REVISION WORKSHEET 1

1. A man of mass 80 kg stands in the lift of mass 500 kg. The lift is accelerating upwards at 2 m/s^2.

   (a) Calculate the tension in the cable.
   (b) If the man was standing on the scale then what is the reading on the scale in Newtons.

2. The blade in a blender speeds up from 24 rad/s to 74 rad/s uniformly. During this time it turns through 40 revolutions. Calculate:

   (a) the angle turned through in radians
   (b) the angular acceleration
   (c) the time taken to turn 40 revs

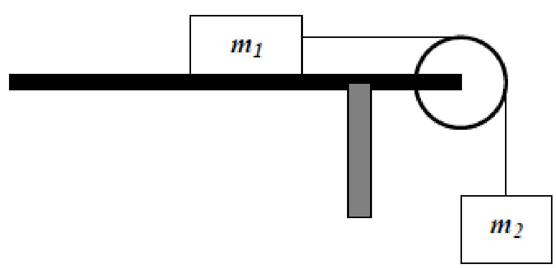
3. The spinner of an electric blender spins at 25 $rad.s^{-1}$ and increasing to 85 $rad.s^{-1}$ makes 30 revolutions.

   (i) Find the total angle turned through in radians.

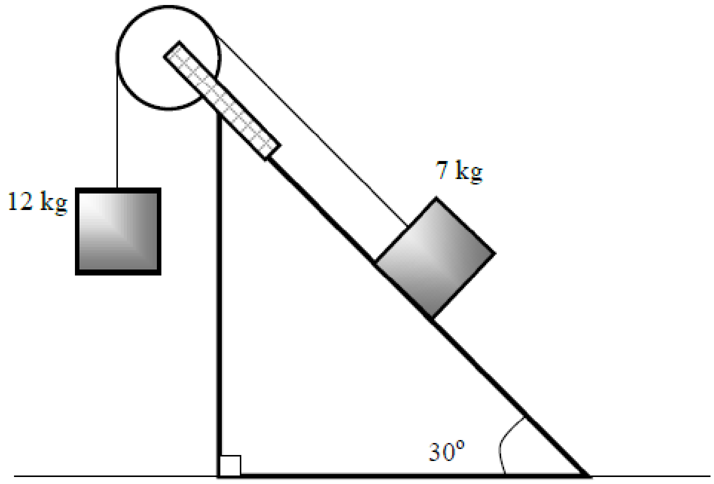
   (ii) Determine the angular acceleration.

   (iii) Find the time taken to turn through the 30 revolutions.

4. Two masses are connected as shown. The mass m_1 = 10 kg and m_2 = 5 kg. The system starts from rest and m_2 falls a distance of one metre in 1.2 seconds. Calculate the coefficient of kinetic friction between m_1 and the table.



5. Two masses are connected by a light inextensible string over a frictionless pulley. The coefficient of friction between the 7 kg mass and the plane is 0.25



. Calculate the acceleration of the system.

REVISION WORKSHEET 2

1. An axe is pressed with a constant force against the edge of a freely spinning grindstone. The radius of the grindstone is 40 cm and moment of inertia is 50 $kg.m^2$. The grindstone initially at 10 rev/s and after 10 seconds it drops to 5 rev/s.

   (a) Calculate the angular acceleration of the grindstone in rad/s^2.

   (a) What is the torque applied to the grindstone?

   (b) Determine the applied force.

   (c) Calculate the time taken for the grindstone to stop rotating.

2. A floppy disk in a computer rotates from rest up to an angular speed of 40 $rads^{-1}$ in a time 0.88 s.

   (i) What is the angular acceleration of the disk, assuming the angular acceleration is uniform?

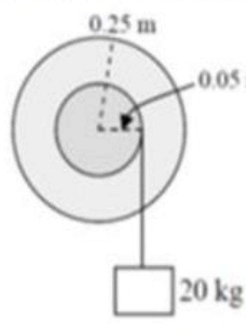
   (ii) How many revolutions does the disk make while coming up to 40 $rads^{-1}$?

   (iii) If the radius of the disk is 5 cm, find the final linear speed of a dust particle sitting on the rim of the disk.

   (iv) What is the magnitude of the tangential acceleration of the dust particle at this time?

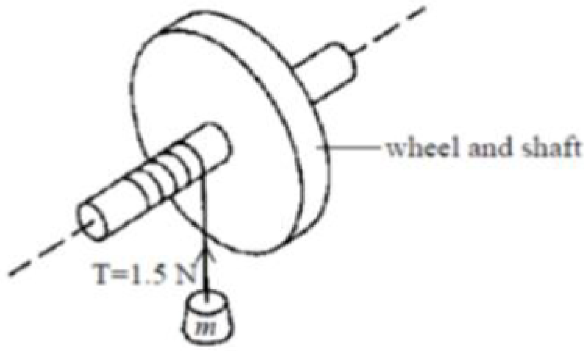
   (v) What is the angular speed of the disk after it has travelled 10 radians?

3 A mass of 20 kg is attached to a rope which in turn is wound around the axle of a wheel mechanism. The radius of the axle is 0.05 m and the radius of the wheel is 0.25 m.



If the mass is released, calculate its acceleration as it falls.

4 The wheel and shaft shown below can rotate with negligible friction about the dotted line axis. The shaft has diameter 6.0 cm and the weight of the mass, *m*, gives the string a tension of 1.5 N. The mass, *m*, falls 1 m in 20 seconds, starting from rest.



(i) What is the angular acceleration of the wheel?

(ii) Find the moment of inertia.

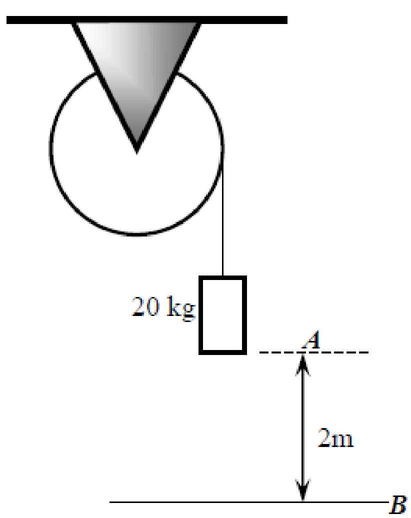
5 A light inextensible string is wrapped around a wheel of radius 10 cm, which can rotate freely without friction. The free end of the string is tied to a 20 kg mass, which accelerates at 2 m/s^2 when released from rest at A. The string comes off the wheel just before the load hits the ground at B. Calculate:

(a) The tension in the string when the mass is released.

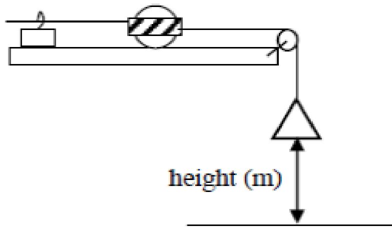
(b) The speed with which the mass strikes the floor.

(c) The rotational kinetic energy of the wheel just after the string comes off.

(d) The moment of inertia, I of the wheel.



(b) A diagram of the experimental setup and table of results for the experiment on Extension of Idea of Kinetic Energy is shown below.



Mass of scale pan	= 0.050 kg
Mass (m)	= 0.100 kg
Mass of cylinder (M)	= 0.500 kg
Height (h)	= 0.70 m
Final speed of the masses	= 1.5 m/s

(i) Calculate the gravitational potential energy lost by the scale pan + mass (m).

____

____ **(1 mark)**

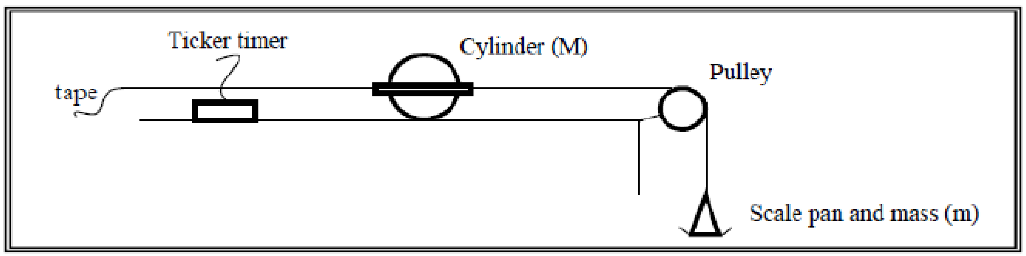
(ii) Calculate the rotational kinetic energy of the cylinder.

____

____

(1 mark)

c. Shown below is an experimental set-up to introduce the idea of rotational motion to a moving object and to measure the rotational energy of a cylinder.



(i) Why is it necessary to compensate for friction in this experiment?

____

____

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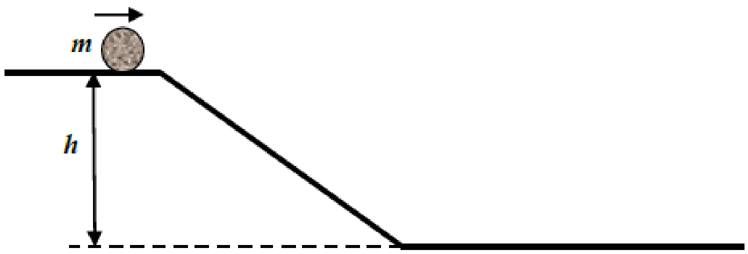
(1 mark)

REVISION WORKSHEET 4

1. A solid sphere of mass, m, and radius, r, starts from rest at a height, h, and rolls down a slope and then onto a horizontal surface as shown in the diagram below.
At the end of the slope it has a linear velocity (v).



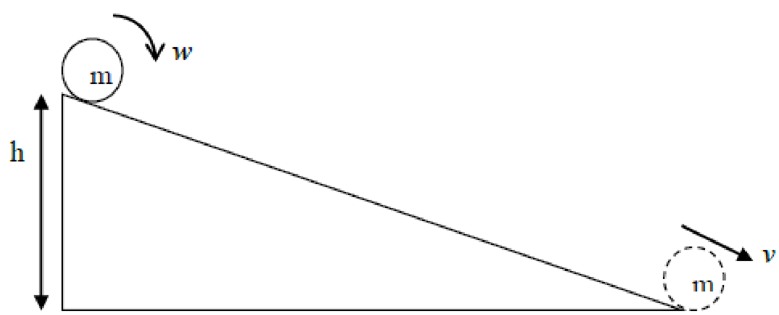
(i) Given that the rotational inertia of the sphere is $\frac{2}{5}mr^2$,

show that the velocity, v, at the bottom of the slope is :

$$V = \sqrt{(10gh)/7}$$

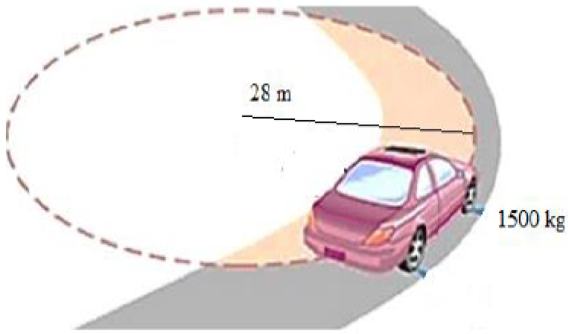
(ii) Calculate v when h = 60 cm.

2. A ball rolls from rest down a slope without slipping and then on to a horizontal surface. At the end of the slope it has a linear velocity v. The ball has mass m and radius r.



Given that the rotational inertia of the ball is $\mathbf{I} = \frac{1}{2}mr^2$, show that the linear velocity, v, of the ball at the bottom of the slope is : $v = \sqrt{\frac{4gh}{3}}$

3. A 1500 kg car moving on a flat horizontal road turns a curve. If the radius of the curve is 28 m, and the coefficient of static friction between the tyre and road is 0.48.



Find the **maximum speed** the car can have and still make the turn safely.

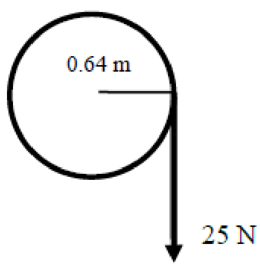
4. An object hangs from a spring balance in an elevator accelerating upwards at 3.5 ms^{-2}. The reading on the balance is 550 N.

Calculate the:

(i) mass of the object.

(ii) reading on the balance when the lift is stationary.

5. A wheel of radius 0.64 m and moment of inertia 3.6 kgm^2 has a constant force of 25 N applied tangentially at the rim, as shown in the diagram below.



(i) Calculate the angular acceleration.
(ii) Find the angular speed after 3 seconds from the rest.

(iii) Find the angular displacement made in 3 seconds from rest.

(iv) Hence show that the work done on the wheel in 3 seconds is equal to the kinetic energy of the wheel after 3 seconds.

REVISION WORKSHEET 3

1. A 500 kg satellite orbits 600 km above the surface of the earth.
   Calculate the following energy of the satellite:

   (i) gravitational potential energy

   (ii) kinetic energy

   (iii) total energy

2. A 100 kg satellite moves in a circular orbit 250 km above the surface of the earth.

   [$M_e = 5.98 \times 10^{24}$ kg, Radius of Earth = 6.37×10^6 m]

   (i) Calculate the gravitational potential energy of the satellite at its current height above the surface of the earth.

   (ii) Determine the kinetic energy of the satellite.

3. The escape speed, v of a body from the planet is usually given as $v = \sqrt{\frac{2GM}{R}}$
   where M is the planet's mass, R is its radius, and G, the universal gravitation constant.

   (i) Define the term **escape velocity**.

   (ii) If the weight of a mass is the same as the gravitational attraction to a planet, show that the escape velocity at the earth's surface can be given by $v = \sqrt{2gR}$ where g is the gravitational field strength on the planet's surface.

4. A satellite moves in a circular orbit around the earth at an altitude of 280 km above the surface of the earth.

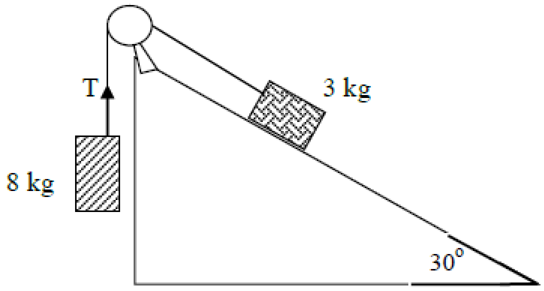
   [radius of earth = 6.37×10^6 m]

   Determine the:

   (a) orbital speed of the satellite ;

   (b) acceleration of the satellite.

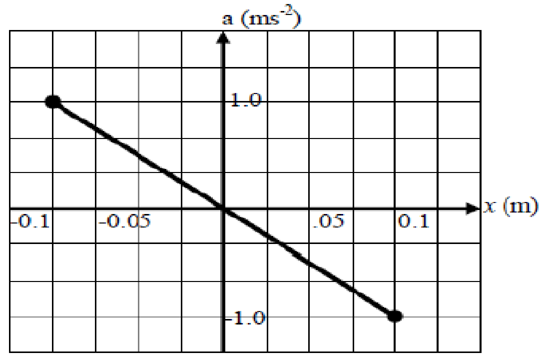
5. A 3 kg mass and a 8 kg mass pull each other over a pulley as shown in the diagram below.



The coefficient of the kinetic friction between the 3 kg mass and the plane is 0.205.

(i) Calculate the magnitude of the friction force.
(ii) Determine the acceleration of the 8 kg mass.
(iii) Determine the tension in the string.

(a) The graph of the acceleration of a particle against its displacement x is shown below.



(i) Write a mathematical equation that relates the acceleration to the displacement.

____

(1 mark)

(ii) What is the amplitude of the motion ?

____

(½ mark)

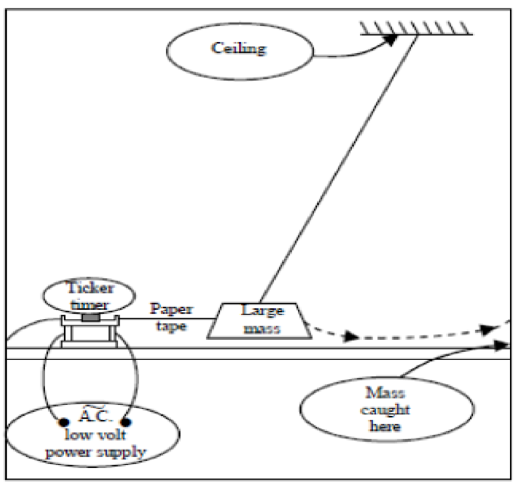
(iii) What conclusion can be drawn about the motion of the particle ?

____

(½ mark)

c. In an experiment to test the suitability of SHM as a model for the behaviour of a real oscillator, a long length of strong string is hung from the ceiling and is attached to a heavy mass which nearly touches the floor.

The materials are set up as shown in the diagram.



The ticker-timer tape is analysed and the values of acceleration, a and displacement, x were tabulated.

(i) Why is it important to choose a heavy mass for this pendulum?

____

____

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(1 mark)

(ii) Describe **one** way of locating the point from which displacement, x is measured.

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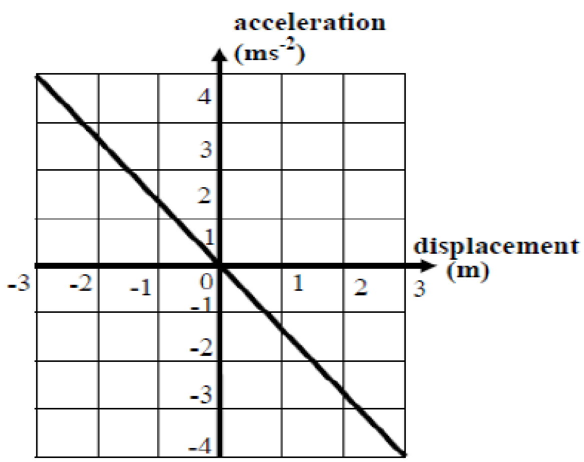
(1 mark)

(iii) Sample data for this experiment is given below.

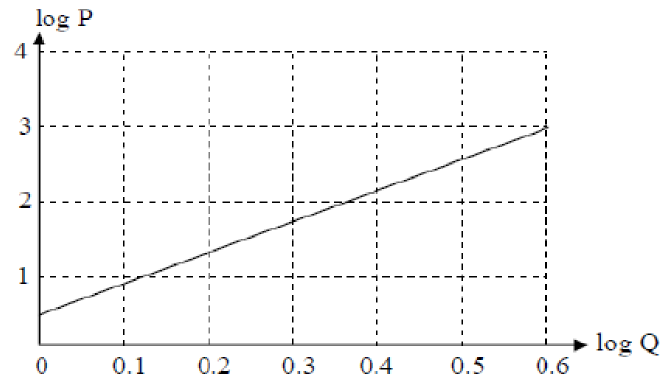
a (ms^{-2})	x (m)
+ 3	– 0.9
+ 1.6	– 0.4
– 1	+ 0.3
– 2	+ 1.1
– 3	+ 0.9

Using the above data, plot a graph of a versus x on the graph paper provided.

b. The diagram below shows the acceleration versus displacement graph for a 80 kg bungy jumper oscillating up and down with a simple harmonic motion.



The relationship between two physical quantities P and Q are shown by the graph of log P versus log Q given below.



(i) **How does log P vary with log Q ?**

____

(½ mark)

(ii) How does P vary with Q ?

____

(½ mark)

(iii) What is the intercept on the log P axis ?

____

(½ mark)

(iv) Determine the slope of the graph.

____

(1½ marks)

(v) Hence work out the mathematical relationship between P and Q.

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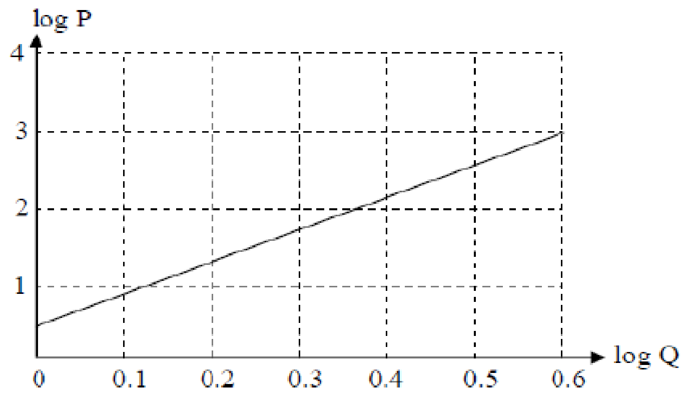
(2 marks)

The relationship between two physical quantities P and Q are shown by the graph of log P versus log Q given below.



(i) **How does log P vary with log Q ?**

____

(½ mark)

(ii) How does P vary with Q ?

____

(½ mark)

(iii) What is the intercept on the log P axis ?

____

(½ mark)

(iv) Determine the slope of the graph.

____

(1½ marks)

(v) Hence work out the mathematical relationship between P and Q.

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(2 marks)

SHM WORKSHEET 1

1. The equation of a SHM is given as $x = 6.5 \cos\left(3\pi t + \frac{\pi}{4}\right)$.

   Calculate:

   (a) the period, amplitude and phase constant of the motion.

   (b) the displacement at $t = 0$s and $t = 1$s.

   (c) the velocity and acceleration at $t = 3$ s.

   (d) the maximum speed and acceleration

2. A SHM has the equation $y = 3.6 \cos\left(2\pi t + \frac{\pi}{4}\right)$
   Calculate the:

   (i) period.

   (ii) amplitude.

   (iii) phase constant.

   (iv) displacement at time t =0 s.

   (v) velocity and acceleration at t = 3 s.

3, A 1.5 kg mass is oscillating at the end of a steel spring with an amplitude of 15 cm. The spring constant, *k*, is 600 N/m. Calculate:

   (a) the angular frequency

   (b) the maximum velocity of the oscillating mass

   (c) the total energy of the oscillating mass.

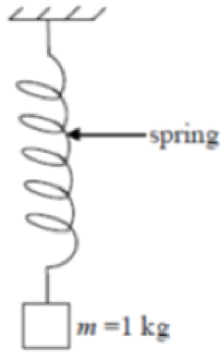
4. A pendulum of length 1.2 m oscillates with amplitude of 0.2 m.

   (a) What is the period of the pendulum?

   (b) Find the velocity at the midpoint of the swing.

   (c) If the mass of the pendulum bob is doubled, calculate the new period.

5. A mass *m*, of 1 kg is suspended from a light spring as shown in the diagram.



When a second 1 kg mass is added , the spring elongates to 15 cm. The second mass is removed and system is set into vibration with that remaining single 1 kg mass with an amplitude of 8 cm.

Calculate the :

(i) frequency of vibration;
(ii) maximum velocity of the vibrating mass;
(iii) maximum acceleration of the vibrating mass.