Raffles Girls' School
(SECONDARY)

Established in 1879

Name: _____

Class: _____   Register No: _____

PHYSICS
YEAR THREE
Pen-and-Paper Assessment

Friday   29 April 2022   1 hour

For examiner's use	
Question / Section	Marks Obtained
Section A / 10	
1-10	
Section B / 30	
11	/4
12	/7
13	/7
14	/6
15	/6
units/ sig. fig.	
Total	/40

INSTRUCTIONS TO CANDIDATES

Write your name and register number in the spaces provided.
Write in dark blue or black ink.
For **Section A**, indicate your answers on the separate Answer Sheet provided.
Answer all other questions in the space provided.
All quantitative answers should include appropriate units.
The use of an approved scientific calculator is expected, where appropriate.
You are advised to show all your working in a clear and orderly manner, as more marks are awarded for sound use of Physics than for correct answers.

INFORMATION FOR CANDIDATES

Assume g = 9.81 N kg^{-1} unless stated otherwise.

The number of marks is given in brackets [ ] at the end of each question or part question.

You may be penalised for incorrect use of units and/or not giving quantitative answers to an appropriate number of significant figures.

The total number of marks for this paper is **40** and the weighting is **25%**.

Parent's / guardian's Name: _____

Signature: _____   Date: _____

This Question Paper consists of 10 printed pages including the cover page.   **[Turn Over**

Section A
There are 10 questions in this section. Answer **all** questions. For each question there are four possible answers **A**, **B**, **C** and **D**. Choose the **one** you consider correct and record your choice in **soft pencil** on the separate Answer Sheet.

1   The graph shows how the velocity of an object changes with time for the intervals X, Y and Z.
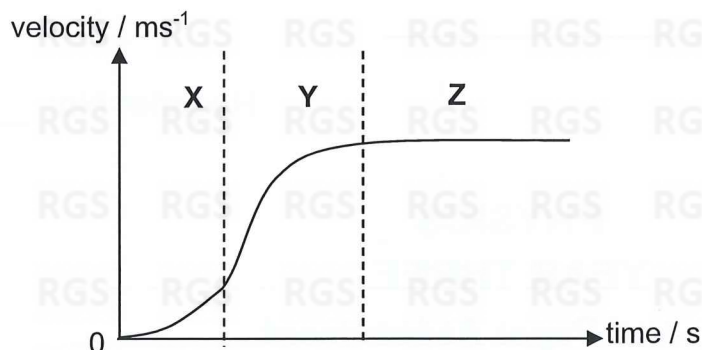
Which row correctly describes the acceleration for the respective intervals?

	X	Y	Z
A	increasing	decreasing	zero
B	decreasing	increasing	zero
C	increasing	decreasing	constant
D	decreasing	increasing	constant

2   A car has an oil leak and drips oil once every second.

Which statement describes the motion of the car?


Direction of motion →
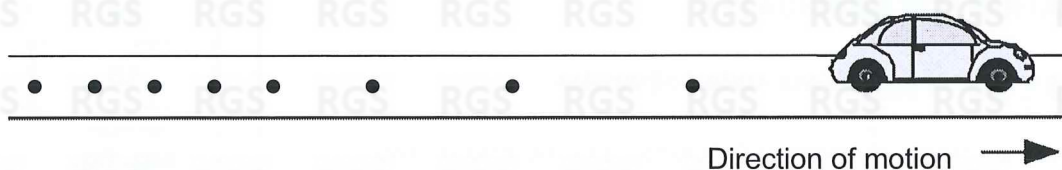
A   It accelerated uniformly.
B   It decelerated uniformly.
C   It moved at a steady speed and then accelerated.
D   It moved at a steady speed and then decelerated.

3   Which car, moving from rest, has an average acceleration of 2.0 m s^{-2}?

A   a car reaching a velocity of 10 m s^{-1} in 2.0 s
B   a car reaching a velocity of 20 m s^{-1} in 5.0 s
C   a car reaching a velocity of 30 m s^{-1} in 10 s
D   a car reaching a velocity of 40 m s^{-1} in 20 s

4   Which acceleration-time graph best represents the motion of a ball bouncing vertically off the floor?

Assume that there is no loss of energy to the surroundings. Take downward direction as positive.
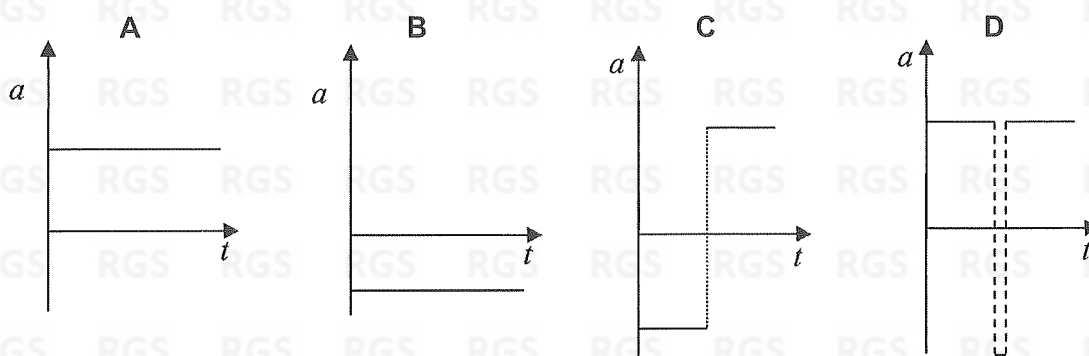

5   An object is accelerating under the influence of a force F on a smooth surface. A while later, an opposing force F of the same magnitude acts on it.

What will happen to the object?

A   The object will come to rest momentarily after the opposing force acts on it.
B   The object will move at constant velocity.
C   The object will move in the opposite direction.
D   The object will slow down.

6   Each figure shows two forces that are equal in magnitude.

Which diagram shows an action-and-reaction pair?

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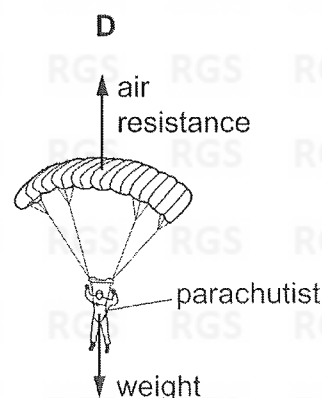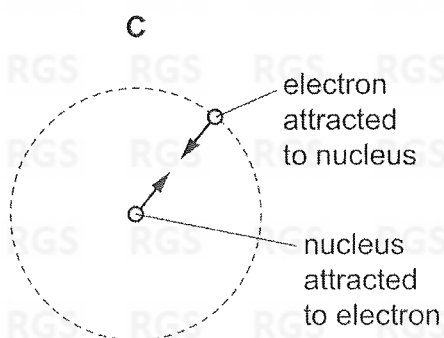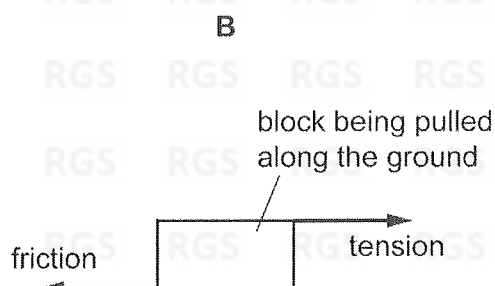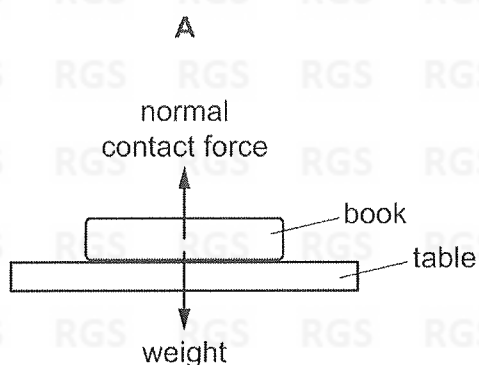
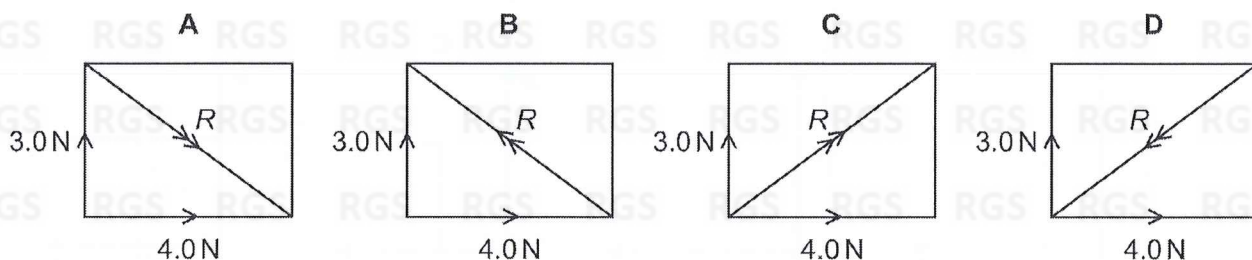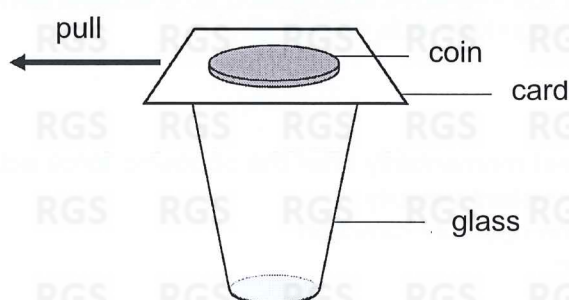**7** Two forces of 3.0 N and 4.0 N act at right-angles to each other.

Which diagram shows the resultant *R* of these forces?

A	B	C	D

3.0 N   *R*   3.0 N   *R*   3.0 N   *R*   3.0 N   *R*

4.0 N   4.0 N   4.0 N   4.0 N

8 A card is supported on top of a glass and a coin is placed on top of it.

pull

coin

card

glass

When the card is pulled away quickly, the coin drops into the glass.

Which property of the coin causes this to happen?

A density	**B** inertia	**C** surface area	**D** volume

9 A ball of mass *m* is dropped from rest from a height *h* above the ground. Each time it hits the ground, 20 % of its energy is lost.

How high will the ball rise after the second bounce?

A $\dfrac{1}{25}h$

B $\dfrac{4}{25}h$

C $\dfrac{1}{2}h$

D $\dfrac{16}{25}h$

10 A robot weighing 820 N ascends 12.0 m vertically each minute.

What is the useful power generated by the robot?

A 0.878 W	**B** 164 W	**C** 4100 W	**D** 9840 W

SECTION B (30 marks)
Answer **ALL** questions in the spaces provided.

11   A robotic vacuum cleaner is used to assist with the cleaning of a place. Fig. 11.1 shows the displacement-time graph of the robot for the first 55 s of its journey. Take the forward direction of the robot to be positive.
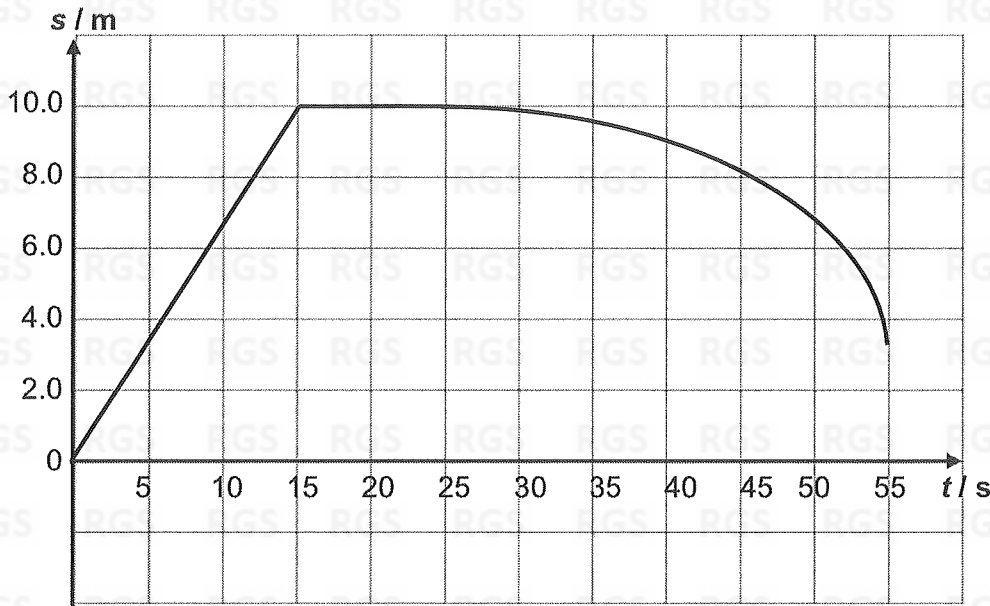
Fig. 11.1

(a)   Describe the motion of the robot between

    (i)   t = 15 s to t = 25 s,   [1]

....

....

    (ii)   t = 25 s to t = 55 s.   [1]

....

....

(b)   Determine the robot's velocity at t = 10.0 s.   [2]

12   The velocity-time graph in Fig.12.1 represents the motion of an object travelling in a straight line and starts its motion when time is 0 s.
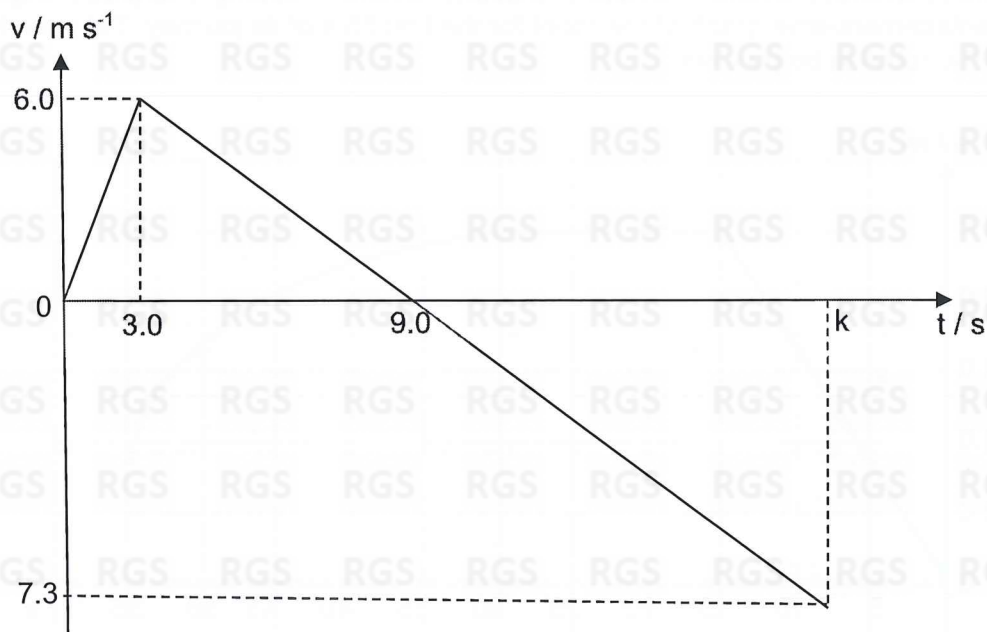

Fig. 12.1

(a)   Calculate the acceleration of the object between 3.0 s and 9.0 s.   [2]

(b)   At what time did the object reverse its direction of motion?   [1]

....

(c)   What is the displacement of the object in the first 9.0 s of its motion?   [2]

(d)   The object returns to its starting point when the time is k. Determine the value of k. [2]

13   Two small tugboats are pulling a large ship in a harbour. Fig. 13.1 (not drawn to scale) represents the view from above and shows the directions of the forces on the ship.
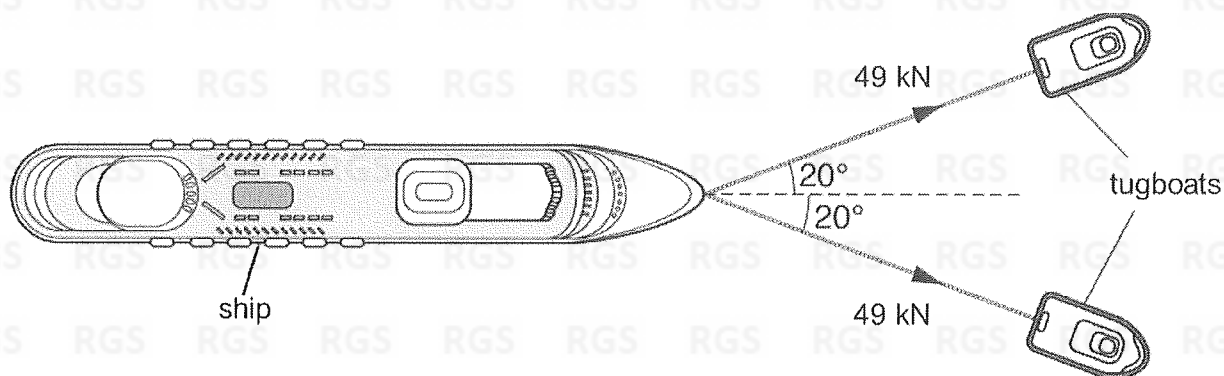

Fig. 13.1

Each of the tugboats is exerting a force of 49 kN on the ship.

(a)   Determine by drawing a scale diagram, the resultant of these two forces. State the scale used.   [4]

Scale: _____

(b) The engines of the ship are not operating and the water in the harbour is stationary.

    (i) The ship is moving at a constant speed in a straight line in the direction of the resultant force exerted by the tugboats.

        Explain, in terms of the forces acting, why the ship is moving in a straight line at constant speed. [2]

    (ii) Upon nearing the wharf, the tugboats will release the ropes attached to the ship bow.

        Describe the subsequent motion of the ship when the ropes from the tugboats are detached from the ship. [1]

14   Fig. 14.1 shows a lorry accelerating in a straight line along a horizontal road.
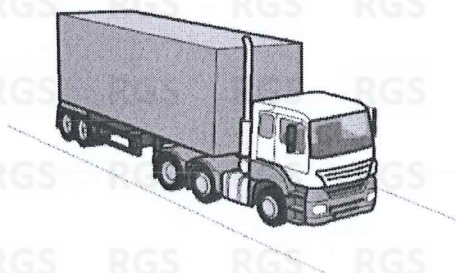

Fig. 14.1

(a) The driving force on the lorry in the forward direction is *D* and the total backward force on the lorry is *B*.

    (i) Using Newton's laws of motion, state and explain whether *D* or *B* is the larger force. [2]

    (ii) Suggest one possible cause of the backward force *B*. [1]

(b) The weight of the lorry is 3.0×10^5 N.

    (i) Calculate the mass of the lorry.   [1]

    (ii) The resultant force on the lorry is 1.5×10^4 N. Calculate the acceleration of the lorry.   [2]

15   Fig. 15.1 shows a simple pendulum which is made by hanging a metal bob of mass 110 g from a point O.
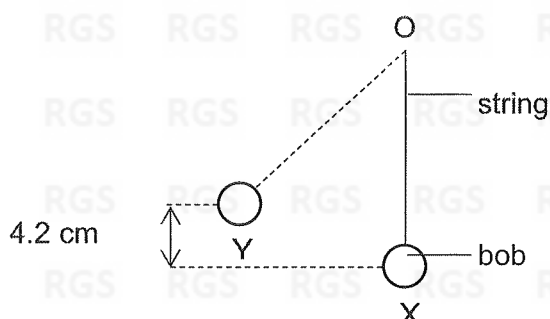

Fig. 15.1

(a) Calculate the work done to raise the bob from X to Y.   [2]

(b)   The bob is released and allowed to swing freely.

   (i)   Determine the maximum speed of the bob after it has been released.   [2]

   (ii)   State any assumptions made in your calculation in **(b)(i)**.   [1]

   ....

   ....

(c)   After some time, it was observed that the period of the pendulum decreases. Suggest why the period does not remain the same after some time.   [1]

   ....

End of Paper

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