2001 HIGHER SCHOOL CERTIFICATE EXAMINATION

Physics

Centre Number

Student Number

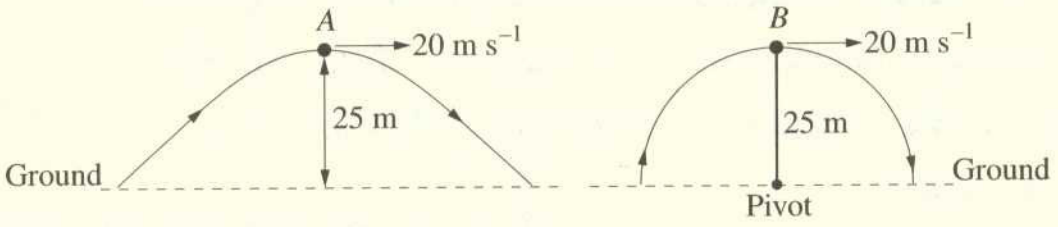
Section I – Part B (continued)

Marks

Question 18 (6 marks)

A 30 kg object, *A*, was fired from a cannon in projectile motion. When the projectile was at its maximum height of 25 m, its speed was 20 m s^{-1}.

An identical object, *B*, was attached to a mechanical arm and moved at a constant speed of 20 m s^{-1} in a vertical half-circle. The length of the arm was 25 m.



Ignore air resistance.

(a) Calculate the force acting on object *A* at its maximum height. **1**

$V^2 = u^2 + 2gs$ ... $90 = u^2$ ... $F = Mg$

$20^2 = u^2 + 2(-9.8)(25)$ ... $u = \sqrt{90}$ ... $= 30 \times 9.8$

$400 = -490 + u^2$ ... $u = 9.5\ ms^{-1}$ ... $= 294\ N$

(b) Calculate the time it would take object *A* to reach the ground from its position of maximum height. **2**

$s = ut + \frac{1}{2}gt^2$ ... $v = u + at$

$25 = \frac{1}{2} 9.8 t^2$ ... $20 = 0 + 9.8t$

$5.1 = t^2$ ... $20 = 9.8t$

$t = \sqrt{5.1} = 2.2\ s$ ... ~~$t = 2.0$ (s)~~ $t = 2.05$

(c) Describe and compare the vertical forces acting on objects *A* and *B* at their maximum heights. **3**

The vertical forces acting on objects A and B at their maximum height is 20 ms^{-1}

Marks

Question 19 (4 marks)

How does Einstein's Theory of Special Relativity explain the result of the Michelson–Morley experiment? 4

Michelson-Morley experiment was designed to detect the properties of the ether, (a hypothetical medium which was believed to fill all space and be the medium in which electrons travelled). However the result concluded was that there was no ether and this led to Einstein's Theory of Special Relativity; that electrons have wave like properties and therefore travell through electromagnetic radiation. - Inertial frames of reference.

Question 20 (4 marks)

The electrical supply network uses a.c. and a variety of transformers between the generating stations and the final consumer. 4

Explain why transformers are used at various points in the network.

Various transformers are used to step down/up the voltage for the consumer. This is because voltage out of the generating stations are very high voltage. In a house hold 240v is usallay only needed. So this is why voltage is then transformed from high to low when it is recived by the consumer.