nature of the conclusion?

Look at this image. Compare the image to what has been written about in the essay answer above. If I were to suggest to you that this drawing is an exact reflection of the writing in relation to the discus (now applied to a javelin), would you agree?

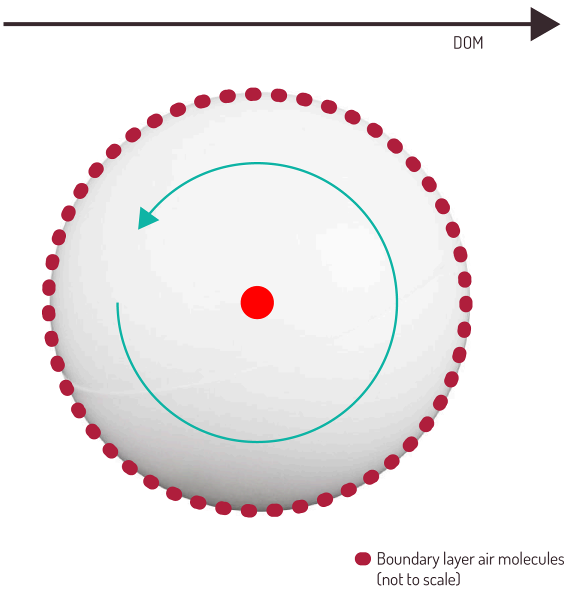


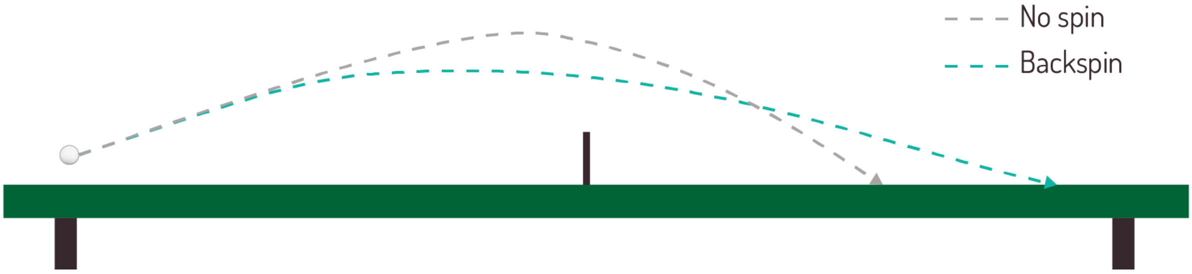
Draw an airflow diagram to show the impact of pressure differentials on a well-thrown javelin:

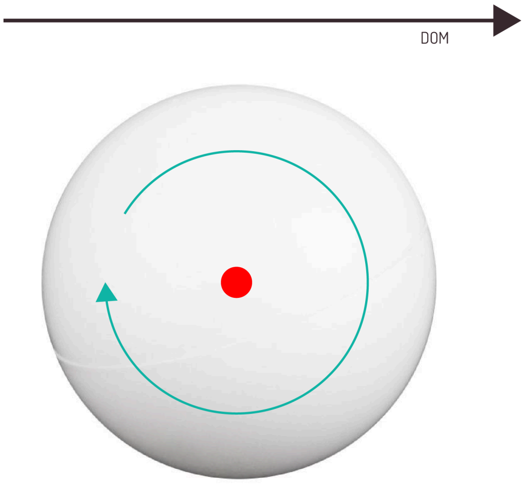

Eccentric force causing backspin
Eccentric force causing topspin


DOM

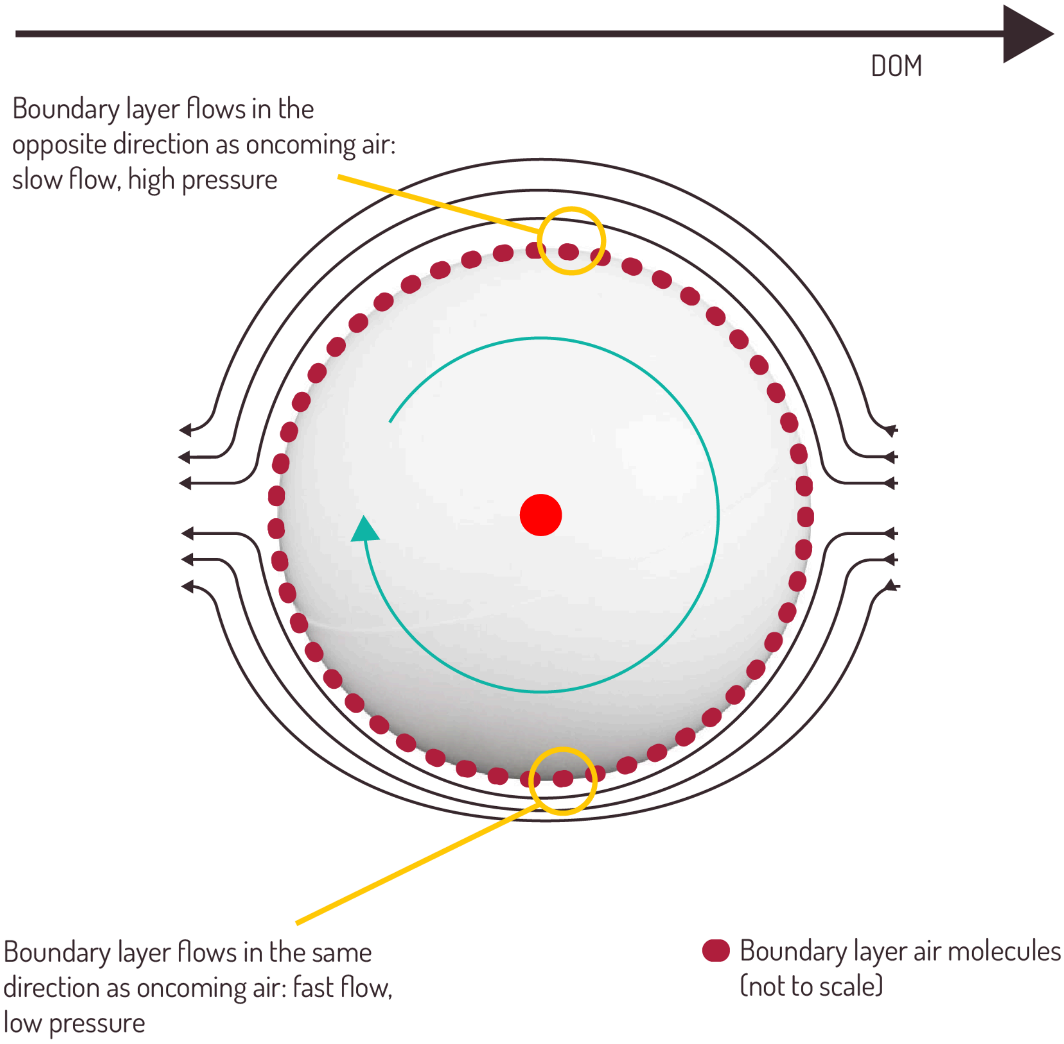
Backspin:

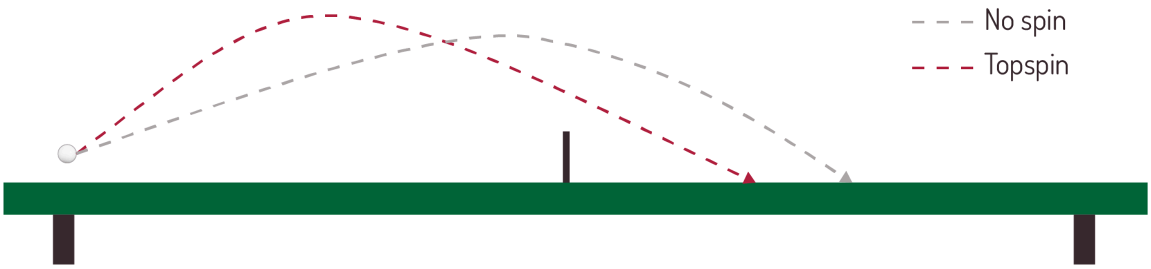

DOM
Boundary layer air molecules
(not to scale)



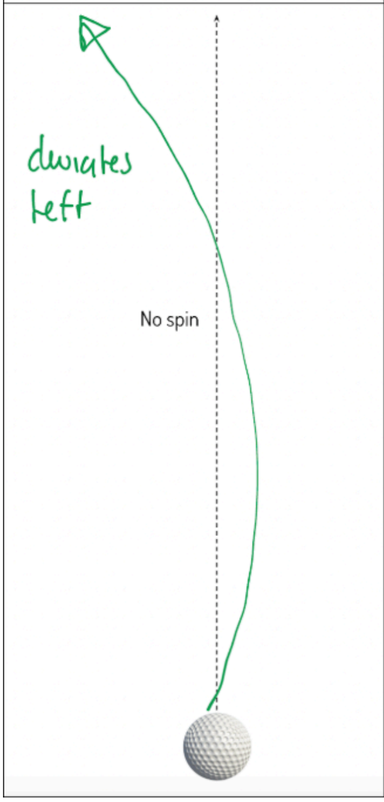
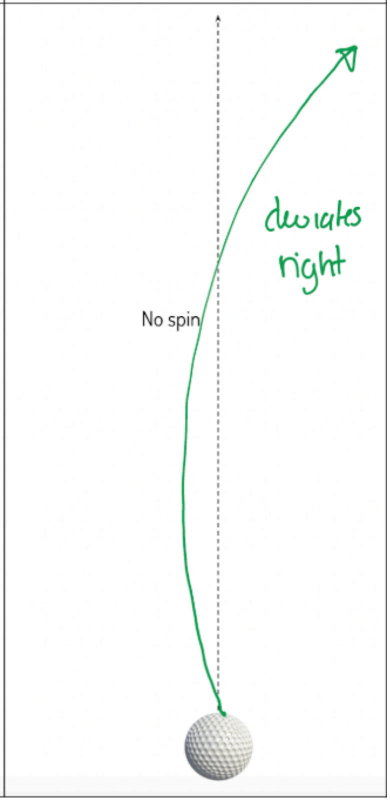


Topspin:

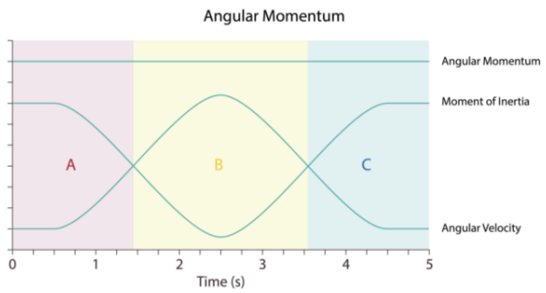

DOM
Boundary layer flows in the opposite direction as oncoming air: slow flow, high pressure
Boundary layer flows in the same direction as oncoming air: fast flow, low pressure
Boundary layer air molecules (not to scale)


No spin
Topspin

Sidespin:

Illustrate the effect of hook spin for a right-handed golfer	Illustrate the effect of slice spin for a right-handed golfer
	

22. Look closely at this image. Using an example, explain why a performer's angular momentum curve would look like this.



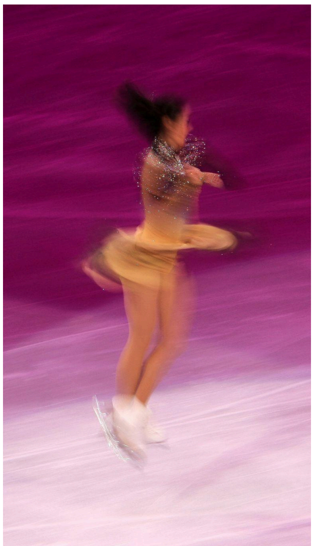
I am going to use the example of a trampolinist performing a tuck somersault. The graph looks like this because ______________________________ ____________________________________. This is evident throughout all phases because of the constant angular momentum plot. In phase A, at the moment of release, the trampolinist has to ____ ____ as they depart the bed. This means their ____________________________ is the greatest. During phase B, they need to ___________________________________ in order to ______________________________ and they do this by _________________________ __________. Angular velocity increases proportionally to the reduction in moment of inertia. Finally, in phase C, they need to _______________________ __________ again by ____ __________ and land safely on the bed again.

Marks: **[4]**

Newton's second analogue tells us:

A rotating body will continue in a state of constant angular momentum until an external torque acts upon it.

Stage	Action	Impact
Prior to take-off		Potential angular velocity in flight will be maximised.
During flight	Reduce moment of inertia by tucking as tightly as possible.	
Prior to entry		Control the rotation in order to enter the water as straight as possible.



Stage	Action	Impact
Prior to take-off		Potential angular velocity in flight will be maximised.
During flight	Reduce the moment of inertia by crossing arms and feet as tightly as possible.	
Prior to entry		Control the rotation in order to land without falling.

FOR STUDENTS

WANT MORE?

FOR TEACHERS