FORM 4 **PHYSICS** **Time: 1 hr. 30 min**

NAME: _____ **CLASS:** _____

Answer all questions in the spaces provided on the Examination Paper. All working must be shown. The use of a calculator is allowed.

Where necessary take the acceleration due to gravity, $g = 10$ m/s^2.

You may find some of these formulae useful.

Area of a Triangle $= \frac{1}{2}$(Base x Height) Area of a trapezium $= \frac{1}{2}$ h.(sum of parallel sides)

$v = \dfrac{s}{t}$ $v = u + at$ $s = \frac{1}{2} at^2$ $W = mg$ $F = ma$

Momentum = Mass x Velocity Pressure $= \dfrac{Force}{Area}$ $P = H \rho g$

Heat energy = Mass x Specific heat Capacity x Temperature Change

$V = I R$ $P = V I = I^2 R$ $R = R_1 + R_2 + R_3$

SECTION A. Answer all questions in the spaces provided. This section carries 55 marks.

1.   A spacecraft of mass 1000 kg takes 5 s to increase its velocity from 40 m/s to 50 m/s. Calculate the:

(a).   initial momentum of the space craft,

_____ [2]

(b).   momentum of the spacecraft after 5 s,

_____ [2]

(c).   acceleration of the spacecraft,

_____ [3]

(d).   force causing the spacecraft to accelerate.

_____ [3]

2.	(a).	Select the correct word or phrase.

	(i).	When a resultant force acts on a body, the body (accelerates, moves with uniform velocity).	[1]

	(ii)	The magnitude or size of the acceleration of a moving body (increases, decreases) with force and (increases, decreases) with mass.	[2]

	(b).	Fill in:
	in a moving car, we wear seat belts so that

	_____

	_____	[2]

3.	(a). Underline the correct answer:

	(i).	Pascal is the unit of (energy, pressure).	[1]
	(ii).	Stiletto heeled shoes produce a (larger, smaller) pressure on the ground than normal shoes.	[1]
	(iii).	As one climbs a mountain, atmospheric pressure (increases, decreases).	[1]

	(b).	Fill in:

	A block of stone measuring 1 m by 2 m by 3 m has a mass of 15000 kg and rests with its smallest face in contact with the ground.

	(i).	Its weight in newtons is _____	[1]
	(ii).	The area in contact with the ground is _____	[1]
	(iii).	The pressure exerted on the ground is _____	[2]

	(c).	Underline the correct word.

	(i).	Liquid pressure (increases, decreases) with depth.	[1]
	(ii).	The greater the density of a liquid the (greater, smaller) is the pressure at a depth of 1 m.	[2]
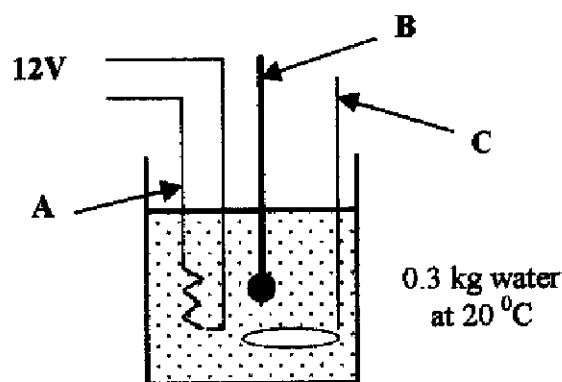

4.	The diagram shows the apparatus used to find the specific heat capacity of water.

(a)	(i).	A is a _____

	(ii).	B is a _____

	(iii).	C is a _____

	[3]

12V

B

C

A

0.3 kg water
at 20 °C

(b).   The water in the beaker is heated from 20^0 C to 30^0 C . When supplied with 12.6 kJ of heat energy.

   (i).   The temperature change of water is _____ [1]

   (ii).   Heat supplied in joules is _____ [1]

   (iii). Calculate the specific heat capacity of water.

   _____

   _____ [3]

   (iv).   State two precautions which are needed to achieve an accurate result.

   _____

   _____ [2]

5.(a). (i).   What type of charge does a polythene rod get when rubbed with a cloth?
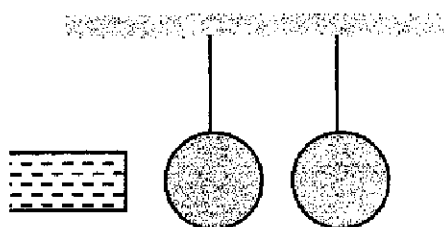
   _____ [1]

   (ii).   Explain the answer to (i) in terms of electron flow.

   _____

   _____ [2]

   (iii). The charged polythene rod is brought close to a charge cellulose acetate rod which is freely suspended. State what happens and give a reason.

   _____

   _____ [3]

(b).   Two light similar metal spheres are suspended a short distance away by insulated threads. A negative charge is brought near one of the spheres as shown.

   (i).   Draw the charge distribution on each sphere.   [2]

   (ii).   State what happens to the spheres.

   _____ [2]

6. (a). The heating element of an electric iron has a resistance of 40 Ω and is connected to a 240 V supply.

(i). Calculate the current in the heating element when it is in use.

_____

_____ [2]

(ii). From the list below, choose the value of the fuse that should be fitted to the plug of the electric iron.

1 A   3 A   5 A   7 A   [2]

(iii). Explain your choice:

_____ [2]

(b). The cable connecting the electric iron to the mains should include an earth wire.

(i). State which part of the electric iron should be connected to the earth wire.
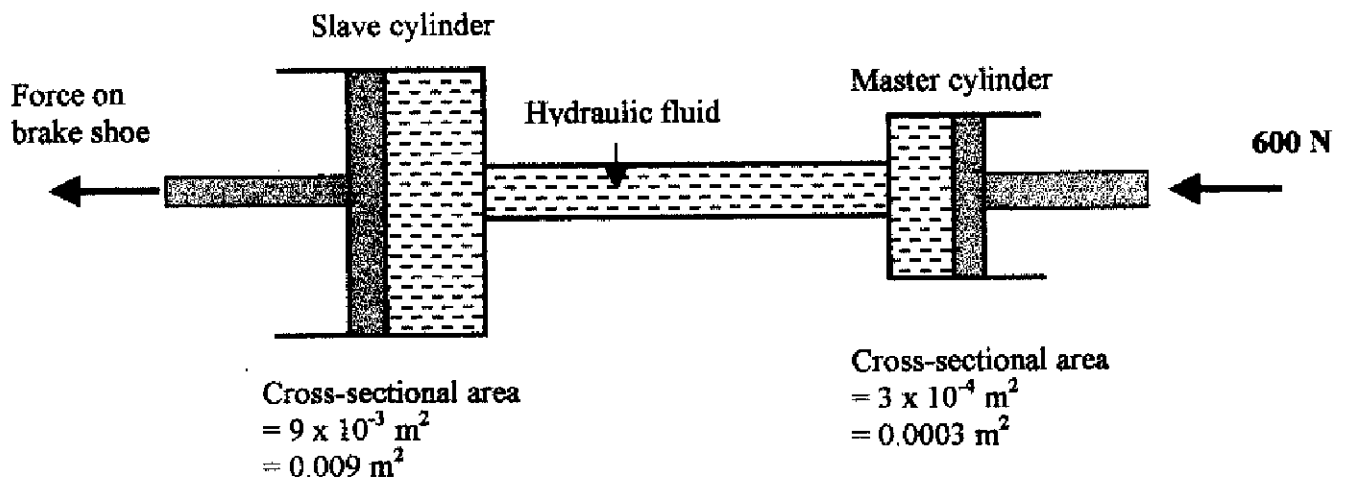
_____ [2]

(ii). Explain how the earth wire makes the iron safer when in use.

_____ [2]

SECTION B: Answer all questions in this section on the foolscaps provided. This section carries 45 marks.

7. **This question is about a car's braking system and heat capacity.**

Slave cylinder

Force on brake shoe

Hydraulic fluid

Master cylinder

600 N

Cross-sectional area
= 9 x 10⁻³ m²
= 0.009 m²

Cross-sectional area
= 3 x 10⁻⁴ m²
= 0.0003 m²

(a)   (i).   Give one reason why liquids are suitable to use in hydraulic systems such as the above.   [2]

(ii).   Calculate the pressure on the hydraulic fluid in the master cylinder by the 600 N force.   [3]

(iii).   What is the pressure in the hydraulic fluid in the slave cylinder?   [2]

(iv).   Calculate the force exerted by the piston on the brake shoe by the hydraulic fluid.   [2]

(b).
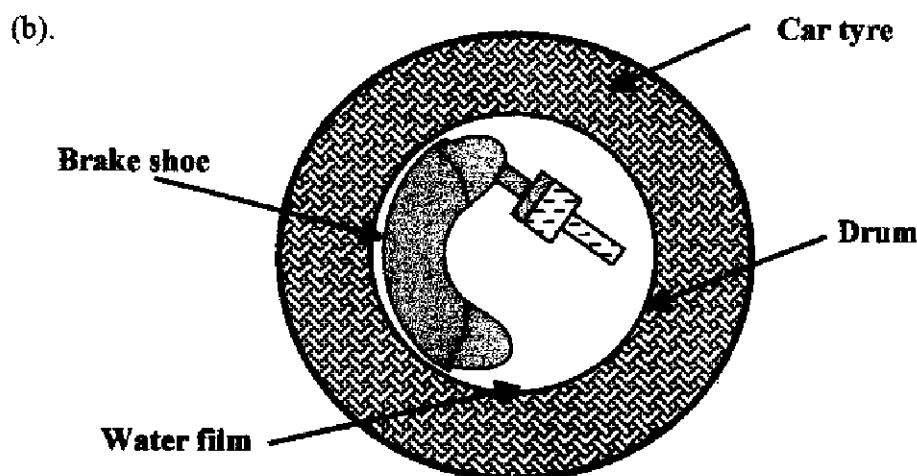
The diagram shows a part of the braking system in a motor car. The brake shoe and drum get soaked in rainwater as the car passes through a flooded area. The work done by friction as the brake pad is pressed against the drum is changed to heat energy.

(i).   Assuming that the heat energy is 21000 J and half of this energy is absorbed by water, calculate the temperature rise of the water if it has a mass of 0.05 kg and a specific heat capacity of 4200 J/kg ^{0}C.   [4]

(ii).   Explain why pressing the brake pedal several times helps to evaporate the water in the drum.   [2]

8. **This question is about electric circuits.**

The circuit diagram below is set up to measure the resistance of a length of wire PQ when different values of potential difference are applied across it.
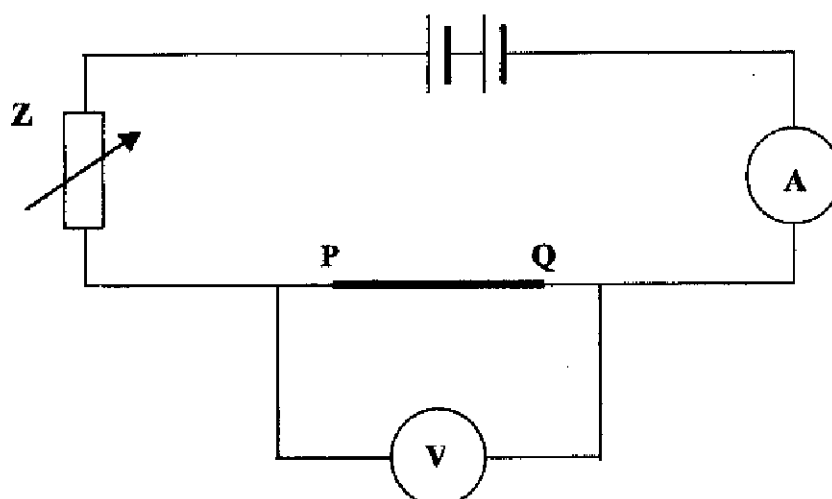
(a) i. What is component Z called? [1]

ii. State the purpose of the component Z in the circuit. [1]

(b) Some measurements obtained for the wire PQ are shown below.

Potential difference, V / V	0	1.0	2.0	3.0	4.0	5.0	6.0
Current, I / A	0	0.5	1.0	1.5	2.0	2.5	3.0

(i) Plot a graph of current, I (y-axis) against potential difference, V (x-axis) on the graph paper provided. [5]

(ii) From your graph find the value of the current I in amps when the p.d. across the wire PQ is 7.0 V. [2]

(iii) From your graph find the value of p.d. across the wire PQ in volts when the current through it is 2.75 A. [1]

(iv) Calculate the resistance of the wire. [1]

(v) Calculate the power when the p.d. across the wire PQ is 6.0 V. [1]

(c). (i). Does the wire obey Ohm's Law? [1]

(ii). State how you arrived at your conclusion. [1]

(iii). What can be said about the resistance of the wire while the voltage across it is increased? [1]

9.   **This question is about heat transfer and the design of an experiment.**

(a)   A metal pan containing water is being heated over a gas flame.

   i.   What do we call the process by which heat energy is transferred from the flame through the metal to the water?
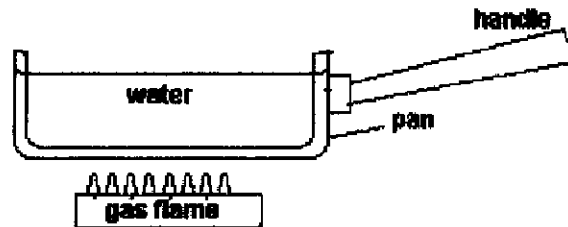
[1]

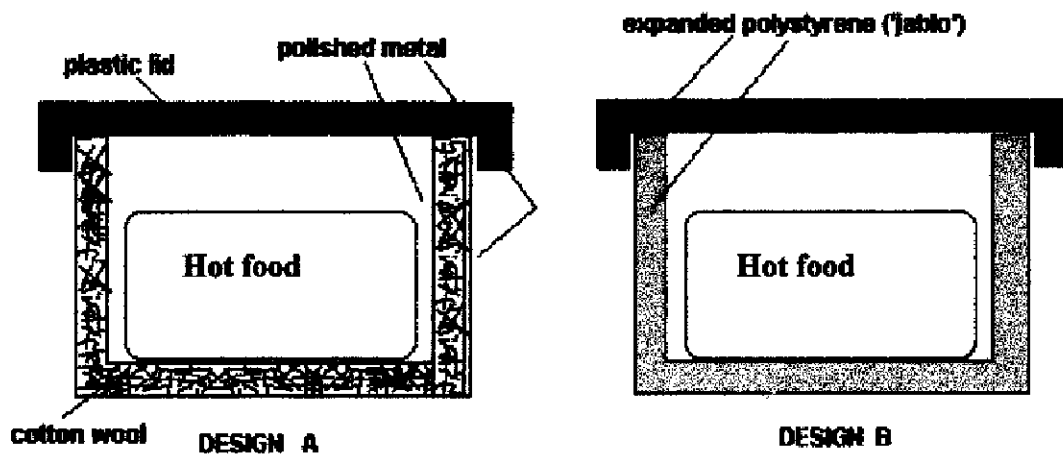   ii.   By which process is the heat transferred throughout all parts of the water in the pan.

[1]

   iii. Why is it more efficient for the outer surface of the pan to be highly polished?

[3]

(b)   Two groups of students are asked to design a container which would keep food warm for the longest possible time.

They present the following two designs, A and B, in the following diagram.

Examine each design carefully. Then answer the following questions.

You are told to carry out an experiment to investigate which container keeps food warmer for the longer time.

Describe the experiment you would perform. Your answer should include:

(i).   any additional apparatus you would use   [2]

(ii).   the method you would use   [4]

(iii).   any two precautions taken to ensure a reliable conclusion   [2]

(iv).   the way you would display your results.   [2]