DIRECTORATE FOR QUALITY AND STANDARDS IN EDUCATION
Department for Curriculum Management and eLearning
Educational Assessment Unit
Annual Examinations for Secondary Schools 2013

Tra...

| FORM 3 | PHYSICS | TIME: 1h 30min |

Name: _____   **Class:** _____

Answer all questions.
All working must be shown. The use of a calculator is allowed.
Where necessary take acceleration due to gravity g = 10 m/s^2.

You may find some of these equations useful:

Energy and Work	$W = Fs$ $PE = mgh$	$E = Pt$ $KE = \frac{1}{2}\,mv^2$
Forces	$W = mg$	Moment = Force x perpendicular distance
Pressure	$P = \dfrac{F}{A}$	$P = h\rho g$
Density and Heat	Density $(\rho) = \dfrac{m}{V}$	$Q = mc\Delta\Theta$

For office use only:

Question No.	1	2	3	4	5	6	7	8	Total Mark	Practical Mark	Final Mark
Score											

SECTION A: Answer ALL questions. This section has a total of 40 marks.

1. The diagram shows a lady and a child pushing a shopping trolley. The lady pushes force of 40 N and the child with a force of 10 N.
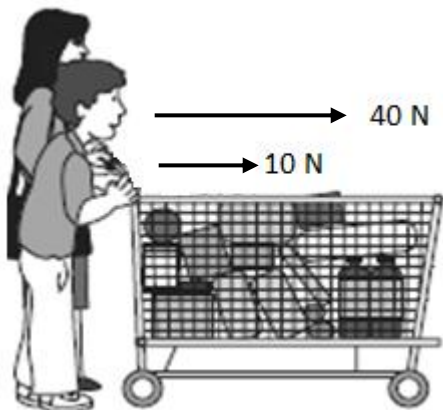
    (a) What is the **total** horizontal force on the trolley?

    _____
    (1)

    (b) Calculate the work done to push the trolley a distance of 80 m.

    _____
    (2)

    (c) On the diagram draw **two** other forces acting on the trolley.
    (2)

(d) Name **one** of these forces acting on the trolley.   _____
    (1)

(e) It takes 100 seconds to push the trolley a distance of 80 m. Calculate the power.

_____

_____
(2)

2.(a) Complete the following sentences about the energy changes in a washing machine.

    (i) An electric motor in a washing machine is designed to transform

    _____ energy into _____ energy.   (2)

    (ii) Some of the energy supplied to the motor is wasted as _____ energy and

    _____ energy.   (2)

(b) Would more or less energy be required to wash the clothes at a temperature of 60 ^{o}C instead of 40 ^{o}C? Explain why.

_____
(2)

(c) An '**A**' rated washing machine uses an input power of 600 W to give 420 W of output power. Calculate its efficiency.

_____
(2)

3. The diagram shows a set of shelves with a number of jars on it.
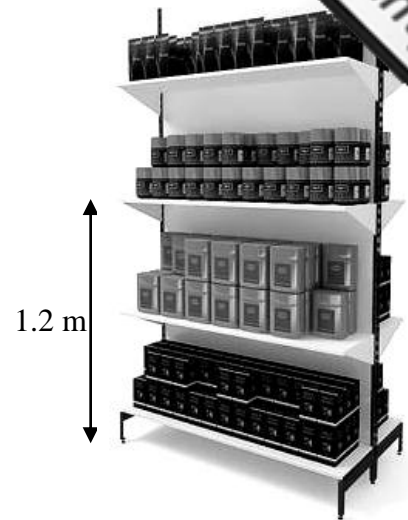
(a) Complete the **Principle of Conservation of Energy**.

Energy is neither _____ nor

_____ but only changed from one

form to another. (2)

1.2 m

(b) (i) The distance between the floor and one of the shelves is 1.2 m. The mass of one jar is 0.4 kg. Calculate the potential energy gained when one jar is lifted from the floor onto this shelf.

_____

_____
(2)

(ii) This jar falls off the shelf accidentally. What is the kinetic energy of the jar just above the floor?
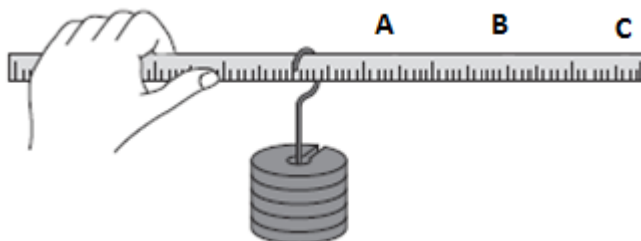
_____
(1)

(iii) Calculate the velocity of the jar just before it hits the floor.

_____

_____

_____
(2)

(iv) What will happen to the velocity if the same jar falls from the top shelf?

_____
(1)

4.(a) A student holds a ruler at one end and slides a weight along the ruler.

(i) What is meant by the moment of a force?

_____

(1)

(ii) At which point **A**, **B** or **C** will the turning effect of the weight feel greatest? Give a reason for your answer.
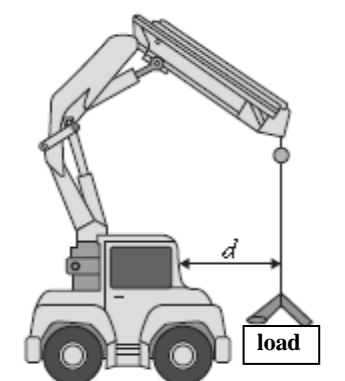
_____

_____

(2)

(iii) In which direction will the moment of the weight act?

_____

(1)

(b) The diagram shows a mobile crane. The crane driver finds that a load of 10 000 N would be safe at a distance, d, of 6.0 m.

(i) Calculate the moment produced by this force.

_____

_____

(2)

(ii) What might happen if a very large load is lifted by the crane? Explain why.

_____

(2)

5. Joanne collects data from the Internet about planets in the solar system, as shown

Name of Planet	Distance from sun in millions of kilometres	Time taken for one orbit of the sun in years	Time taken to spin on its axis in hours	Average temperature °C
Mercury	60	0.24	1400	430
Venus	110	0.60	5800	470
Earth	150	1	24	20
Mars	230	2	25	- 20
Jupiter	780	12	10	-150
Saturn	1400	30	10	-180
Uranus	2900	84	17	-220
Neptune	4500	165	16	-230

(a) Name the force which keeps planets in their orbits. _____

(1)

(b) What is the name of the galaxy which contains our Solar System?

_____

(1)

(c) Pluto is missing from the above table. Explain why.

_____

(1)

(d) Which two planets have the same length of day?

_____

(1)

(e) Which planet has the longest year? _____

(1)

(f) Explain why the temperature on Neptune is very cold.

_____

(1)

(g) What form of energy would be very useful to use in space? Name **one** advantage of using this source.
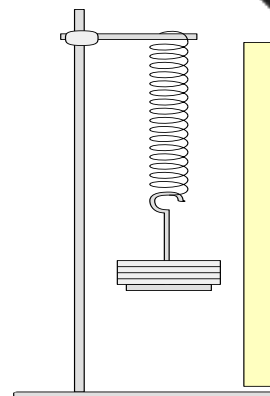
_____

_____

(2)

SECTION B: Answer ALL questions. This section has a total of 45 marks.

6. *This question is about Forces.*
(a) Jeffrey hangs different weights at the end of a spring. Each time he measures the length of spring. The results are shown below.

Weight (N)	0	1	2	3	4	5	6	7
Length (mm)	40	48	60	64	72	80	88	96
Extension (mm)	0	8						

(i) Complete the above table by filling in the missing values.   (3)

(ii) What is the original length of the spring? _____   (1)

(iii) Plot a graph of *Extension (mm)* on the y-axis against *Weight (N)* on the x-axis. Draw the best straight line through your points.   (5)

(iv) Jeffrey reads one of the **lengths** incorrectly. Which one is it? _____   (1)

(b) The **same** spring is now attached to a block resting on a rough surface, as shown below.
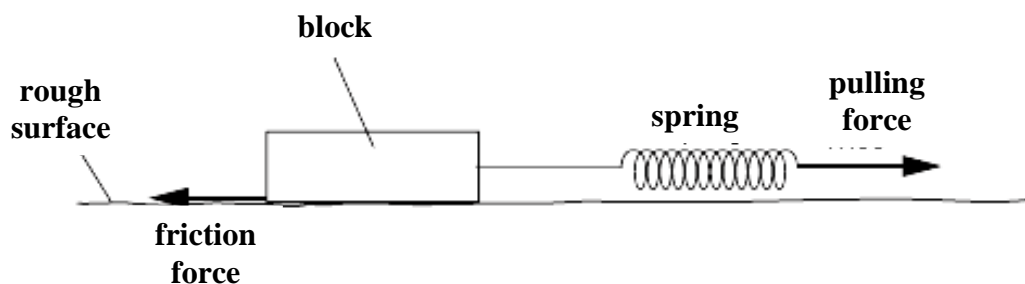
(i) As the pulling force is increased, the block just starts to move to the right when the spring is 68 mm long. What is the extension of the spring when it is 68 mm long?

_____
(1)

(ii) The same spring is now used to pull a much heavier block. The spring becomes permanently deformed. Explain why.

_____

_____
(2)

(iii) Name **two** ways in which this frictional force can be reduced.

_____

_____
(2)
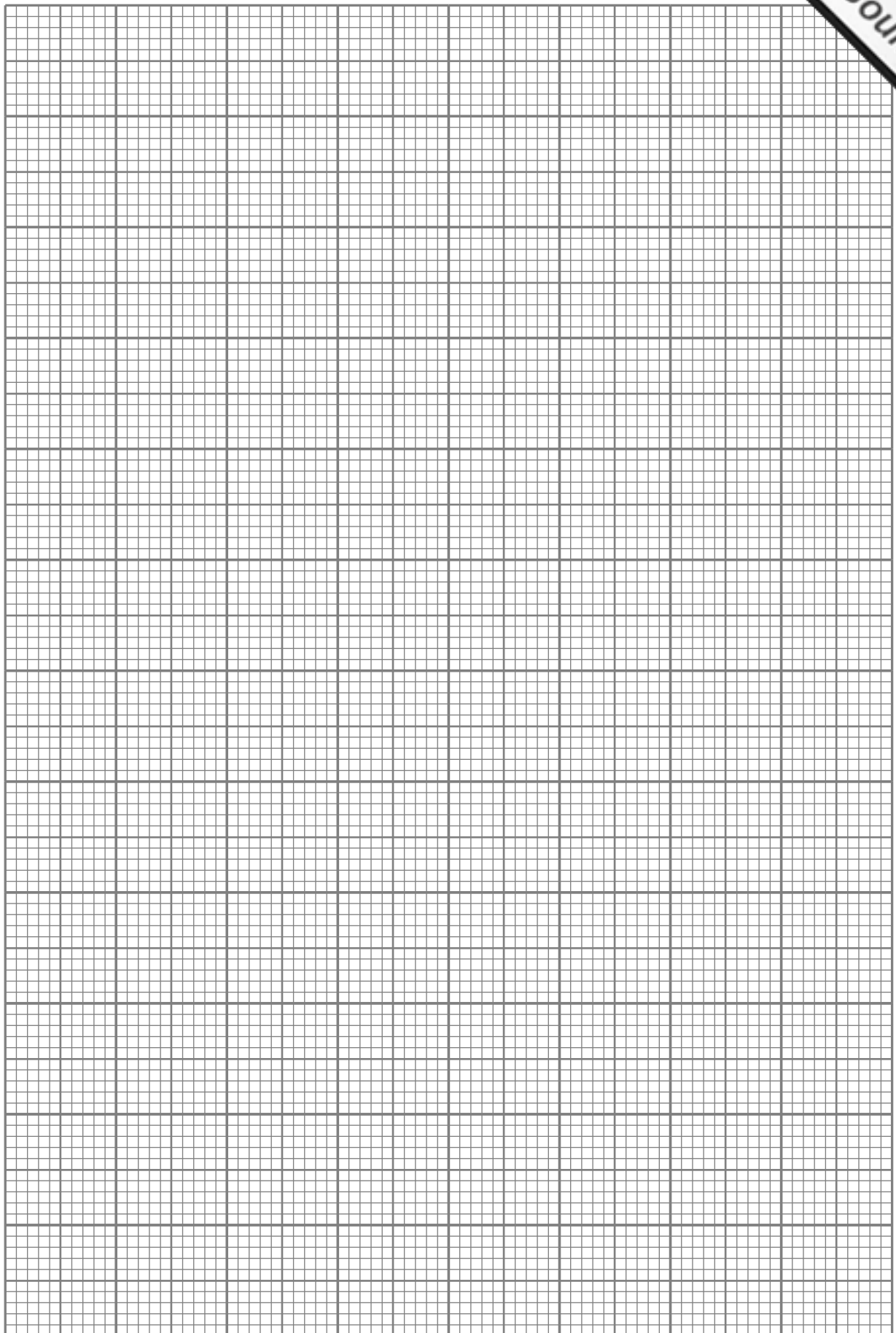
7. ***This question is about Heat.***
(a) The diagram below shows a simple heat exchanger. Heat is transferred from the ho
     the cold water through the walls of the pipe.

     Rachel and Caroline investigate whether the efficiency of a heat exchanger depends on t
     material used to make the pipe. The students test three different materials.

                                        Thermometer

Hot water   Cold water
   in   out
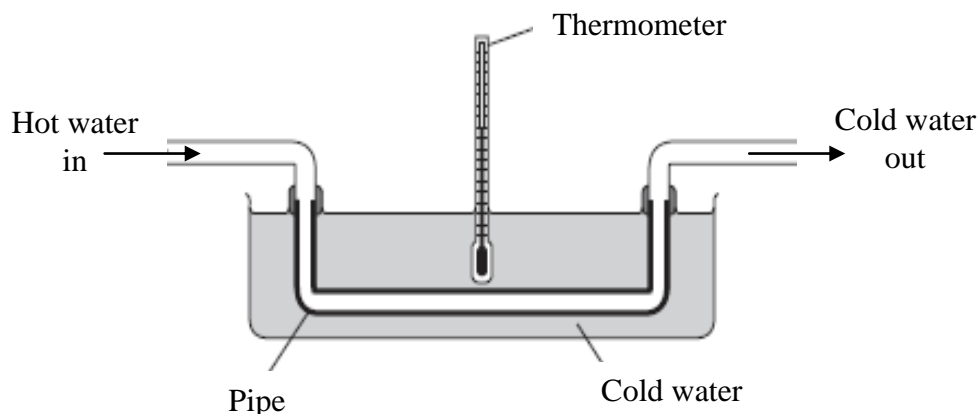
                                        Cold water
        Pipe

 (i)   Name the **main** process by which heat is transferred from the hot water inside the pipe
       to the cold water in the tank.

_____

                                                                                    (1)

The results obtained are recorded in the table below.

Material	Initial temperature of cold water (°C)	Final temperature of the cold water (°C)	Change in temperature (°C)
Copper	20	36	
Glass	20	23	
Plastic	20	21	

(ii)   Fill in the missing values in the above table.   (3)

(iii) Name **one** precaution to obtain accurate results.

_____

                                                                                    (2)

(iv)   Use the above table to choose which **one** of the three materials is the best heat
       exchanger. Give a reason for your answer.

_____

_____

                                                                                    (2)

(v)   The density of water is 1 g/cm^3 and the volume of water is 15 000 cm^3. Calculate its
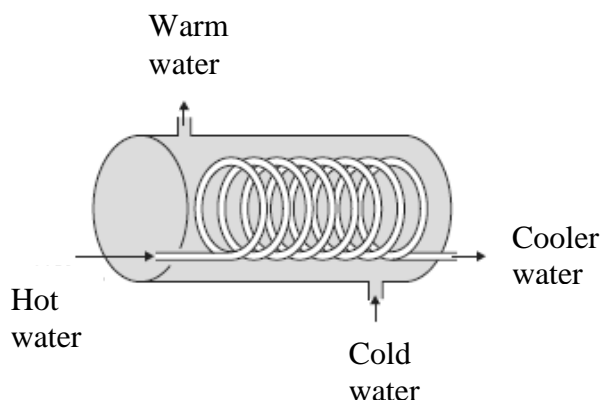   mass.

_____

_____

                                                                                    (2)

(vi)   The specific heat capacity of water is 4200 J/kg°C. Calculate the energy _____ when 50 kg of water pass through the heat exchanger, assuming that the mos_ material is used.

_____

_____

(3)
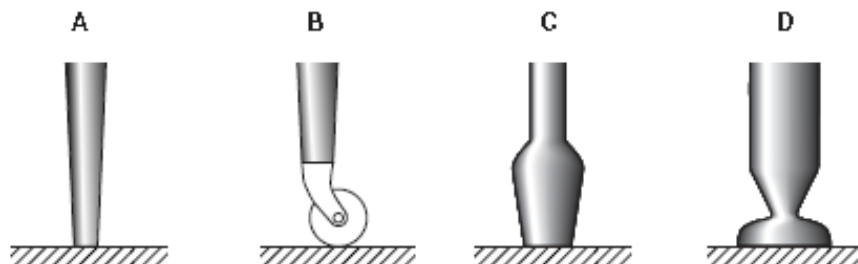
(b)   The diagram shows a heat exchanger used in an industrial laundry. What is the advantage of having a coiled pipe?

_____

_____

_____ (2)

Warm
water

Cooler
water

Hot
water

Cold
water

8.   ***This question is about Pressure.***
(a)   Heavy furniture sometimes marks the floor on which it stands. Four tables A, B, C and D, of the same weight, have legs of different shapes as shown below.

A   B   C   D

(i)   Which leg is **least** likely to mark the floor underneath it?   Give a reason for your answer.

_____

(2)

(ii)   Leg A has an area of 30 cm^2 in contact with the ground.   Calculate the **total** area of the table in contact with the ground if the table has four legs.

_____

(1)

(iii)   The mass of table A is 20 kg. Calculate the pressure exerted by the table on the floor.

_____

_____

(2)

(b) In 1851 Richard Dudgeon invented the hydraulic jack. The diagram below the hydraulic jack is applied to lift a car. The hydraulic fluid transmits pressure piston A.

car support

hydraulic fluid

4 pistons, each
of area 0.02 m^2
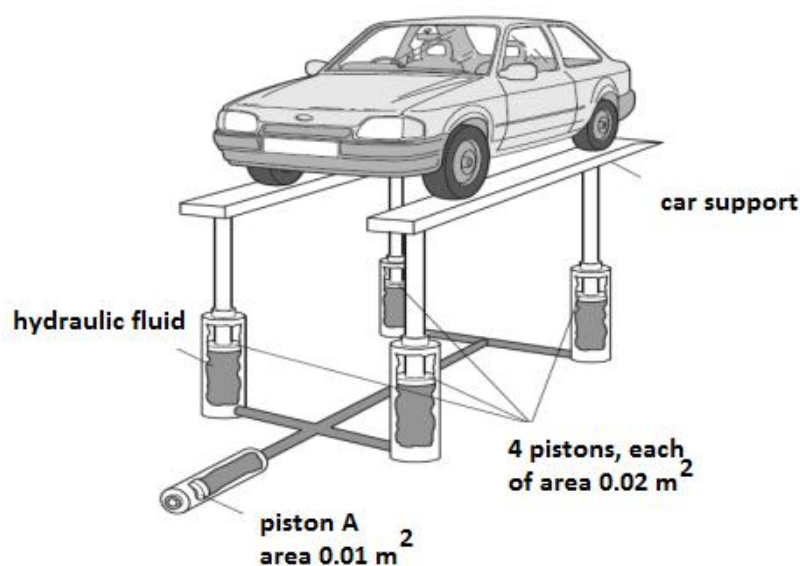
piston A
area 0.01 m^2

(i) Calculate the pressure caused by a force of 1000 N on piston A of area 0.01 m^2.

_____

_____
(2)

(ii) What is the pressure at **each** of the four pistons holding the car? Explain why.
_____

_____
(2)

(iii) Calculate the force on **each** piston of area 0.02 m^2.

_____

_____
(2)

(iv) Calculate the **total** upward force provided by the hydraulic lift on the car.

_____
(2)

(v) The weight of the car is 7000 N. Is the hydraulic lift able to lift the car? Give a reason for your answer.

_____

_____
(2)