

Practice Question Set For A-Level  
**Subject : Physics**  
**Paper-1 Topic: Further Mechanics**

Name of the Student: \_\_\_\_\_

Max. Marks : 26 Marks

Time : 26 Minutes

Mark Schemes

**Q1.**

- (a) (i)  $mgh = \frac{1}{2}mv^2$  **or** correct numerical substitution M1
- 13.3 m s<sup>-1</sup>
- no marks for use of equation of motion for constant acceleration
- allow  $gh = mv^2 / 2$  or  $v^2 = 2gh$  but not  $v^2 = 2as$  A1
- (2)
- (ii)  $mv = Ft$  (or  $F = ma$  and  $a = v / t$ )
- (or numerical equivalent) C1
- 48.8 to 50.0 N e.c.f. from (i) {3.75 × (i)} A1
- (2)
- (iii) power = energy transformed / time C1
- or** power = average force × average velocity
- or**  $P = Fv$  leading to (i) × (ii) (664 W if (i) and (ii) are correct)
- 330 to 332 W e.c.f. from (i) and / or (ii) {(i) × (ii) / 2} A1
- (2)
- (b) (i) the ball accelerates toward centre (of circular path) /  
the point of suspension / upwards
- or the ball is changing direction upwards B1
- centripetal force / resultant force upwards /  
force towards centre of circular path
- or string initially stretches producing an elastic force B1
- (2)
- (ii)  $T - mg = mv^2 / r$  **or**  $F = mv^2 / r$  (or numerical equivalent)
- or**  $F = ma$  **and**  $a = v^2 / r$

C1

centripetal / resultant accelerating force = 6.6 N

e.c.f. from (i)  $(0.0375 \times (a)(i)^2)$

C1

tension = their centripetal force + 4.4 N (11 N)

A1

(3)

(c) (i)  $m(13.3)^2 = \frac{1}{2}mv^2 + mg \times 4.5$

or velocity is same as when falling 4.5 m so  $\frac{1}{2}mv^2 = mg \times 4.5$

or KE at bottom = KE at half way + PE

allow  $\frac{1}{2}mv^2 = mg \times 4.5$

B1

9.4 m s<sup>-1</sup> (no marks if 9.4 m s<sup>-1</sup> arrived at using equation of motion)

B1

(2)

(ii) horizontal velocity is constant after string breaks

or continued movement in the horizontal direction

or idea of KE due to horizontal motion

B1

at max height the ball still has KE so acquires less PE

or not all KE becomes (gravitational) PE

B1

(2)

or upward velocity = 9.4 sin 51

B1

use of equation of motion leading to 2.72 m after the break

B1

or after string breaks downward force increases / the upward force ceases to exist

B1

there is greater vertical deceleration

B1

[15]

**Q2.**

(a) (i) loss of PE = gain of KE or  $mgh = \frac{1}{2}mv^2$

allow for statement of conservation of energy

(energy can not be destroyed but can be converted from one form to another)

B1

correct height used (2.4 m or  $2 \times 1.2$  seen in an equation)

B1

correct substitution including values for  $h$  and  $g$  (no u.p.)

**B1**  
**(3)**

(ii)  $F = mv^2 / r$

(allow  $mrv\omega^2$ )

**C1**

2800 N (2780 N) or

2700 N (2740 N) if using  $v = 6.86 \text{ m s}^{-1}$

**A1**  
**(2)**

(iii) (ii) + 690 (3500 N or 3460 N)

(3400 N or 3430 N if using  $v = 6.86 \text{ m s}^{-1}$ )

**B1**  
**(1)**

(iv) graph shape down up down up (condone linear); minima at  $90^\circ$  and  $270^\circ$

**M1**

graph starts at 690 (N); this point labelled;

maximum labelled consistent with answer to (iii),

zero at 90 and 270 (allow any shape between these points)

**A1**  
**(2)**

(b) stress =  $F / A$  and strain = extension / original length **and**  $E = \text{stress} / \text{strain}$

or

$$E = Fl / Ae$$

**C1**

correct substitution using 690 N (condone 700 N)

**or** substitution with e.c.f. from graph

**C1**

allow e.c.f. for use of  $g$  without substitution if penalised in (i)

$$8.9 \times 10^{-6} - 9.1 \times 10^{-6} \text{ m}$$

**A1**

allow only 1 mark if candidate divides by 2 at any stage

**(3)**

**[11]**