

# **LINEAR MOTION**

## **KCSE QUICK REVISION**

*Compilation of Possible Questions in Physics Likely to be examined in  
KCSE.*

*A Special Analysis of Prediction Questions that may be Tested in KCSE from this  
Topic in Form 3.*

## **PHYSICS**

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### **SERIES 1**

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*For Marking Schemes*

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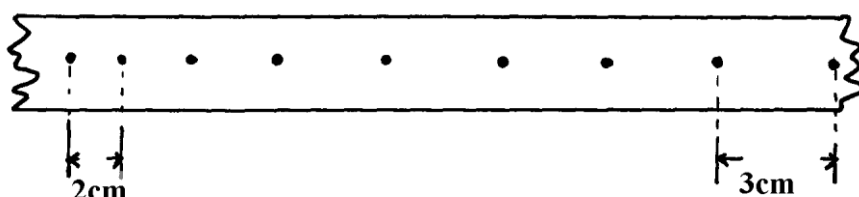
# **MWALIMU CONSULTANCY**

## **LINEAR MOTION**

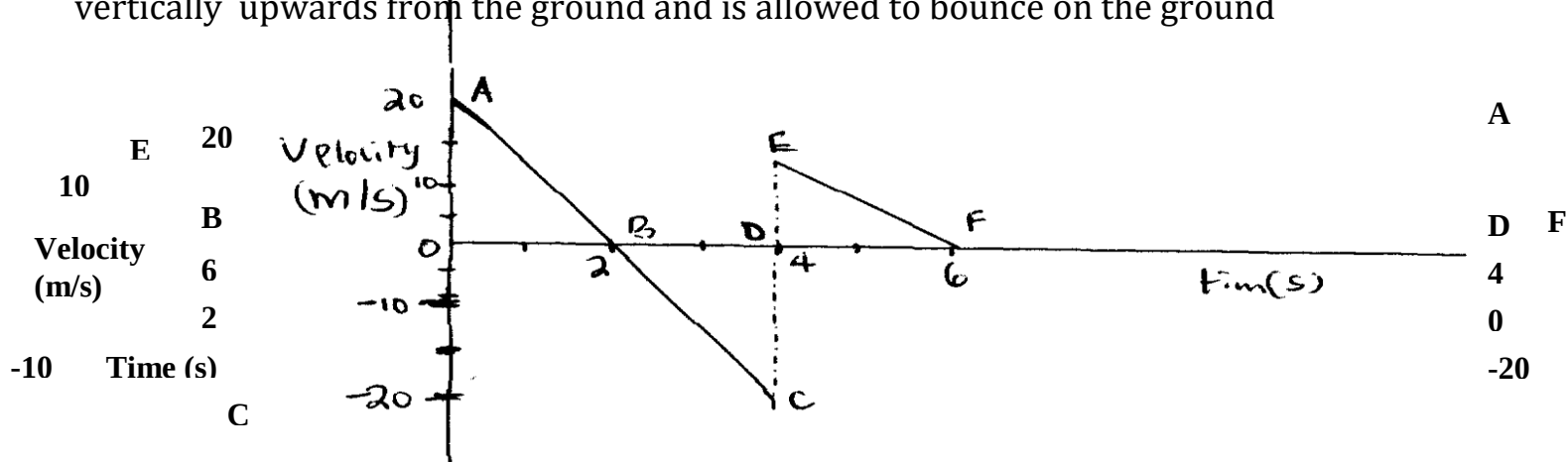
1. a) Distinguish between the terms '**uniform velocity**' and '**uniform acceleration**'

b) The figure below shows a section of a ticker tape. The dots were made at a frequency of 50 Hz.

Determine the acceleration of the trolley pulling the tape



c) The graph below shows a part of the motion of a basket ball which is projected vertically upwards from the ground and is allowed to bounce on the ground



i) Explain the motion of the ball relating it to its different positions along the following

I.AB      II.BC      III.CE

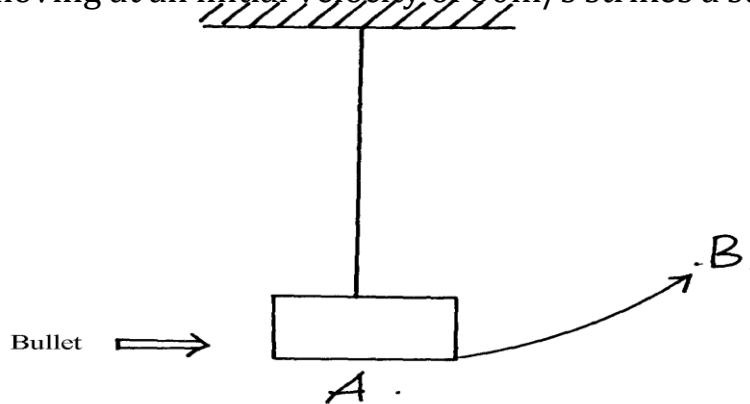
ii) From the graph calculate the acceleration due to gravity

c) State Newton's second law of motion

2. One end of a metal rod is heated in a flame. After some time the other end becomes hot.

Explain this observation

3. A bullet of mass 150g moving at an initial velocity of 80m/s strikes a suspended block of mass 2.5kg



3. (a) The block swings from point **A** to **B**. Determine the vertical displacement between **A** and **B**  
(b) What observations are you likely to observe on the block after collision
4. The diagram below shows a velocity – time graph of a certain motion.

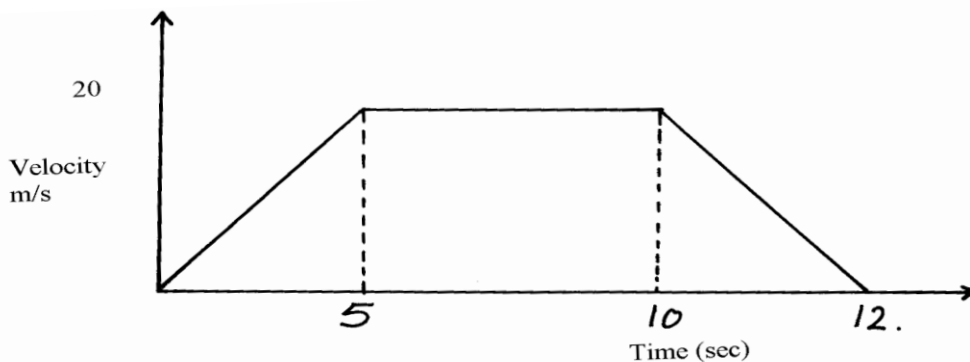


*Figure 2*

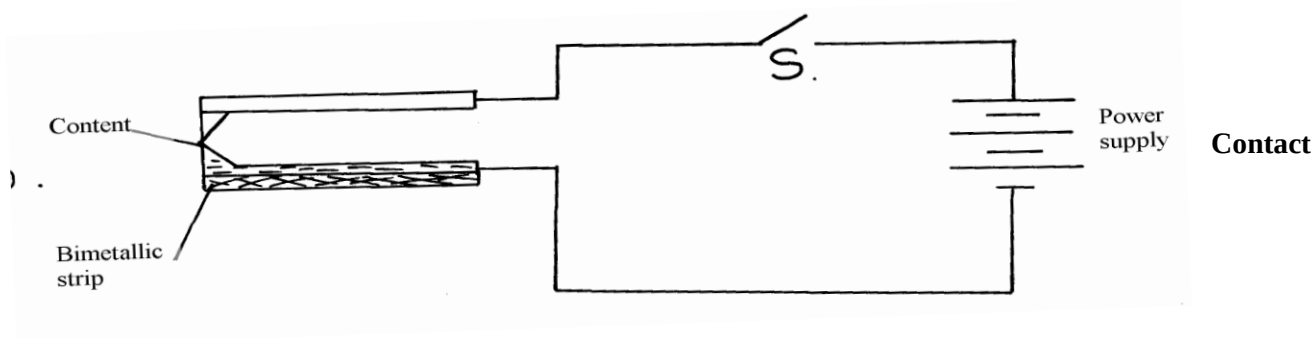
From the graph, determine the average speed of the body.

5. The diagram below shows a ball being whirled in a vertical plane.

*Figure 7*

(a) Sketch on the same diagram, the path followed by the ball if the string cuts when the ball is at position shown in the diagram.

6. The figure below shows a circuit diagram for controlling temperature of a room.



- (i) Explain the purpose of the strip.  
 (ii) Describe how the circuit controls the temperature when the switch S is closed.
7. The **figure 5** below shows a uniform bar of length 1.0m pivoted near one end. The bar is kept in equilibrium by a spring balance as shown:

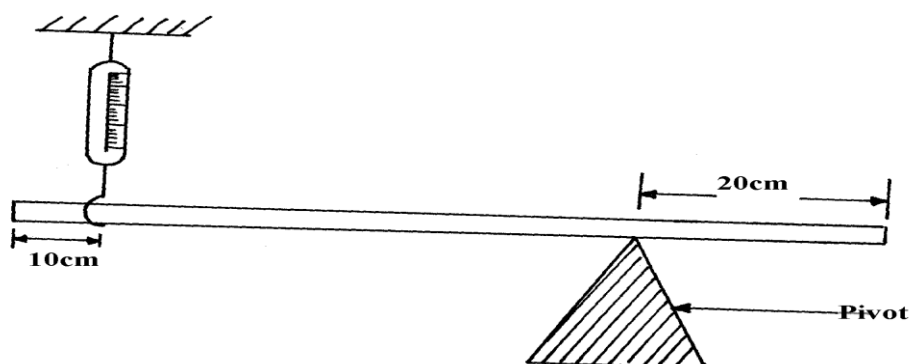


**figure 5**

- Given that the reading of the spring balance is 0.6N, determine the reaction force at the pivot
8. The **figure 8** shows the motion of a train over a section of track which includes a sharp bend
- (a) The section of the track with the sharp bend has a maximum speed restriction. The train decelerates approaching the bend so that at the start of the bend, it has just reached the maximum speed allowed. The train is driven around the bend at the maximum speed allowed and accelerates immediately on leaving the bend. Calculate the length of the bend
- (b) The train has to slow down to go round the bend. Calculate the deceleration
- (c) As the train is driven round the bend, there is an extra force acting, called the centripetal force.
- (i) On the **figure 9** below, draw an arrow to show the direction of this force

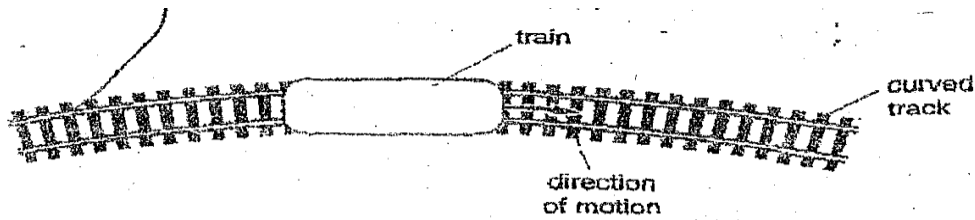
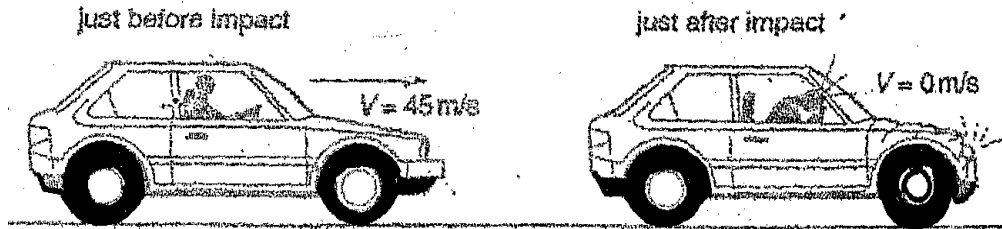


figure 9

(ii) State the effect that this force has on the motion

(iii) State how this force is provided

(d) **Figure 10** below shows a car with a dummy driver before and after a collision test:



The mass of the dummy driver is 90kg. The impact time to reduce the dummy's speed from  $45 \text{ ms}^{-1}$  to zero is 1.2 seconds:

(i) Calculate the average force on the dummy during impact

(ii) State the main energy transformation during the collision

(iii) Calculate how much of the dummy's energy is transformed during the collision

9. (a) The velocity-time graph in the figure below illustrates the motion of a ball which has been projected vertically upwards from the surface of the moon. The weight of the object on earth's surface is 20N, when the acceleration due to gravity is  $10 \text{ ms}^{-2}$ .

(i) State why the velocity becomes negative after 3 seconds.

(ii) Determine the acceleration of free fall on the moon showing clearly your work

(iii) Determine the total distance travelled by the ball in 5.0sec

(iv) Find the weight of the ball on the moon

(v) If the ball was projected vertically upwards on the earth with the same velocity.

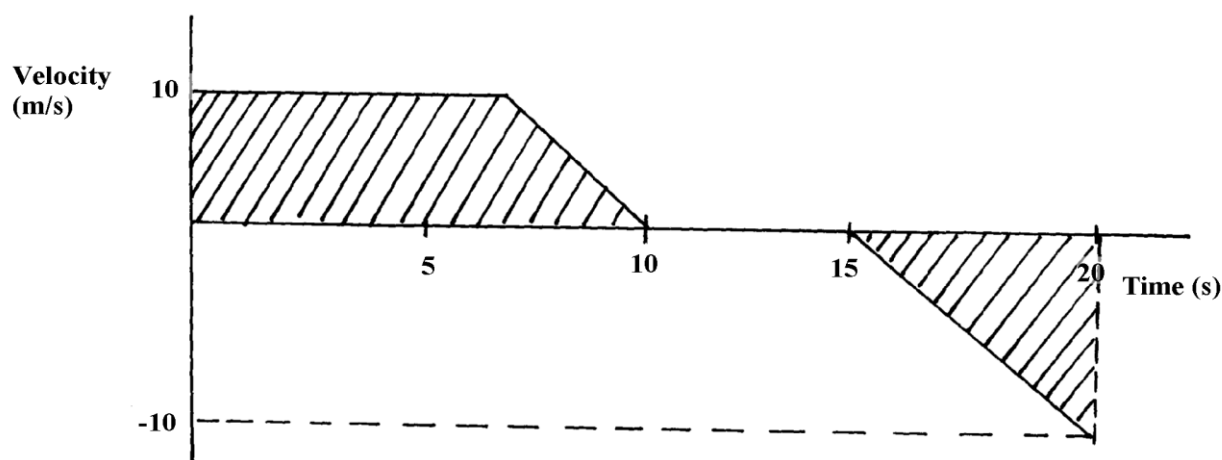
What difference would you expect to observe in the velocity-time graph above. Illustrate with a sketch on the same axis

(b) The figure below represents part of a tape pulled through a ticker-timer of frequency 50Hz moving down an inclined plane.

If the trolley was allowed to move down the inclined plane for 4 seconds, calculate the distance it covers

10. (a) State Boyle's law  
(b) The volume of a bubble at the base of a container of water is  $3\text{cm}^3$ . The depth of water is 30cm. The bubble rises up the column until the surface ;  
(i) Explain what happens to the bubble as it rises up the water column  
(ii) Determine the volume of the bubble at a point 5cm below the water surface  
(c) A faulty thermometer records  $11^\circ\text{C}$  instead of  $0^\circ\text{C}$  and  $98^\circ\text{C}$  instead of  $100^\circ\text{C}$ . Determine the reading on the thermometer when dipped in liquid at a temperature of  $56^\circ\text{C}$

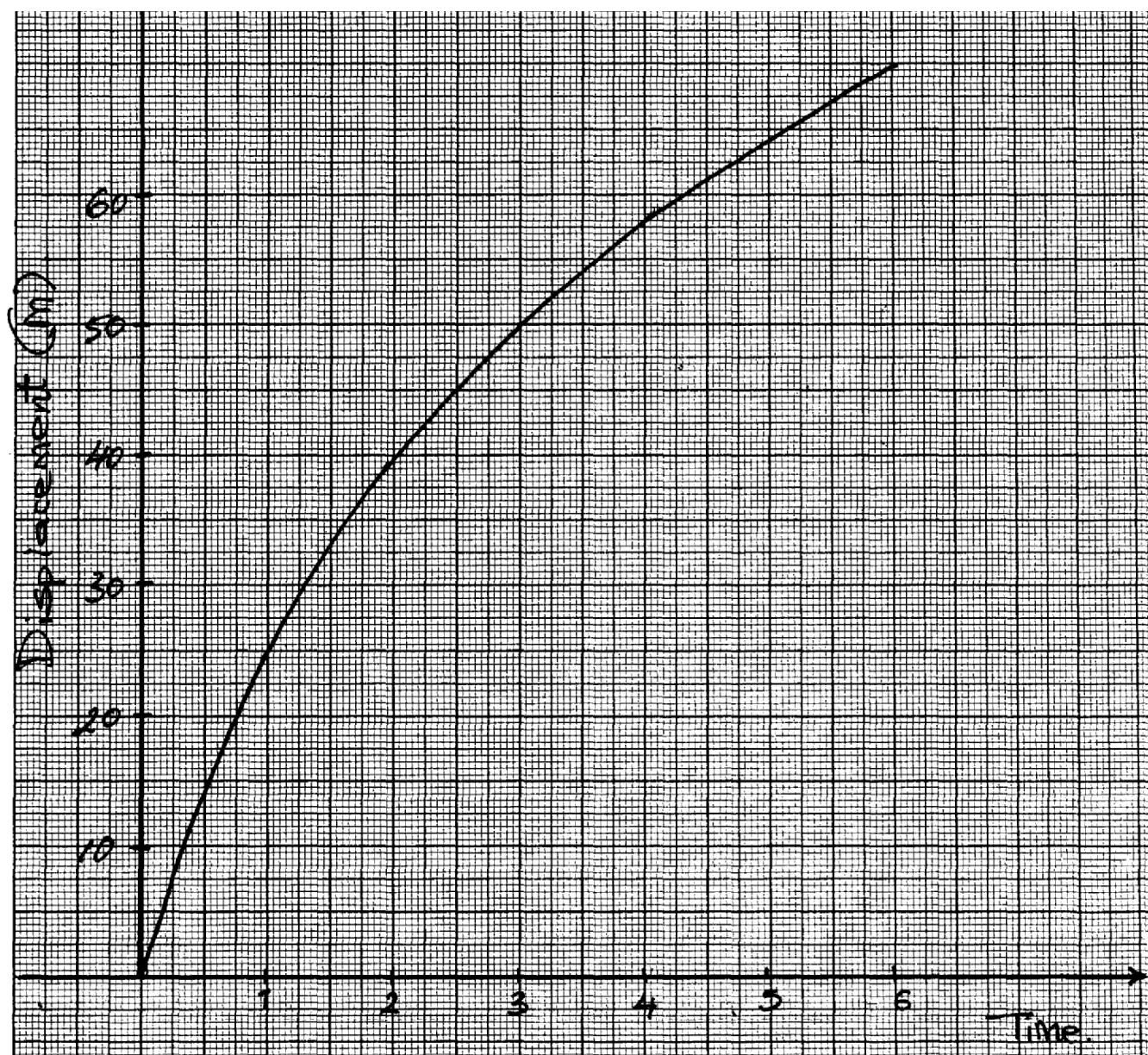
11. Figure 9 is a velocity- time graph describing the motion of a particle



What does the shaded area represent?

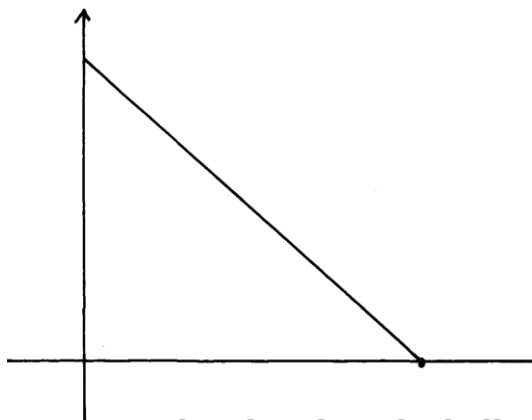
12. a) State Newton's first law of motion  
b) A parcel is to be dropped from an aeroplane traveling horizontally at  $120\text{ms}^{-1}$ , at an altitude of 720m, to fall into a certain village. Determine:  
i) The time taken for the parcel to reach the ground  
ii) How far ahead of the plane, the village should be when the parcel is released  
c) A small stone,  $M_1$  of mass 20g is attached to a string which in turn is passed through a smooth thin cylinder. The other end of the string is tied to mass  $M_2$ . The mass  $M_1$  is whirled in a horizontal circle of radius 1m and mass  $M_2$  remains stationary as shown in figure 10  
i) State **two** forces acting on the system other than the tension in the thread on  $M_2$   
ii) Explain the observation made on mass  $M_2$  if the speed of  $M_1$ , is increased  
iii) Calculate the velocity of  $M_1$ , if the mass  $M_2$  is 50g and the radius of the circle is 1m

13. (a) Define uniform velocity  
 (b) The graph **figure 10** below shows displacement –time graph of **a** in motion  
**fig 10**



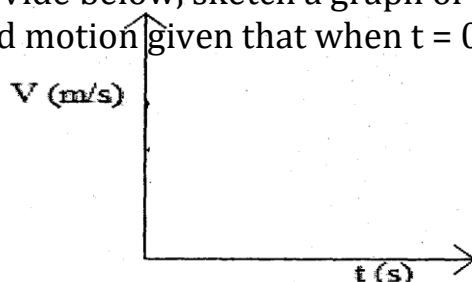
- (i) Determine the instantaneous velocities at **t = 1second** and at **t = 4 seconds**  
 (ii) Use the results in **(b)(i)** above to determine the acceleration of the body
14. A ball of mass 100g is kicked horizontally from the top of a cliff. If the ball takes 4 seconds to hit the ground, determine the height of the cliff
15. A ball is kicked vertically upward from the ground with a velocity of 60m/s and reaches a maximum height (h), it then falls freely back to the ground and bounces upwards to a height of 5M

- (a) Sketch a velocity-time graph to represent the motion of the ball from the time it is kicked vertically upwards until it bounces to a height of 5M
- (b) Determine:
- (i) the time taken by the ball to reach the maximum height(h)
  - (ii) The maximum height (h) reached by the ball
  - (iii) The velocity with which it bounces after striking the ground for the first time
- (c) State any assumption made in your calculations in **(b)** above
- 16.** In an experiment on momentum, trolley **P** of mass 800g was attached to a ticker timer of frequency 50Hz. Trolley P, initially moving with a velocity of 0.5m/s, was made to collide with a stationary trolley **Q** of mass 400g. A copy of the tape as it appeared after the collision is presented in the figure below:-
- (a) Determine the velocity of the trolley **P** after collision
- (b) Calculate the impulsive force experienced by trolley **P**
- (c) State the type of collision
- 17.** I. (a) State the **three** equations of linear motion.
- (b) A car is traveling uniformly at 100km/hr when the driver observes a road block ahead. He takes 0.5 s before applying the brakes which brings the car to rest with a uniform deceleration of  $4\text{m/s}^2$ . Determine the distance traveled by the car from the time the driver observed the road block until the car comes to rest.
- (c) A car moves at a constant speed of  $20\text{ms}^{-1}$  for 50s and then accelerates uniformly to a speed of  $25\text{ms}^{-1}$  over a period of 10s. This speed is maintained for 50 s before the car is brought to rest with uniform deceleration in 15s.
- (d) Draw a graph of velocity (Y – axis) against time (graph paper to be availed)
- (II) Calculate:
- (i) The average speed for the whole journey.
  - (ii) The acceleration when the velocity changes from  $20\text{ms}^{-1}$  to  $25\text{ms}^{-1}$  .
- m, show that  $v^2=2as +u^2$
- 18.** Sketch a velocity-time graph for a body moving with zero acceleration
- 19.** The figure below shows a velocity –time graph of a ball bouncing vertically upward from the ground. The velocity upward is taken positive.



Determine the maximum height when the ball rises.

20. (a) On the axes provide below, sketch a graph of velocity  $V$  versus time ( $t$ ) for uniformly accelerated motion given that when  $t = 0$ ,  $V$  is greater than zero.



- (b) A car is brought to Rest from a speed of  $20 \text{ ms}^{-1}$  in time of 2 seconds.

Calculate the deceleration.

21. (a). State the law of **linear momentum**

(b). A marble of mass 50g moving on a horizontal surface at a velocity of  $V$  collides with another glass marble of mass 75g resting on same horizontal surface. After collision, the marble bounces back along the path at a speed of  $3.5 \text{ m/s}$  while the other marble moving with a speed of  $3.0 \text{ m/s}$  Forward.

Determine the speed  $V$ .

- (c). The paper below was attached to a trolley and pulled through a ticker tape timer of frequency 50Hz. Determine the acceleration of the trolley.

- (d). Study the figure below

Calculate the pressure in the steam in the cylinder which would just raise the piston if area of the piston in contact with steam is  $2 \text{ cm}^2$  and Atmospheric pressure is  $1.0 \times 10^5 \text{ Nm}^{-2}$ .

- (e) State a reason why the earth is colder at night than daytime during a sunny

21. A block of mass 20kg slides downward a plane inclined of  $60^\circ$  with the horizontal. The coefficient of friction between the plane and the block is 0.4.

Calculate the acceleration of the block.

22. A body accelerates uniformly from initial velocity of  $U \text{ m/s}$  to a final velocity of  $V \text{ m/s}$  in time  $t$  seconds. If acceleration during the motion is  $a \text{ m/s}^2$  and the distance covered is  $S$

*For Marking Schemes/Answers*

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