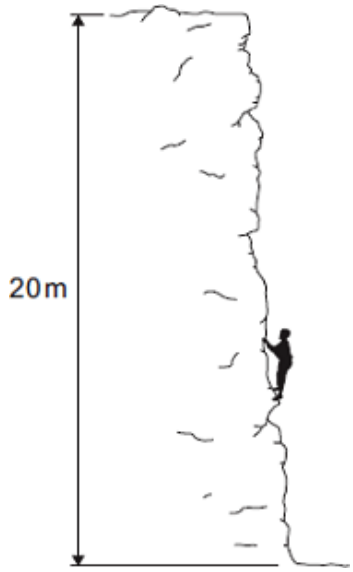
Q1. The diagram shows a climber part way up a cliff.



(a) Complete the sentence.

When the climber moves up the cliff, the climber

gains gravitational ..... energy.

(1)

(b) The climber weighs 660 N.

(i) Calculate the work the climber must do against gravity, to climb to the top of the cliff.

Use the correct equation from the Physics Equations Sheet.

.....

.....

Work done = ... J

(2)

(ii) It takes the climber 800 seconds to climb to the top of the cliff.
During this time the energy transferred to the climber equals the work done by the climber.

Calculate the power of the climber during the climb.

Use the correct equation from the Physics Equations Sheet.

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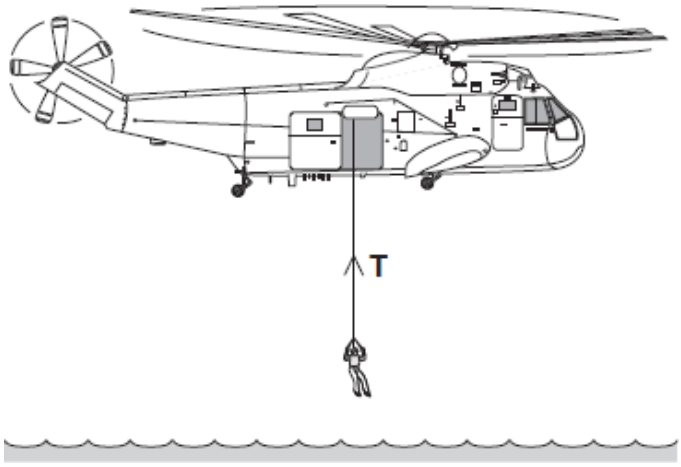
Power = ... W

(2)

(Total 5 marks)

Q2. The diagram shows a helicopter being used to rescue a person from the sea.



(a) (i) The mass of the rescued person is 72 kg.

Use the equation in the box to calculate the weight of the rescued person.

weight = mass × gravitational field strength

gravitational field strength = 10 N/kg

Show clearly how you work out your answer.

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Weight = ... N

(2)

(ii) An electric motor is used to lift the person up to the helicopter.
The motor lifts the person at a constant speed.

State the size of the force, **T**, in the cable.

Force **T** = ... N

(1)

(b) To lift the person up to the helicopter, the electric motor transformed 21 600 joules of energy usefully.

(i) Use a form of energy from the box to complete the following sentence.

gravitational potential	heat	sound

The electric motor transforms electrical energy to kinetic energy. The kinetic energy is then transformed into useful ..... energy.

(1)

(ii) It takes 50 seconds for the electric motor to lift the person up to the helicopter.

Use the equation in the box to calculate the power of the electric motor.

$$\text{power} = \frac{\text{energy transformed}}{\text{time}}$$

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

Choose the unit from the list below.

coulomb (C) **hertz (Hz)** **watt (W)**

.....

.....

Power = ...

(3)
(Total 7 marks)

Q3. The diagram shows a supermarket worker stacking jars of coffee onto a shelf.

(a) The mass of each jar of coffee is 0.4 kg.

Calculate the weight of each jar of coffee.

gravitational field strength = 10 N/kg

Write down the equation you use, and then show clearly how you work out your answer.

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Weight = ... N

(2)

(b) The distance between the floor and the middle shelf is 1.2 m.

Calculate the work done to lift one jar of coffee from the floor onto the shelf.

Write down the equation you use, and then show clearly how you work out your answer and give the unit.

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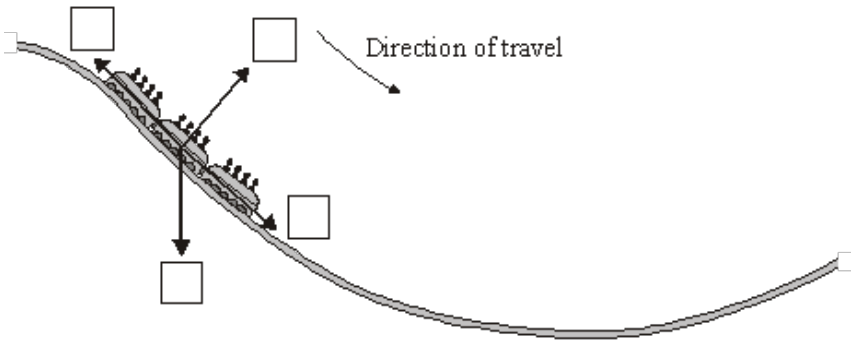
Work done = ...

(3)
(Total 5 marks)

Q4. The diagram shows the passenger train on part of a rollercoaster ride.

(a) Which arrow shows the direction of the resultant force acting on the passenger train?

Put a tick (✓) in the box next to your choice.



(1)

(b) At the bottom of the slope, the passengers in the train all have the same speed but they each have a different kinetic energy.

Why is the kinetic energy of each passenger different?

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.....

(1)

(c) For part of the ride, the maximum gravitational field strength acting on the passengers seems 3 times bigger than normal.

Normal gravitational field strength = 10 N/kg

(i) Calculate the maximum gravitational field strength that seems to act on the passengers during the ride.

.....

.....

Maximum gravitational field strength = ... N/kg

(1)

(ii) One of the passengers has a mass of 80 kg.

Use the equation in the box to calculate the maximum weight this passenger seems to have during the ride.

weight = mass × gravitational field strength

Show clearly how you work out your answer.

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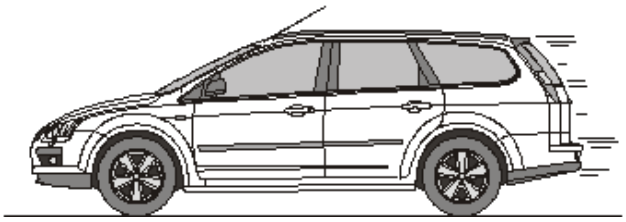
Maximum weight = ... N

(2)

(Total 5 marks)

Q5. (a) The diagram shows a car travelling at a speed of 12 m/s along a straight road.



(i) Use the equation in the box to calculate the momentum of the car.

momentum = mass × velocity

Mass of the car = 900 kg

Show clearly how you work out your answer.

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Momentum = ... kg m/s

(2)

(ii) Momentum has direction.

Draw an arrow on the diagram to show the direction of the car's momentum.

(1)

(b) The car stops at a set of traffic lights.

How much momentum does the car have when it is stopped at the traffic lights?

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Give a reason for your answer.

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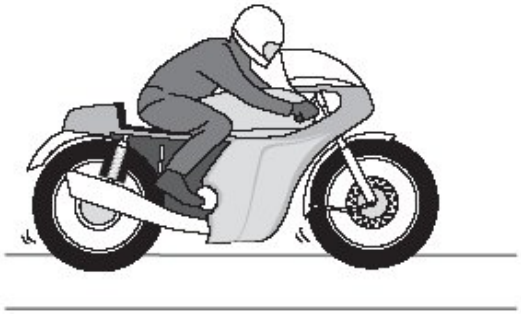
(2)
(Total 5 marks)

Q6. The diagram shows a motorbike of mass 300 kg being ridden along a straight road.



The rider sees a traffic queue ahead. He applies the brakes and reduces the speed of the motorbike from 18 m/s to 3 m/s.

(a) Use the equation in the box to calculate the kinetic energy lost by the motorbike.

$$\text{kinetic energy} = \frac{1}{2} \times \text{mass} \times \text{speed}^2$$

Show clearly how you work out your answer.

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Kinetic energy lost = ... J

(2)

(b) (i) How much work is done on the motorbike by the braking force?

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(1)

(ii) What happens to the kinetic energy lost by the motorbike?

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(1)

(Total 4 marks)