

**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  $g = 10 \text{ m/s}^2$ .**

*You may find some of these equations useful:*

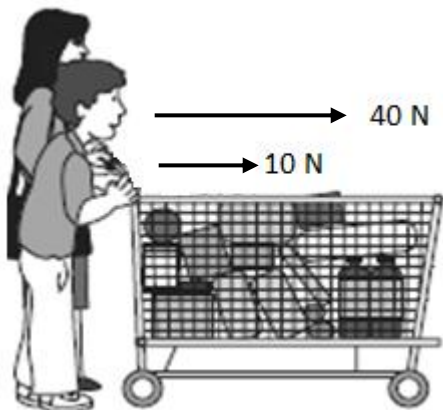
Energy and Work	$W = Fs$ $PE = mgh$	$E = Pt$ $KE = \frac{1}{2} mv^2$
Forces	$W = mg$	Moment = Force x perpendicular distance
Pressure	$P = \frac{F}{A}$	$P = h\rho g$
Density and Heat	Density ( $\rho$ ) = $\frac{m}{V}$	$Q = mc\Delta\theta$

***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.



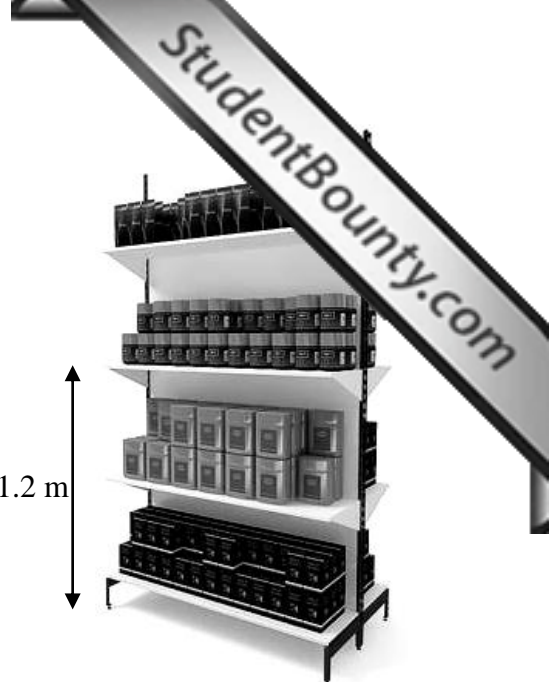
- (i) An electric motor in a washing machine is designed to transform \_\_\_\_\_ energy into \_\_\_\_\_ energy. (2)
- (ii) Some of the energy supplied to the motor is wasted as \_\_\_\_\_ energy and \_\_\_\_\_ energy. (2)
- (b) Would more or less energy be required to wash the clothes at a temperature of 60 °C instead of 40 °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)

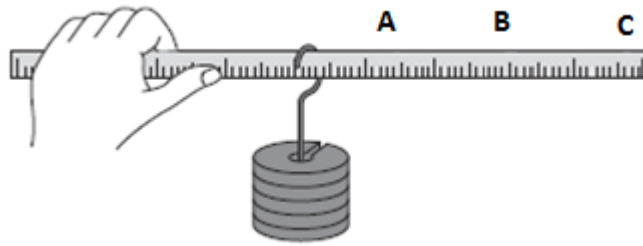
- (iii) Calculate the velocity of the jar just before it hits the floor.

(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)

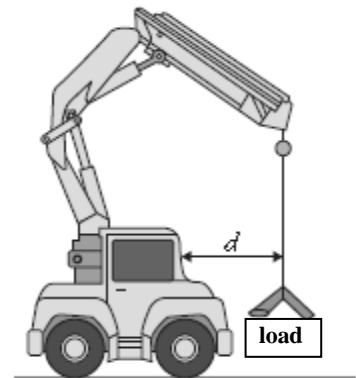
(iii) In which direction will the moment of the weight act?

(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 in the table below.

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
<b>Mercury</b>	60	0.24	1400	430
<b>Venus</b>	110	0.60	5800	470
<b>Earth</b>	150	1	24	20
<b>Mars</b>	230	2	25	- 20
<b>Jupiter</b>	780	12	10	-150
<b>Saturn</b>	1400	30	10	-180
<b>Uranus</b>	2900	84	17	-220
<b>Neptune</b>	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.

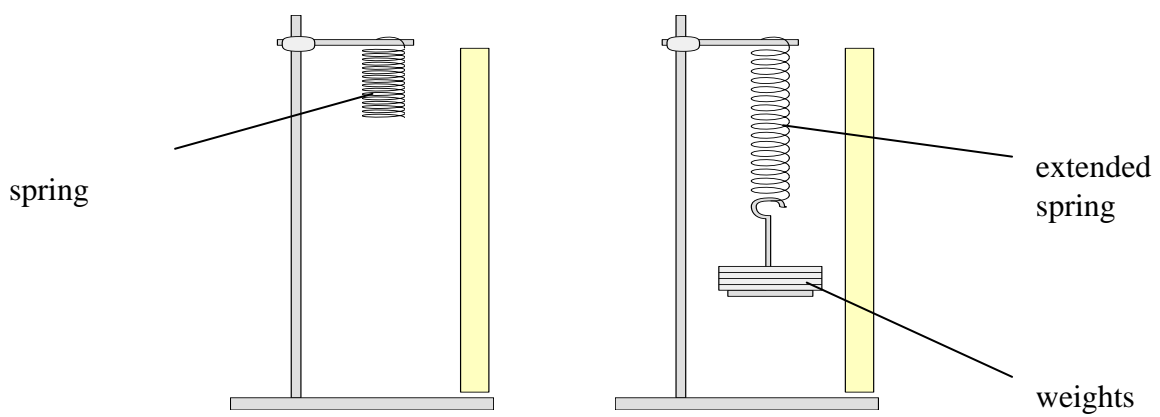
\_\_\_\_\_

\_\_\_\_\_  
(2)

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

6. *This question is about Forces.*

David measures the **extension** of a spring when **weights** are added.



David's results are as follows:

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

- (a) What is the length of the unstretched spring?  


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(1)
- (b) David left out some results. Complete the table by working out the missing values.  
(3)
- (c) Plot a graph of **Extension (mm)** on the **y-axis** against **Weight (N)** on the **x-axis**. Draw the best straight line for your graph.  
(5)
- (d) One of David's results is incorrect. Which extension is incorrect?  

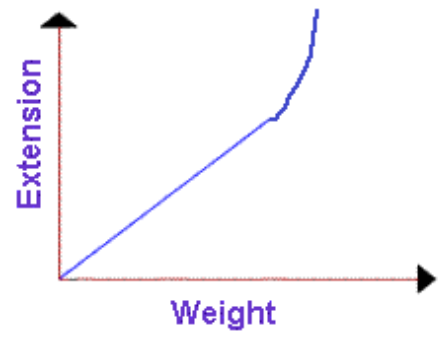

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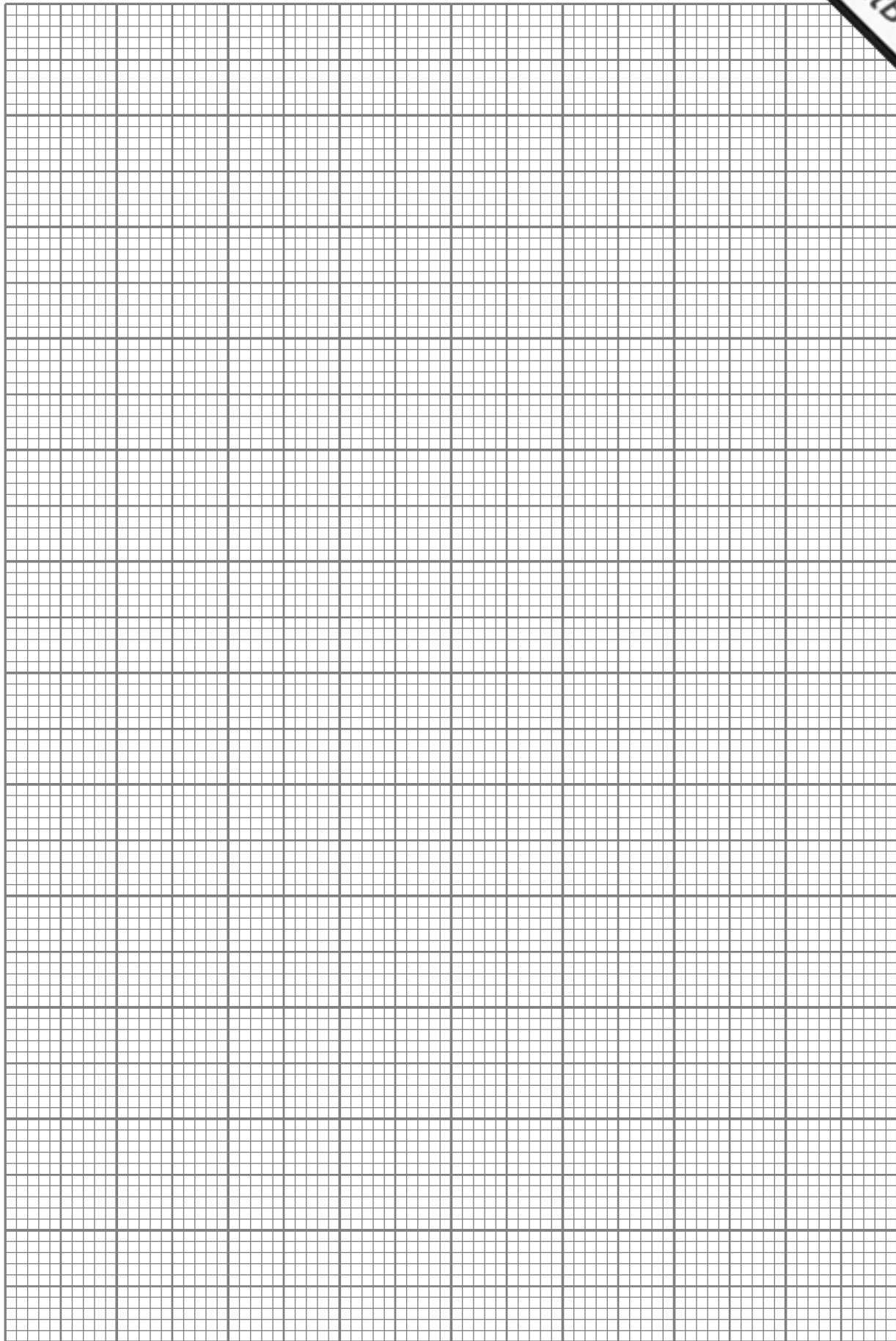
(2)
- (e) Use the graph to find the weight which causes an extension of 36 mm.  


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(1)
- (f) David adds more weights to the spring. He notices that his spring loses its shape. Complete:  
The spring has exceeded the \_\_\_\_\_ limit and no longer obeys \_\_\_\_\_ Law. (2)

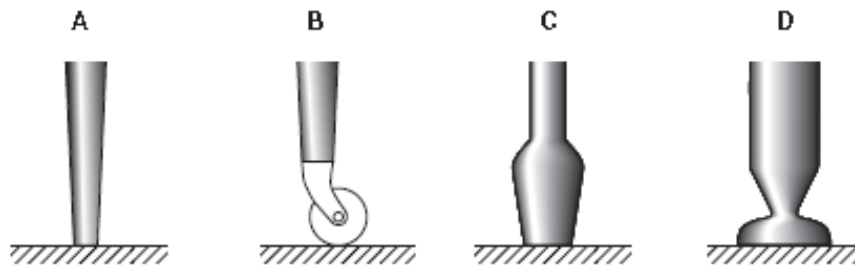
- (g) On the diagram shown, mark with a cross **X** the point where the spring loses its shape.  
(1)





7. *This question is about Pressure.*

- (a) Sometimes heavy furniture marks the floor. The diagram below shows four legs A, B, C, D of four different tables.



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

(2)

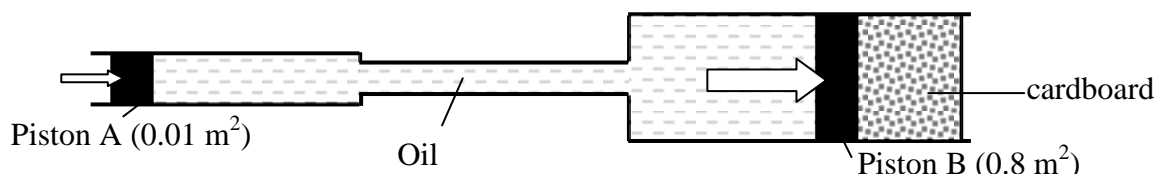
- (ii) Leg A has an area of  $30 \text{ cm}^2$  touching the floor. Calculate the **total** area of the table in contact with the floor if the table has four legs.

(1)

- (iii) The table has a weight of 200 N. Calculate the **total** pressure of the table on the floor.

(2)

- (b) The diagram shows a simple hydraulic machine used to compress cardboard. When a force is applied on piston A, the cardboard is compressed by piston B.



- (i) **Underline** the correct word in the brackets:

The advantage of a hydraulic machine is that with a (small / large) force, a (small / large) force results.

(2)

- (ii) Calculate the pressure made by a force of 1000 N on piston A of area  $0.01 \text{ m}^2$ .

(3)

- (iii) What is the pressure acting on piston B ?

(1)

- (iv) Calculate the force on piston B.

(1)



- (v) **Underline** the correct word in the brackets.

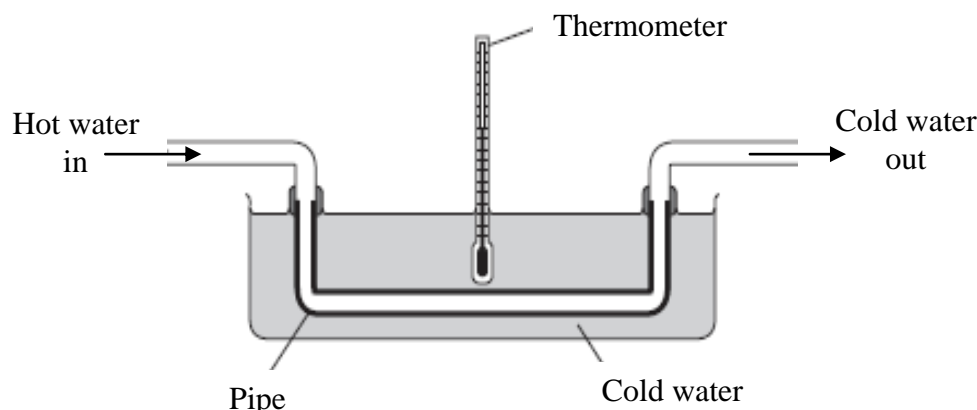
As the cardboard is compressed, its:

- volume (increases / decreases / remains the same).
- density (increases / decreases / remains the same).
- mass (increases / decreases / remains the same).

(1)

8. ***This question is about Heat.***

- (a) Rachel and Caroline investigate which is the best material to transfer heat from one place to another using the apparatus shown below. The students test copper, glass and plastic pipes.



Their results are shown below.

Pipe Material	Initial temperature of the water ( $^{\circ}\text{C}$ )	Temperature of the water after 10 minutes ( $^{\circ}\text{C}$ )	Change in temperature ( $^{\circ}\text{C}$ )
Copper	20	36	
Glass	20	23	
Plastic	20	21	

- (i) Fill in the missing values in the above table. (3)

- (ii) Name **one** precaution to obtain accurate results.

(2)

- (iii) Which material is best at transferring heat ? Give a reason for your answer.

(2)

- (iv) A volume of  $0.15 \text{ m}^3$  of water passes through the pipe. The mass of this water is 150 kg. Calculate the density of water.

(3)

- (v) The specific heat capacity of water is  $4200 \text{ J/kg}^\circ\text{C}$ . The mass of water is  $150 \text{ kg}$ .  
value for the change of temperature from the table, calculate the energy transferred by  
**copper** pipe. ( $Q = m c \Delta\theta$ )

(3)

- (b) Pipes are used to carry warm water from the water heaters to the sink.

Choose the best material (copper / glass / plastic) to be used for the  
pipes that carry warm water. Give **one** reason for your answer.



(2)