Last Name: (Print clearly)			
First Name: (Print clearly)		Initials	

TONBRIDGE SCHOOL

Specimen paper for entry into Year 12

PHYSICS

Time allowed: 45 minutes

Information

You may find the following information helpful

Area of a circle = πr^2

Force = Pressure x area

$F = m a$

$g = 10\ Nkg^{-1}$ or ms^{-2}

$KE = ½ m v^2$

$\triangle Q = m c \triangle T$

$Q = I t$

$PE = m g h$

$P = I V$

$v = s \div t$

$V = I R$

$W = Fd$

Question	Mark
1	/13
2	/19
3	/7
4	/6
5	/8
Total	**/53**

Instructions

This paper assesses your aptitude for Physics, as much as your knowledge. There will be questions on unfamiliar topics that you may not have studied, however it is important that you **answer all the questions** using the information in the question or on the front of this paper. The questions are designed so that you only need your understanding of Physics to answer them, rather than specific knowledge.

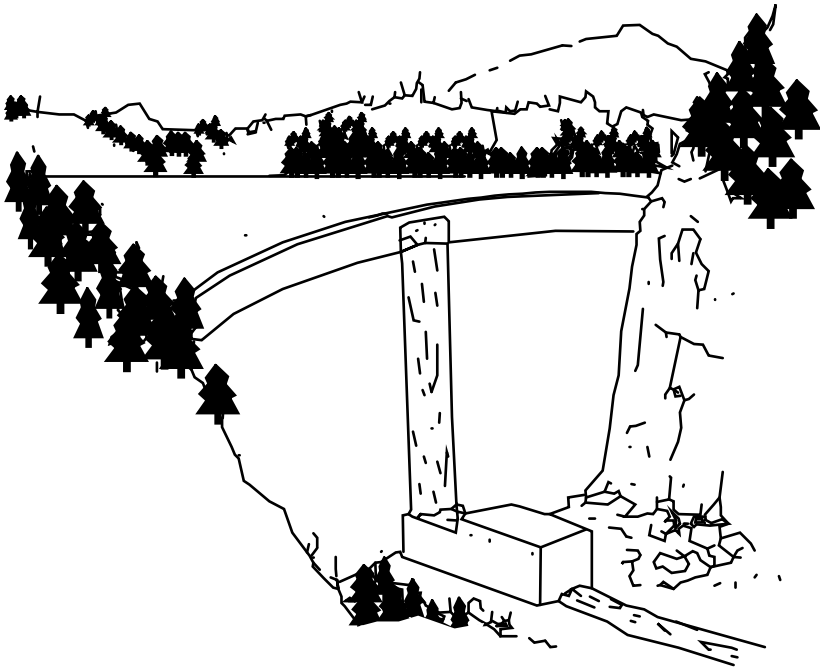
The marks allocated with each question indicate the level of detail required for each answer.

There are **53** marks available in this paper. Calculators may be used.

Show ALL working with your answers. Credit may be given for correct working, even if the final answer is incorrect. Use of correction fluid is not permitted.

Note to teachers, please print this double sided as the paper has been designed so that questions face each other.

1. The diagram below shows water falling from a dam. Each minute 12 000 kg of water falls vertically into the pool at the bottom.



The time taken for the water to fall is 2 s and the acceleration of the water is 10 m/s².

(a) Assume the speed of the water at the bottom of the dam is zero. Calculate the speed of the water just before it hits the pool at the bottom.

.....

.....

.....

(2)

(b) Use your answer to part (a) to calculate the average speed of the falling water.

.....

(1)

(c) Calculate the height that the water falls.

.....

.....

.....

(2)

(d) What weight of water falls into the pool each minute?

.....

.....

(2)

(e) How much work is done by gravity each minute as the water falls?

.....

.....

(2)

(f) A small electrical generator has been built at the foot of the waterfall. It uses the falling water to produce electrical power.

(i) How much energy is available from the falling water each minute?

.....

(ii) How much power is available from the falling water?

.....

.....

(iii) If the generator is 20% efficient, calculate the electrical power output of the generator.

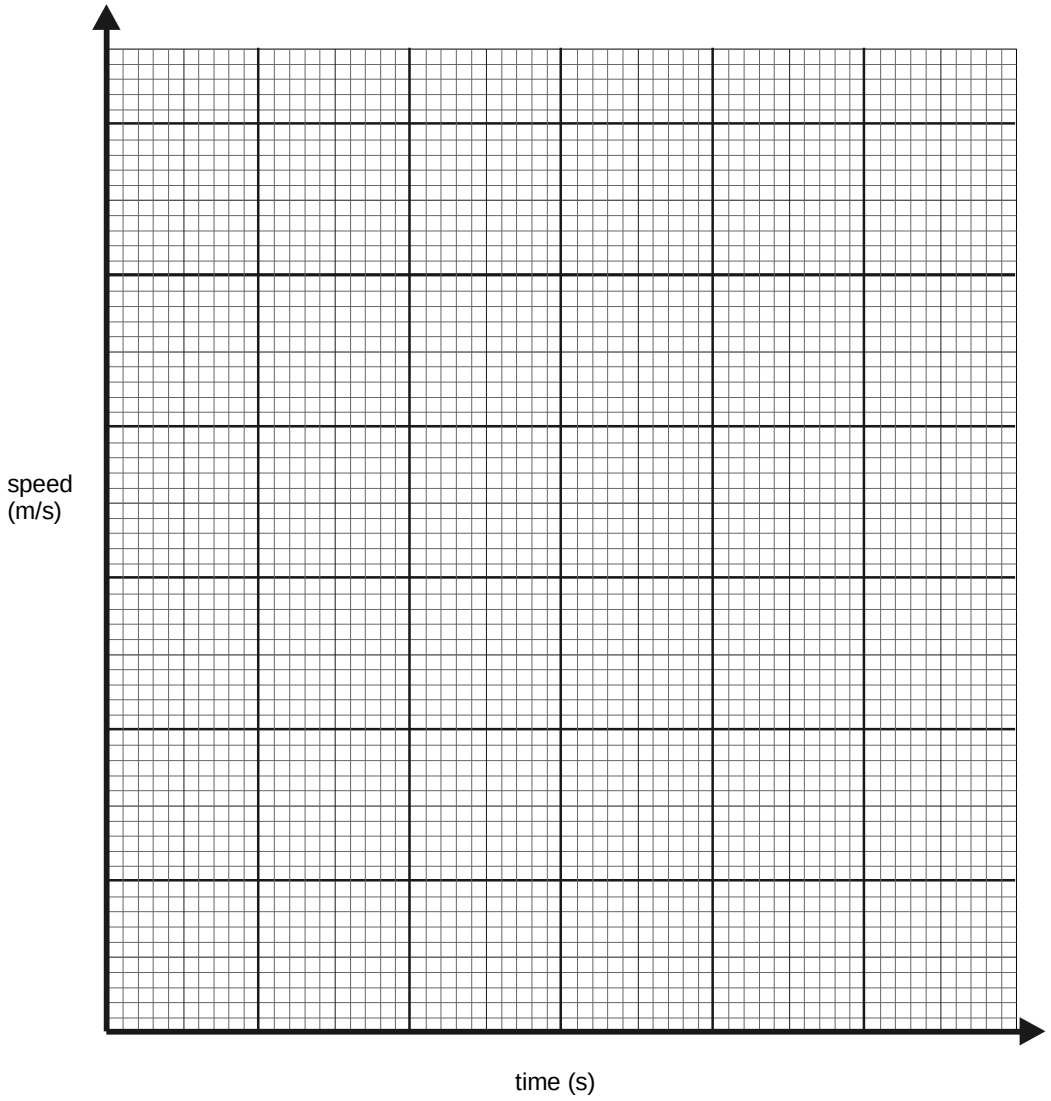
.....

.....

(4)

2. A driver is driving along a road at 30 m/s. The driver suddenly sees a large truck parked across the road and reacts to the situation by applying the brakes so that a constant braking force stops the car. The reaction time of the driver is 0.67 seconds, it then takes another 5 seconds for the brakes to bring the car to rest.

(a) Using the data above, draw a speed-time graph to show the speed of the car from the instant the truck was seen by the driver, until the car stopped.



(5)

(b) Calculate the acceleration of the car whilst the brakes are applied.

.....

.....

.....

Answer = ... m/s^2

(3)

(c) The mass of the car is 1500 kg. Calculate the braking force applied to the car.

.....

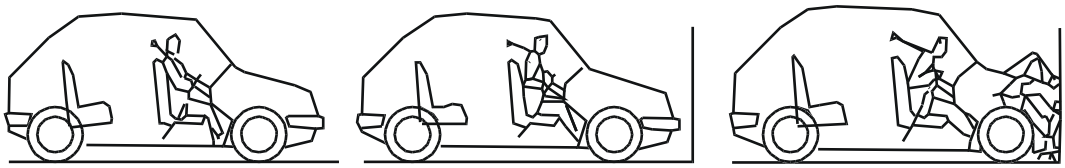
.....

.....

Answer = ... N

(3)

(d) The diagrams below show what would happen to a driver in a car crash.



(i) Explain why the driver tends to be thrown towards the windscreen.

.....

.....

.....

.....

.....

.....

.....

.....

.....

(ii) During the collision the front end of the car becomes crumpled and buckled. Use this information to explain why such a collision is described as "inelastic".

.....

.....

(iii) The car was travelling at 30 m/s immediately before the crash. Calculate the energy which has to be dissipated as the front of the car crumples.

.....

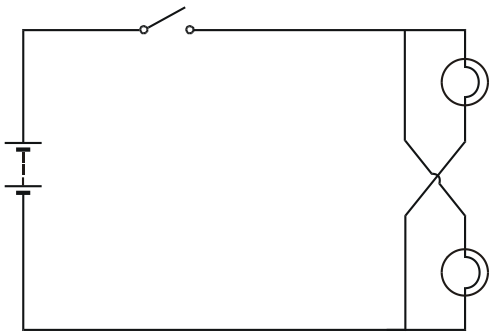
.....

.....

.....

(8)

3. The circuit diagram below shows a circuit used to supply electrical energy to the two headlights of a car.



The current through the filament of one car headlight is 3.0 A. The potential difference across each of the two headlights is 12 V.

(a) Suggest a suitable fuse for the circuit. .....

(1)

(b) Calculate the resistance of the headlight filament when in use.

.....

.....

.....

.....

Answer ..... Ω

(2)

(c) Calculate the power supplied to the two headlights of the car.

.....

.....

.....

Answer ..... W

(2)

(d) The fully charged car battery can deliver 72 kJ of energy at 12 V. How long can the battery keep the headlights fully on?

.....

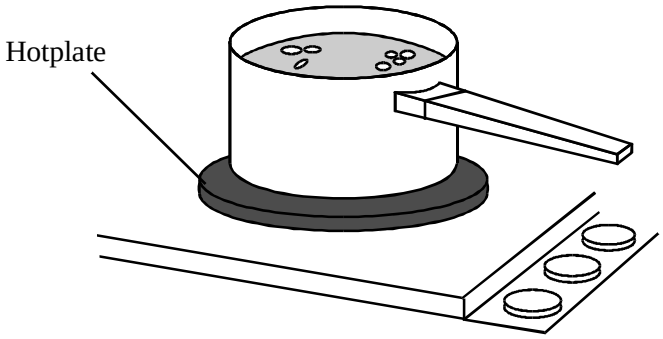
.....

.....

Answer ..... s

(2)

4. The drawing shows water being heated in a metal saucepan.



(a) Explain, in terms of the particles in the metal, how heat energy is transferred through the base of the saucepan.

.....

.....

.....

.....

(2)

(b) Energy is transferred through the water by convection currents. Explain what happens to cause a convection current in the water. The answer has been started for you.

As heat energy is transferred through the saucepan, the water particles at the bottom

.....

.....

.....

.....

.....

.....

.....

.....

(3)

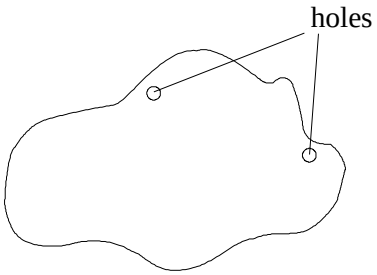
(c) Some energy is transferred from the hotplate to the air by *thermal radiation*. What is meant by *thermal radiation*?

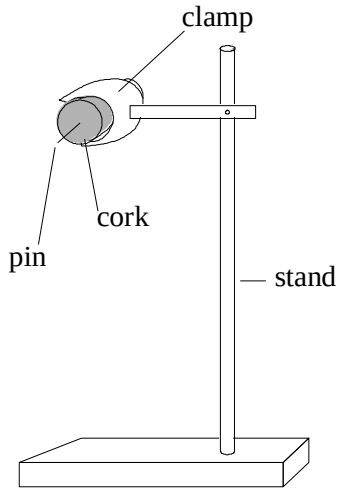
.....

.....

(1)

5. (a) A thin sheet of cardboard is cut to the shape below. Two holes are made in it. A pin is stuck into a cork held in a clamp. The apparatus is used to find the centre of mass of the card.





(i) What other piece of equipment is needed?

.....

(1)

To gain full marks in this question you should write your ideas in good English. Put them into a suitable order and use the correct scientific words.

(ii) Describe how you would use the equipment to find the centre of mass of the card.

.....

.....

.....

.....

.....

.....

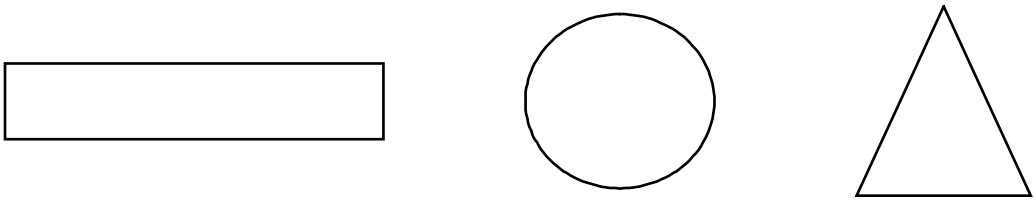
.....

.....

.....

(4)

(b) Label with an **X** the centre of mass of each of the three objects below.



(3)