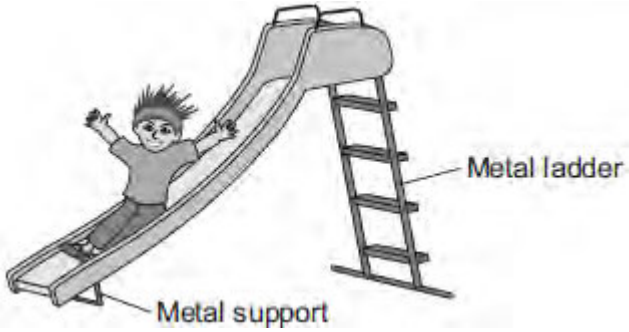
Q1. The figure below shows a slide in a children's playground.



(a) A child of mass 18 kilograms goes down the slide.

The vertical distance from the top to the bottom of the slide is 2.5 metres.

Calculate the decrease in gravitational potential energy of the child sliding from the top to the bottom of the slide.

Gravitational field strength = 10 N / kg

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.....

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Decrease in gravitational potential energy = ... J

(2)

(b) The slide is made of plastic.

(i) The child becomes electrically charged when he goes down the slide.

Explain why.

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(2)

(ii) Going down the slide causes the child's hair to stand on end.

What conclusion about the electrical charge on the child's hair can be made from this observation?

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Give a reason for your answer.

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(2)

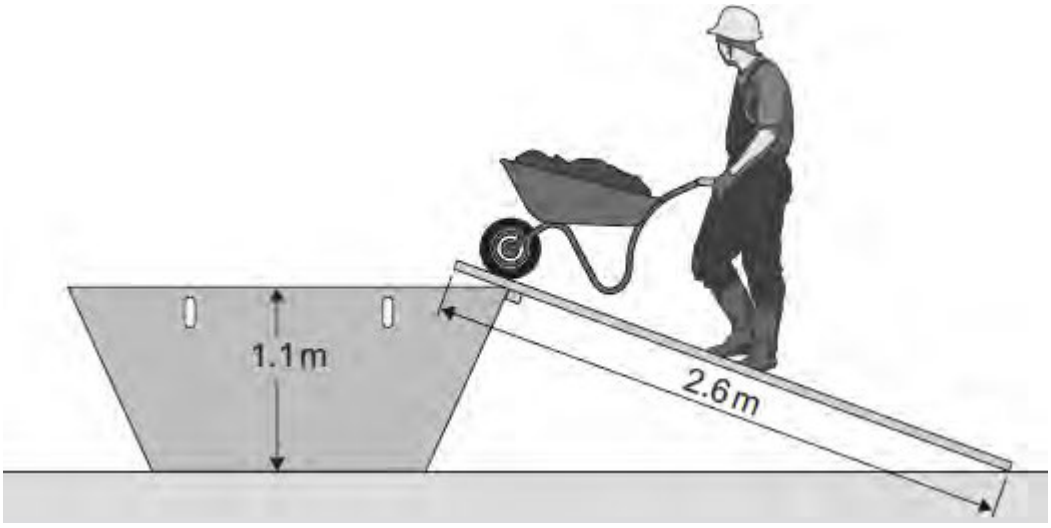
(iii) Why would the child **not** become electrically charged if the slide was made from metal?

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(1)
(Total 7 marks)

Q2. (a) The diagram shows a builder using a plank to help load rubble into a skip.



The builder uses a force of 220 N to push the wheelbarrow up the plank.

Use information from the diagram to calculate the work done to push the wheelbarrow up the plank to the skip.

Show clearly how you work out your answer.

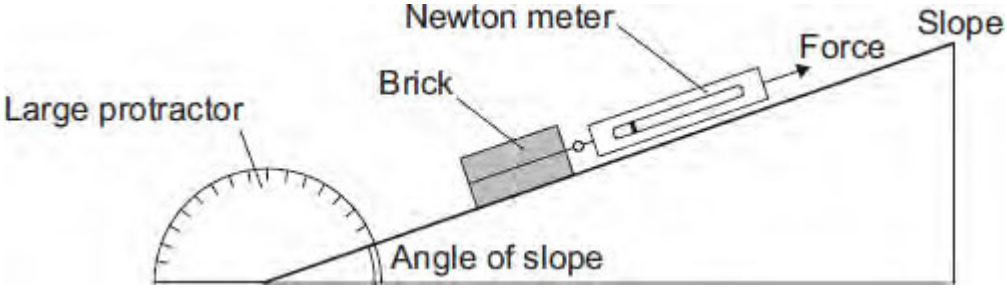
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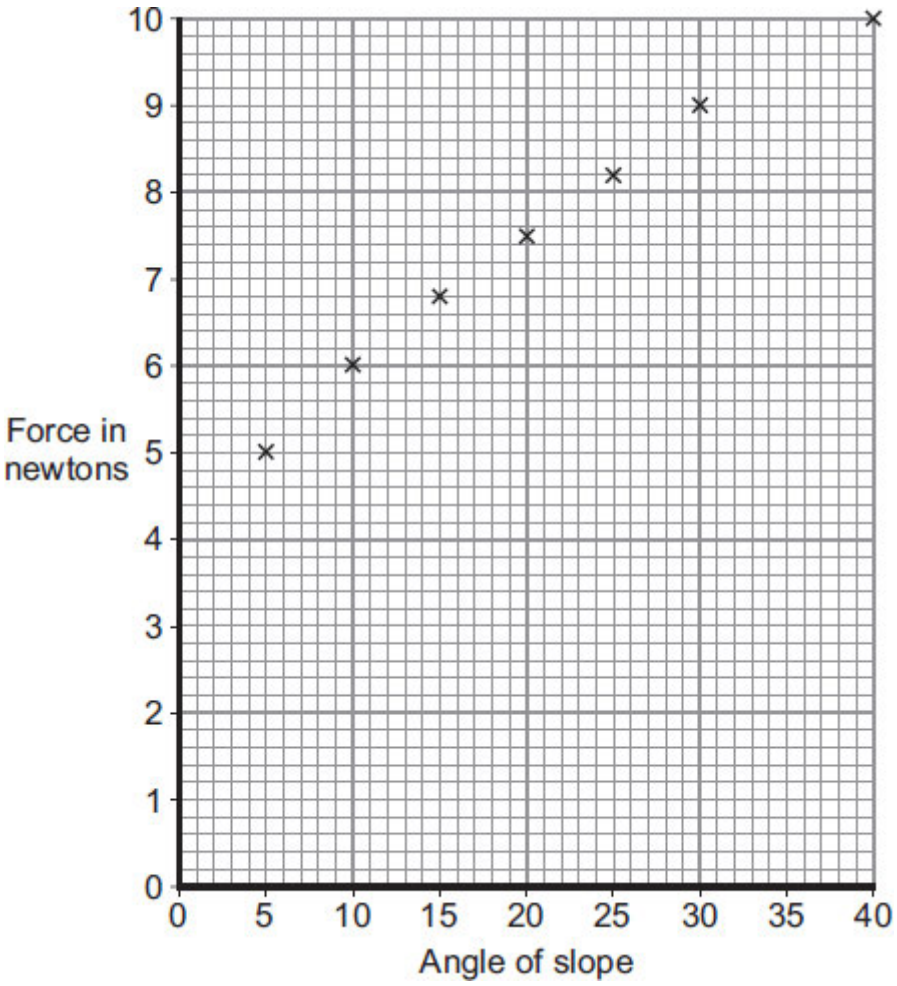
Work done = ... J

(2)

(b) A student investigated how the force needed to pull a brick up a slope, at a steady speed, depends on the angle of the slope.
The apparatus used by the student is shown in the diagram.



The student used the results from the investigation to plot the points for a graph of force used against the angle of the slope.



(i) Draw a line of best fit for these points.

(1)

(ii) How does the force used to pull the brick up the slope change as the angle of the slope increases?

.....

.....

(1)

(iii) Consider the results from this experiment.
Should the student recommend that the builder use a long plank or a short plank to help load the skip?

Draw a ring around your answer.

long plank **short plank**

Explain the reason for your answer.

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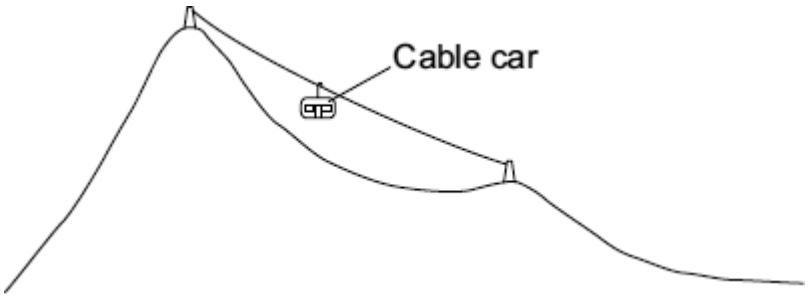
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(2)
(Total 6 marks)

Q3. (a) The diagram shows a cable car used to take skiers to the top of a mountain.



(i) The total mass of the cable car and skiers is 7500 kg.

Calculate the weight of the cable car and skiers.

gravitational field strength = 10 N/kg

Show clearly how you work out your answer and give the unit.

.....

.....

Weight = ...

(3)

(ii) The cable car moves at a constant speed. It lifts skiers through a vertical height of 800 metres in 7 minutes.

Calculate the work done to lift the cable car and skiers.

Show clearly how you work out your answer.

.....

.....

Work done = ... J

(2)

(b) The diagram shows a skier who is accelerating down a steep ski slope.



(i) Draw an arrow on the diagram to show the direction of the resultant force acting on the skier.

(1)

(ii) How and why does the kinetic energy of the skier change?

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(2)

(c) Last year, 18 000 skiers suffered a head injury. It is thought that nearly 8000 of these injuries could have been avoided if the skier had been wearing a helmet. However, at present, there are no laws to make skiers wear helmets.

Suggest why skiers should be made aware of the benefits of wearing a helmet.

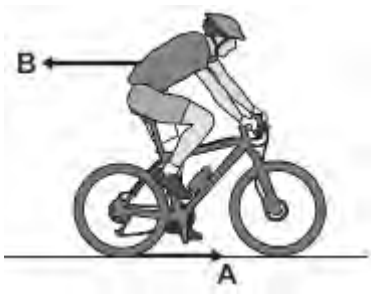
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(1)
(Total 9 marks)

Q4.(a) **Figure 1** shows the horizontal forces acting on a moving bicycle and cyclist.

Figure 1



(i) What causes force **A**?

Draw a ring around the correct answer.

friction **gravity** **weight**

(1)

(ii) What causes force **B**?

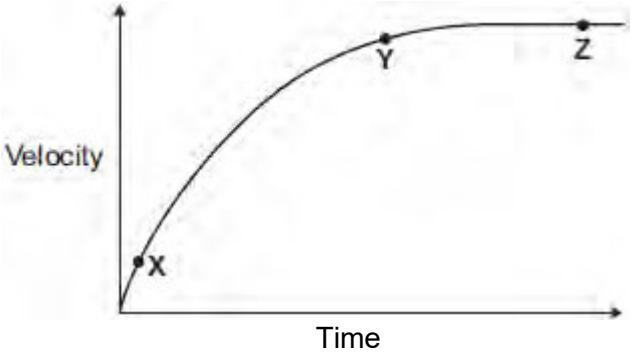
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(1)

(iii) **In this question you will be assessed on using good English, organising information clearly and using specialist terms where appropriate.**

Figure 2 shows how the velocity of the cyclist changes during the first part of a journey along a straight and level road. During this part of the journey the force applied by the cyclist to the bicycle pedals is constant.

Figure 2



Describe how **and** explain, in terms of the forces **A** and **B**, why the velocity of the cyclist changes:

- between the points **X** and **Y**
- and between the points **Y** and **Z**, marked on the graph in **Figure 2**.

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Extra space .....

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(6)

(b) (i) The cyclist used the brakes to slow down and stop the bicycle.

A constant braking force of 140 N stopped the bicycle in a distance of 24 m.

Calculate the work done by the braking force to stop the bicycle. Give the unit.

.....

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Work done = ...

(3)

(ii) Complete the following sentences.

When the brakes are used, the bicycle slows down. The kinetic energy of the

bicycle ..... .

At the same time, the ..... of the brakes increases.

(2)
(Total 13 marks)

Q5.A car has an oil leak. Every 5 seconds an oil drop falls from the bottom of the car onto the road.

(a) What force causes the oil drop to fall towards the road?

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(1)

(b) The diagram shows the spacing of the oil drops left on the road during part of a journey



Describe the motion of the car as it moves from **A** to **B**.

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Explain the reason for your answer.

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(3)

(c) When the brakes are applied, a braking force slows down and stops the car.

(i) The size of the braking force affects the braking distance of the car.

State **one** other factor that affects the braking distance of the car.

.....

(1)

(ii) A braking force of 3 kN is used to slow down and stop the car in a distance of 25 m.

Calculate the work done by the brakes to stop the car and give the unit.

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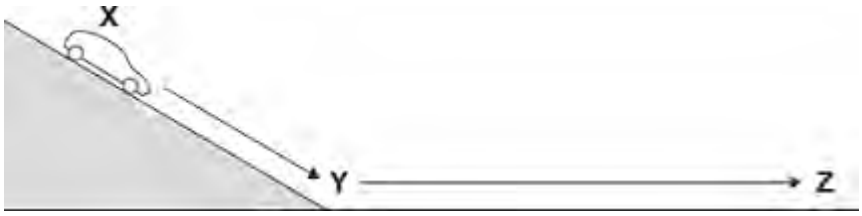
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Work done =.....

(3)
(Total 8 marks)

Q6.(a) The diagram shows a car at position **X**.



The handbrake is released and the car rolls down the slope to **Y**.
The car continues to roll along a horizontal surface before stopping at **Z**.
The brakes have **not** been used during this time.

(i) What type of energy does the car have at **X**?

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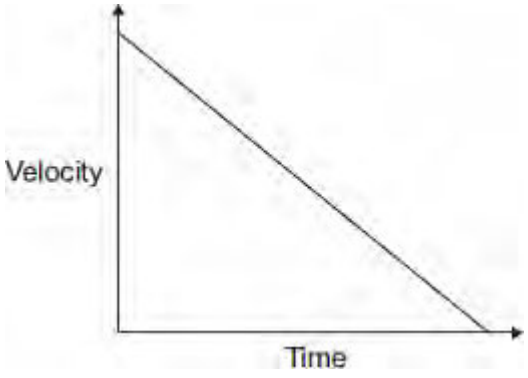
(1)

(ii) What type of energy does the car have at **Y**?

.....

(1)

(b) The graph shows how the velocity of the car changes with time between **Y** and **Z**.



(i) Which feature of the graph represents the negative acceleration between **Y** and **Z**?

.....

(1)

(ii) Which feature of the graph represents the distance travelled between **Y** and **Z**?

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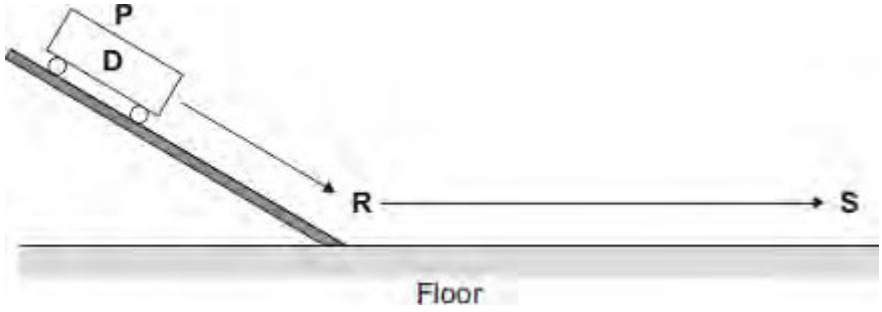
(1)

(iii) The car starts again at position **X** and rolls down the slope as before. This time the brakes are applied lightly at **Y** until the car stops.

Draw on the graph another straight line to show the motion of the car between **Y** and **Z**.

(2)

(c) Three students carry out an investigation. The students put trolley **D** at position **P** on a slope. They release the trolley. The trolley rolls down the slope and along the floor as shown in the diagram.



The students measure the distance from **R** at the bottom of the slope to **S** where the trolley stops. They also measure the time taken for the trolley to travel the distance **RS**.
They repeat the investigation with another trolley, **E**.

Their results are shown in the table.

Trolley	Distance RS in centimetres	Time taken in seconds	Average velocity in centimetres per second

D	65	2.1	
E	80	2.6	

(i) Calculate the average velocity, in centimetres per second, between **R** and **S** for trolleys **D** and **E**. Write your answers in the table.

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(3)

(ii) Before the investigation, each student made a prediction.

- Student **1** predicted that the two trolleys would travel the same distance.
- Student **2** predicted that the average velocity of the two trolleys would be the same.
- Student **3** predicted that the negative acceleration of the two trolleys would be the same.

Is each prediction correct?

Justify your answers.

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(3)
(Total 12 marks)