Name of the Student:_____
Max. Marks : 23 Marks **Time : 23 Minutes**

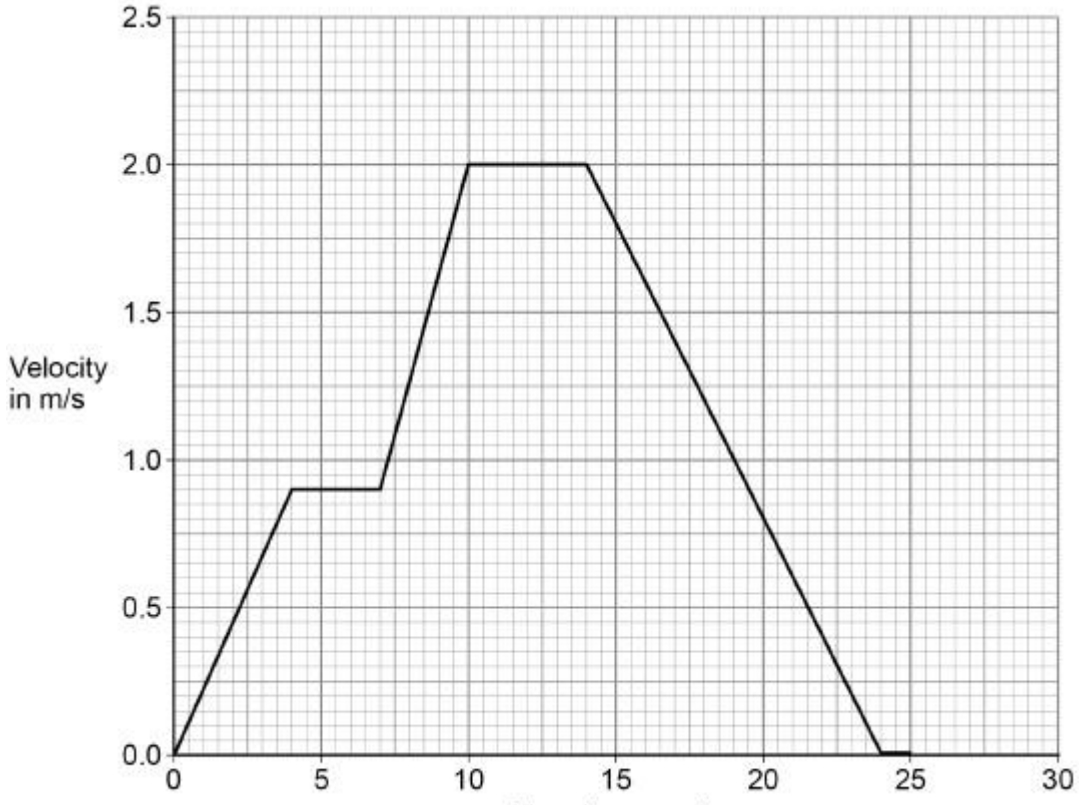
Q1.

Figure 1 shows a runner using a smart watch and a mobile phone to monitor her run.

Figure 1

Figure 2 is a velocity–time graph for part of the runner's warm-up.

Figure 2



(a) Determine the total time for which the velocity of the runner was increasing.

_____

_____

Time = _____ s

(2)

(b) Determine the deceleration of the runner.

_____

_____

_____

_____

Deceleration = _____ m/s^2

(2)

The smart watch and mobile phone are connected to each other by a system called Bluetooth.

Bluetooth is wireless and uses electromagnetic waves for communication.

(c) Suggest why the phone and watch being connected by a wireless system is an advantage when running.

_____

_____

(1)

(d) Write down the equation that links frequency, wave speed and wavelength.

_____

(1)

(e) The electromagnetic waves have a frequency of 2 400 000 000 Hz

The speed of electromagnetic waves is 300 000 000 m/s

Calculate the wavelength of the electromagnetic waves.

_____

_____

_____

_____

_____

_____

Wavelength = _____ m

(3)

(f) The table shows some information about four types of Bluetooth.

Type	Power in milliwatts	Range in metres
1	100	100
2	2.50	10.0
3	1.00	1.00
4	0.50	0.50

Mobile phones use type **2** Bluetooth to communicate with other devices.

Suggest **two** reasons why.

1 _____

_____

2 _____

_____

(2)

(Total 11 marks)

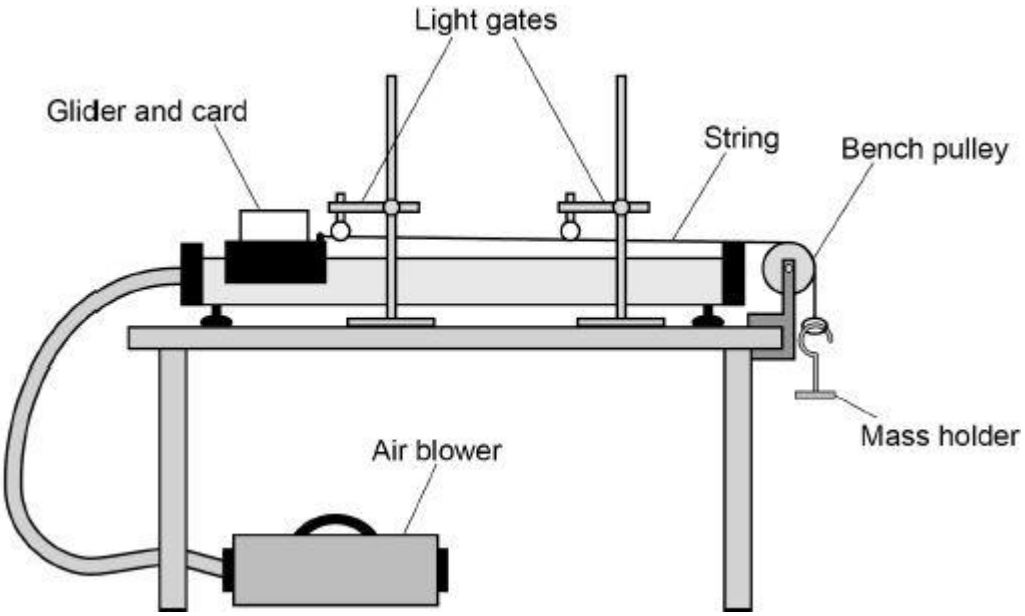
Q2.

A student investigated acceleration using gliders, an air track and light gates.

The air track reduces friction between the glider and the track to zero.

Figure 1 shows the apparatus.

Figure 1



The glider was released from rest and moved along the track.

The mass holder hit the ground before the card passed through the second light gate.

(a) Which **two** statements describe the effect this would have on the glider?

Tick **two** boxes.

Its acceleration would decrease to zero.	☐
Its acceleration would increase.	☐
The resultant force on it would decrease to zero.	☐
The resultant force on it would increase.	☐
Its speed would increase.	☐

(2)

(b) The mass holder should **not** hit the ground before the card passes through the second light gate.

Suggest **one** way that the student could stop this happening.

_____

_____

(1)

The student increased the resultant force acting on the glider by adding more masses to the mass holder.

She calculated the acceleration of the glider for each resultant force.

Each test was done three times.

Table 1 shows the results.

Table 1

Resultant force in N	Acceleration in m/s^2			Mean acceleration in m/s^2
	Test 1	Test 2	Test 3	
0.20	1.3	1.2	1.3	1.26667
0.39	2.6	2.5	2.6	2.6
0.59	3.8	3.8	3.9	3.8
0.78	5.1	5.1	5.1	5.1
0.98	6.4	7.2	6.4	6.7

(c) The student made **two** mistakes in the mean acceleration column.

Identify the mistakes the student made.

Suggest how each mistake can be corrected.

Mistake _____

_____

Correction _____

_____

Mistake _____

_____

Correction _____

_____

(4)

(d) Write a conclusion for this investigation.

Use the data in **Table 1**

_____

_____

(1)

(e) The student used a constant resultant force to accelerate the glider.

The student changed the mass of the glider and calculated the new acceleration.

She repeated this for different masses of the glider, keeping the resultant force constant.

The results are shown in **Table 2**

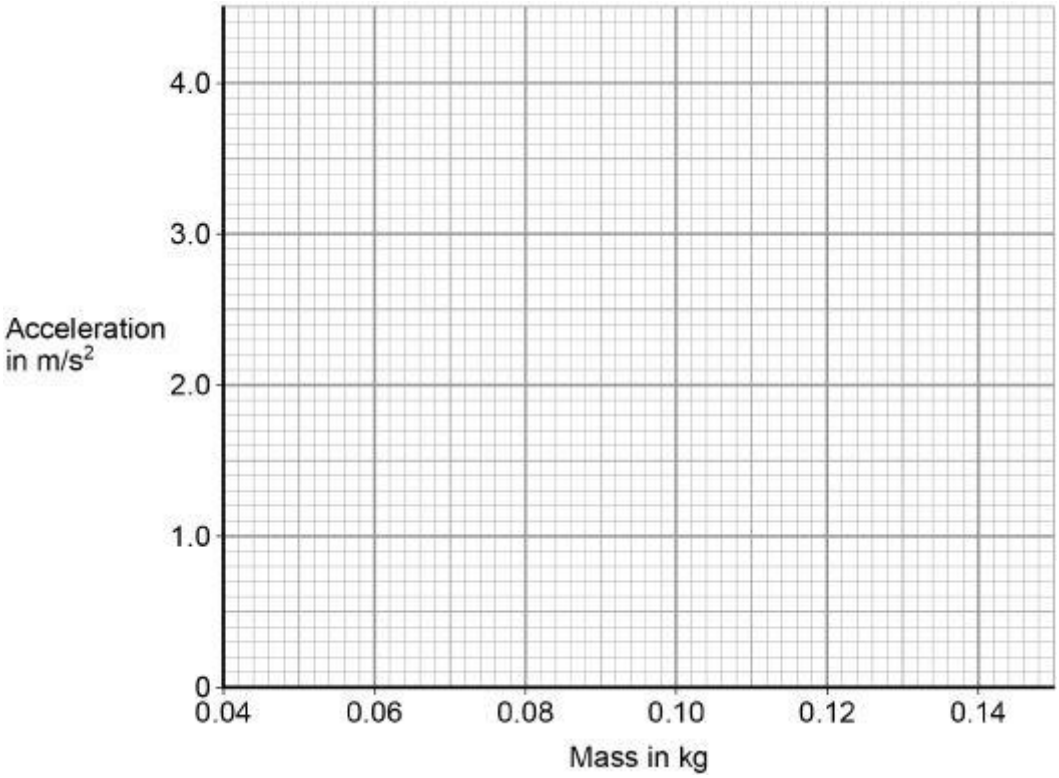
Table 2

Mass of the glider in kg	Acceleration in m/s^2
0.060	3.5
0.080	2.6
0.10	2.0
0.12	1.7
0.14	1.4

Plot the results on **Figure 2**

Draw a line of best fit.

Figure 2



(3)

(f) Describe the relationship between mass and acceleration.

_____

_____

(1)

(Total 12 marks)