1 **(a)** Define a *vector* quantity and give one example.

.....

..... **[2]**

(b) Fig. 3.1 shows a force *F* at an angle of 30° to the horizontal direction.

Fig. 3.1

(i) The **horizontal component** of the force *F* is 7.0 N. Calculate the magnitude of the force *F*.

F = ... N **[2]**

(ii) The force *F* moves an object in the horizontal direction. In a time of 4.2 s, the object moves a horizontal distance of 5.0 m. Calculate

1 the work done by the force

work done = ... J **[2]**

2 the rate of work done by the force.

rate of work done = ... W **[1]**

(c) Fig. 3.2 shows the forces acting on a stage light of weight 120 N held stationary by two separate cables.

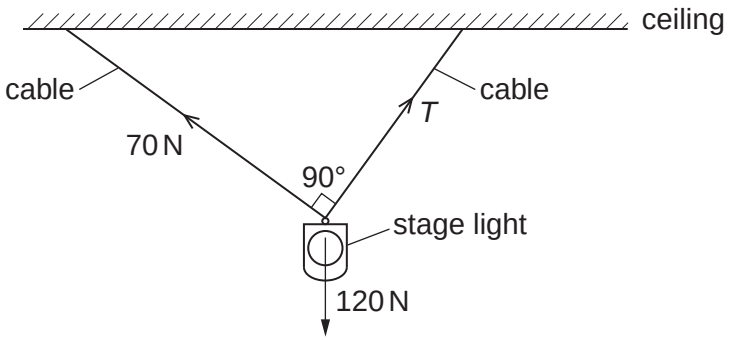

Fig. 3.2

The angle between the two cables is 90°. One cable has tension 70 N and the other has tension *T*.

(i) State the magnitude and the direction of the **resultant** of the tensions in the two cables.

magnitude .....

direction ..... **[2]**

(ii) Sketch a labelled vector triangle for the forces acting on the stage light. Hence, determine the magnitude of the tension *T*.

T = ... N **[4]**

[Total: 13]

2 **(a)** Power can be measured in watts. Define the *watt*.

.....

..... **[1]**

(b) An electric motor-driven crane is used to raise a load of bricks of mass 700 kg through a vertical height of 8.5 m in a time of 45 s. The efficiency of the motor-driven crane is 30%. Calculate

(i) the gravitational potential energy E_p gained by the bricks

E_p = ... J **[1]**

(ii) the output power of the motor-driven crane

output power = ... W **[1]**

(iii) the input power to the motor-driven crane.

input power = ... W **[1]**

[Total: 4]

3 **(a)** A car of mass m is at rest. A constant net force F acts on the car and it moves a distance x in the direction of the force. The final velocity of the car is v.

(i) Write down the equation

1 for the work done by the force F

2 relating force F and acceleration a.

[1]

(ii) Hence show that the kinetic energy of the car is given by the equation $E_k = \frac{1}{2}mv^2$.

[3]

(b) The braking distance of an empty van travelling at a steady speed on a level road is 50 m. The van is now fully loaded with goods and travels at the same speed on the same road.

Explain whether or not the braking distance would be the same. Assume that the driver applies the same braking force.

.....

.....

.....

.....

.....

.....

..... **[3]**

[Total: 7]