STUDYING OSCILLATIONS

1 Fig. 2.1 shows a simple pendulum that swings backwards and forwards between P and Q.

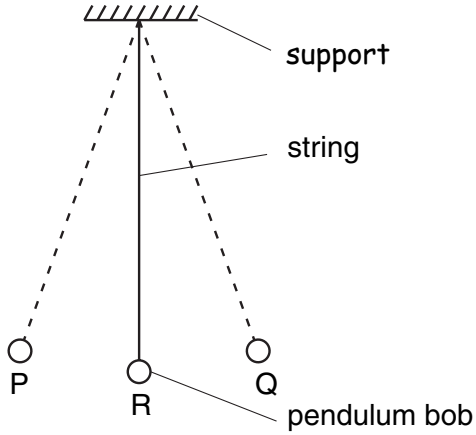

Fig. 2.1

(a) The time taken for the pendulum to swing from P to Q is approximately 0.5 s.

Describe how you would determine this time as accurately as possible.

.....

.....

..... [2]

(b) **(i)** State the two vertical forces acting on the pendulum bob when it is at position R.

1. .....

2. ..... [1]

(ii) The pendulum bob moves along the arc of a circle. State the direction of the resultant of the two forces in **(i)**.

..... [1]

(c) The mass of the bob is 0.2 kg. During the swing it moves so that P is 0.05 m higher than R.

Calculate the increase in potential energy of the pendulum bob between R and P.

0625/03/M/J/05

potential energy = ... [2]

(a)		time a number of swings (if number stated, >5) time divided by [2 x number of swings]	M1 A1	**2**
(b)	**(i)**	weight of gravity and tension	B1	
	(ii)	force towards centre of circular motion or towards support point	B1	**2**
(c)		p.e. = mgh or 0.2 x 10 x 0.05 = 0.1 J	C1 A1	**2** **[6]**

2 A weight attached to one end of a short length of string is swinging from side to side. The highest points in the swing are A and B, as shown in Fig. 1.1.

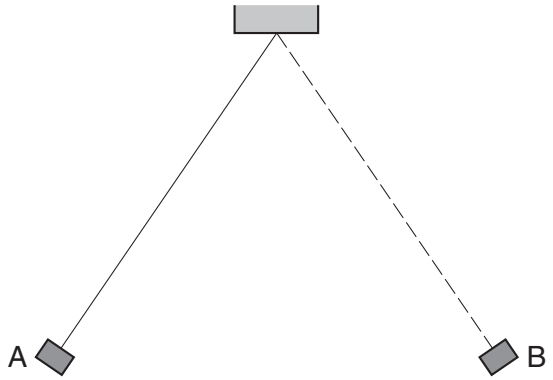

Fig. 1.1

(a) With reference to Fig. 1.1, state what is meant by the amplitude of the oscillations.

..... [2]

(b) Describe how the amplitude of the oscillations could be measured.

.....

.....

.....

.....

..... [3]

[Total: 5]

(a)	mention of distance AB OR distance between highest points of weight OR distance along arc AB of circle OR angle between extreme positions of string		C1
	idea of half of one of the above		A1
(b)	use of protractor / ruler note value of max angle/distance or its double from vertical or halve avoidance of parallax	any 3	B1 × 3

3 A weight attached to one end of a short length of string is swinging from side to side. The highest points in the swing are A and B, as shown in Fig. 1.1.

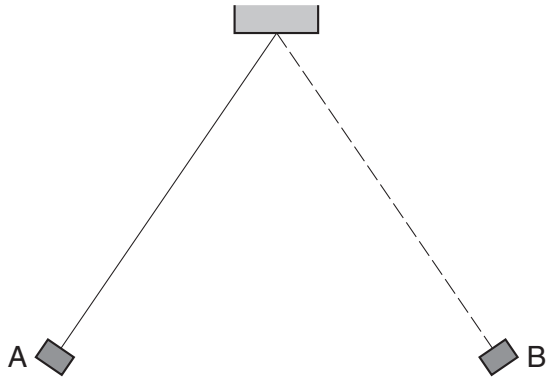

Fig. 1.1

(a) With reference to Fig. 1.1, state what is meant by the amplitude of the oscillations.

..... [2]

(b) Describe how the amplitude of the oscillations could be measured.

.....

.....

.....

.....

..... [3]

[Total: 5]

(a) mention of distance AB OR distance between highest points of weight
OR distance along arc AB of circle OR angle between extreme positions of string C1

idea of half of one of the above A1

(b) use of protractor / ruler)
note value of max angle/distance or its double) any 3 B1 × 3
from vertical or halve)
avoidance of parallax)

[5]

4 An engineering machine has a piston which is going up and down approximately 75 times per minute.

Describe carefully how a stopwatch may be used to find accurately the time for one up-and-down cycle of the piston.

.....

.....

.....

.....

.....

.....

.....

.....

..... [4]

[Total: 4]

MARKING SCHEME:

check zero on stopwatch OR repeat OR other sensible precaution	B1	
start stopwatch at some recognisable point in the cycle	B1	
stop stopwatch after at least 10 cycles OR count no. of cycles in at least 10 s	B1	
divide time by number of cycles	B1	[4]

5 The period of the vertical oscillations of a mass hanging from a spring is known to be constant.

(a) A student times single oscillations with a stopwatch. In 10 separate measurements, the stopwatch readings were:

1.8 s, 1.9 s, 1.7 s, 1.9 s, 1.8 s, 1.8 s, 1.9 s, 1.7 s, 1.8 s, 1.8 s.

What is the best value obtainable from these readings for the time of one oscillation? Explain how you arrive at your answer.

best value = ...

explanation .....

.....

..... [1]

(b) Describe how, using the same stopwatch, the student can find the period of oscillation more accurately.

.....

.....

.....

.....

.....

.....

..... [4]

[Total: 5]

MARKING SCHEME:

(a)	Period: 1.81 s OR 1.8 s as mean value OR 1.8 s as most common reading / the mode	B1
(b)	Time a minimum of 2 (successive) oscillations	B1
	Divide result by the number of oscillations	B1
	OR	
	Count no. of oscillations in at least 20 s	(B1)
	Divide the time by the number of oscillations	
	OR Divide no. of oscillations by time and find reciprocal	(B1)
	2 of: Repeat (several times) and find mean Time with reference to fixed / fiducial point or top or bottom of oscillation Check / set zero of stop-watch Show knowledge of what is meant by one oscillation	B2
		[Total: 5]