PEAK SUCCESS EDUCATION
Kenya Certificate of Secondary Education

NAME: ……..……..……

SCHOOL:……

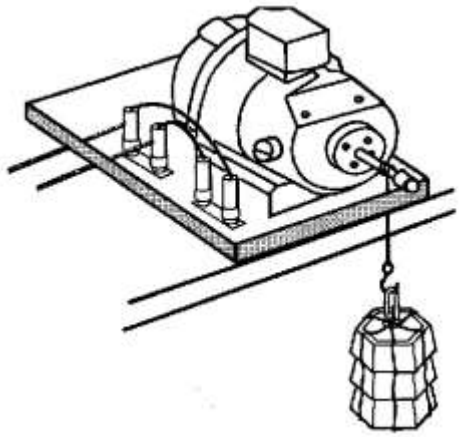
DATE: .....

WORK ENERGY POWER AND MACHINES

INSTRUCTIONS TO CANDIDATES

*Answer **ALL** questions in this paper in the spaces provided.*

1. (a) An electric motor is used to raise a mass of 1.5 kg through a vertical height of 1.2 m. The load is raised at a steady speed.



(i) Calculate the increase in gravitational potential energy of the load when it is raised through 1.2 m.
The gravitational field strength is 10 N/kg.

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(3)

(ii) The time taken to raise the load is 4.0 s.
Calculate the power output of the electric motor as it raises the load.

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(3)

(iii) The input power to the motor as it raises the load is 30W.
Calculate the efficiency of the motor.

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(3)

(b) Suggest a reason why the power given out by the motor is less than the power put in.

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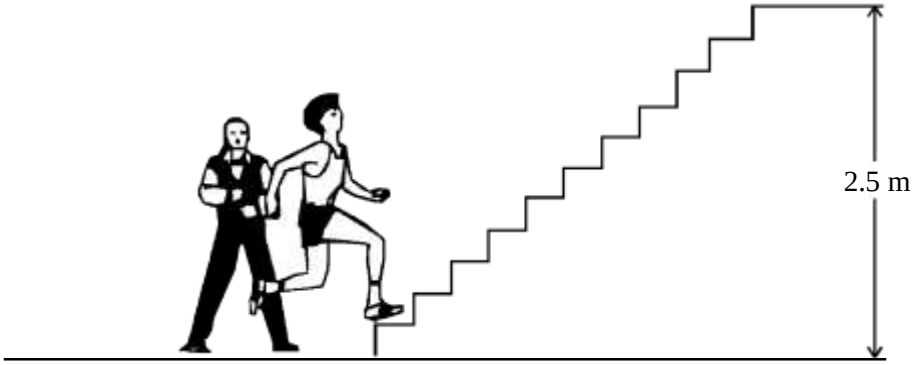
(1)

(Total 10 marks)

2. (a) Two friends are calculating the power needed to climb some steps.
The girl measures how long the boy takes to run up the steps shown in the diagram.



(i) The value of g is 10 N/kg. The mass of the boy is 50 kg.

Calculate his weight.

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(3)

(ii) The vertical height of the steps is 2.5 m.

How much work did the boy do in climbing the steps?

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(3)

(iii) It took the boy 5 seconds to run up the steps. Using

$$\text{power} = \frac{\text{work done}}{\text{time taken}}$$

calculate the power developed by the boy as he ran up the steps.

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(2)

(b) The girl then tried the experiment and took 3 seconds to run up the steps.
Her weight is the same as the boy's.
Was her power output more or less than his?

Explain how you decided.

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(2)

(Total 10 marks)

3. (a) A car is travelling along a straight flat road at 30 m/s.

(i) What type of energy does it have?

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(1)

(ii) When the brakes are applied the car is brought to a stop. What has happened to the energy it had whilst moving?

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(1)

(b) The car starts going up a hill. The driver notices that the speed of the car begins to decrease. He has not applied the brakes or altered the setting on the accelerator.

Explain in terms of energy why the car's speed begins to decrease.

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(2)

(c) When the driver brakes, the distance needed to stop the car moving at 30 m/s up a hill is less than the distance on a flat road.

Explain why.

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(1)

(d) A journey involving a lot of speeding up and slowing down uses more petrol than one where the speed remains fairly constant.

Explain this in terms of energy.

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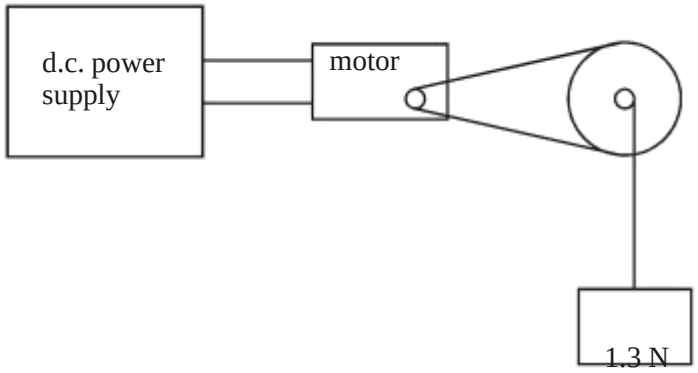
(3)

(Total 8 marks)

4. The diagram shows a small electric motor being used to lift a weight of 1.3 N.

The power input to the motor from the supply is 0.6 W.



(a) The gravitational potential energy of the weight increases by 1.04 J in 4 s.

(i) Calculate the rate at which the weight gains gravitational potential energy.

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(2)

(ii) Calculate the height through which the weight is lifted in 4 s.

State the equation you use in your calculation.

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(3)

(iii) Calculate the efficiency of the motor.

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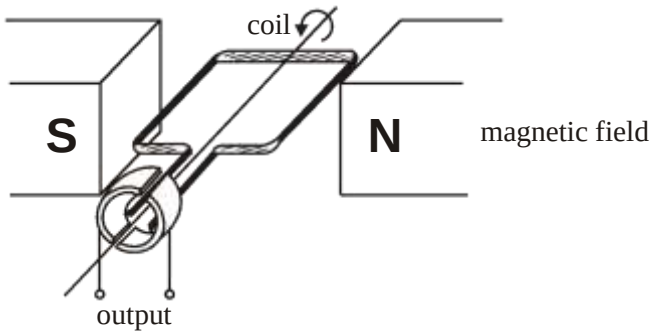
(2)

(b) (i) The raised weight is held in place whilst the power supply is disconnected and a small lamp is connected across the output to the motor. The weight is released and the lamp lights.



Explain this with reference to the diagram of the motor.

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(2)

(ii) The brightness of the lamp is observed to increase as the weight falls.

Explain this.

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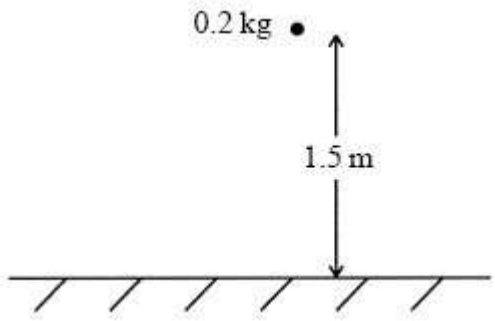
(2)

(Total 11 marks)

5. The diagram shows a ball of mass 0.2 kg held 1.5 m above the ground.



(a) Calculate the gravitational potential energy of the ball.

Assume that the gravitational field strength is 10 N/kg.

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(2)

(b) State the value of the kinetic energy of the ball just as it reaches the ground.

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(1)

(c) Show that just as the ball reaches the ground it has a speed of approximately 5.5 m/s.

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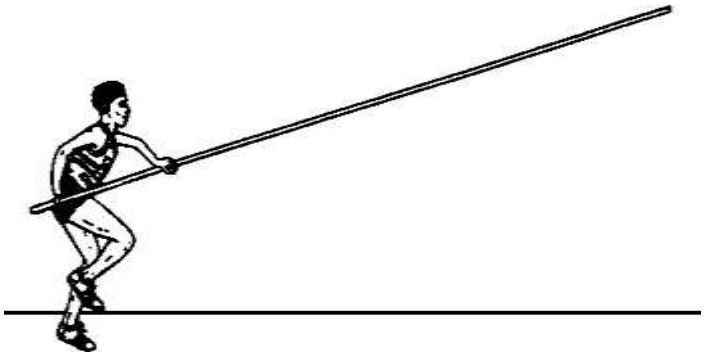
(2)

(Total 5 marks)

PEAK SUCCESS EDUCATION

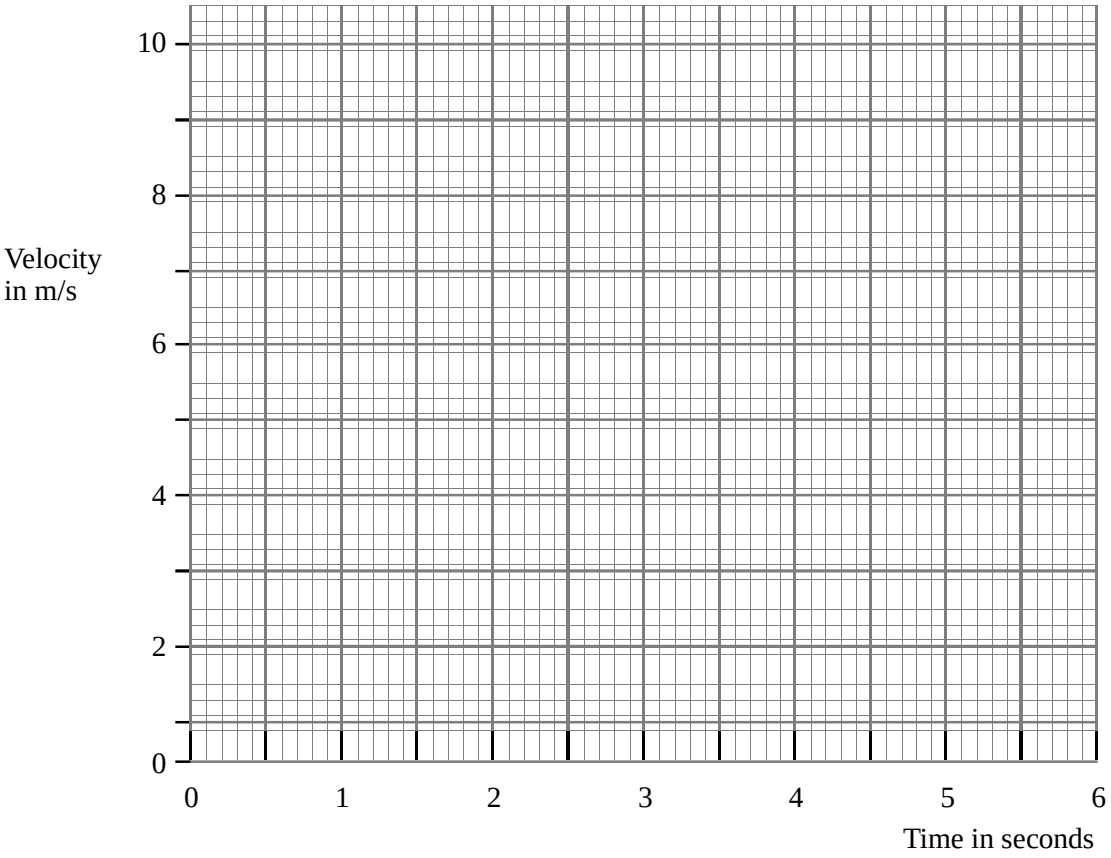
6. In an athletics competition, Tim competes in the pole vault.



The table shows how Tim's velocity changes during his run up.

Velocity (m/s)	0	2.8	5.0	6.8	8.0	8.6	8.6
Time (s)	0	1.0	2.0	3.0	4.0	5.0	6.0

(a) (i) Draw a graph of his velocity against time.



(3)

(ii) Use your graph to find his velocity at 3.5 seconds.

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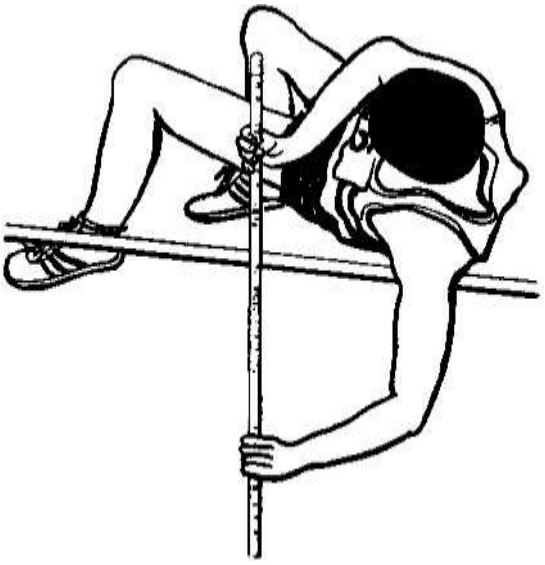
(1)

(b) Tim weighs 750 N.



Calculate the work Tim would need to do to raise his body 4.0 m vertically.
State the unit in your answer.

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(3)

(Total 7 marks)