Established in 1879

Raffles Girls' School
(SECONDARY)

Name: _____

Class: _____ Register No: _____

PHYSICS
YEAR THREE
End-of-Year Assessment

Thursday **7 October 2021** **2 hours**

INSTRUCTIONS TO CANDIDATES

Write your name, class 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 spaces provided.
All quantitative answers should include appropriate units.
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 **80** and the weighting is **40%**.

For examiner's use	
Question / Section	**Marks Obtained**
Section A / 20	
1-20	
Section B / 60	
21	/ 9
22	/ 8
23	/ 10
24	/ 10
25	/ 11
26	/ 4
27	/ 8
units / sig.fig.	
Total	/ 80

Parent's / guardian's Name: _____

Signature: _____ Date: _____

SECTION A (20 marks)

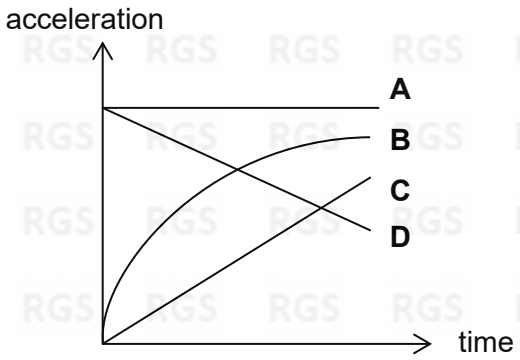
Answer **ALL** questions. For each question, there are four possible answers (**A**, **B**, **C** and **D**). Choose the most appropriate answer and record your choice on the separate Answer Sheet provided.

1 A piece of paper is allowed to fall through a vacuum in an experiment.

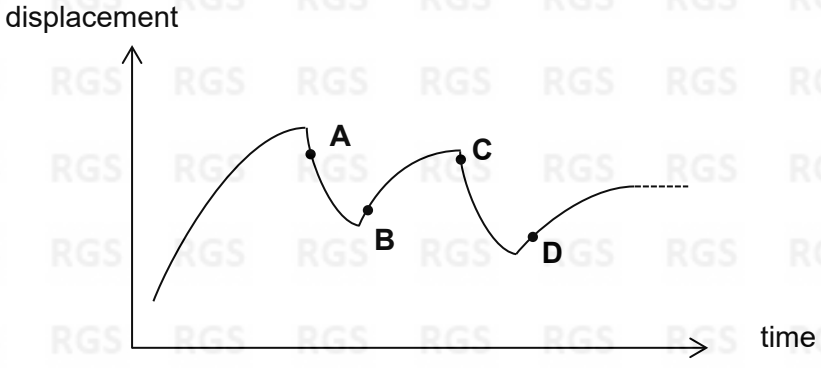
Which row describes the acceleration and velocity of the paper?

	acceleration	velocity
A	constant	constant
B	constant	increasing
C	increasing	constant
D	increasing	increasing

2 Which graph shows the acceleration-time graph of an eraser which is dropped from a desk?



3 The diagram shows how the displacement of a ball varies with time during a game.



Which part of the graph shows the highest speed?

4 Which of the following is a non-contact force?

A friction
B normal
C tension
D weight

5 A parachutist falls with terminal velocity. Which of the following free-body diagrams correctly shows the forces acting on him?

A 

B 

C 

D 

6 A box of mass 0.20 kg was pushed along a horizontal surface with a constant acceleration of 0.50 m s^{-2}. If it was pushed with a force of 0.30 N, what is the resistive force acting on the box?

A 0.10 N
B 0.20 N
C 0.30 N
D 0.40 N

7 Which statement best explains Newton's first law?

A An object at rest will remain at rest.
B An object does not undergo acceleration when resultant force acting on it is zero.
C When an object exerts a force on another object, it will experience an equal and opposite force.
D The magnitude of an object's acceleration is directly proportional to the resultant force acting on it.

8 When a car accelerates up a hill, which of the following best describes what happens?

A The car gains both gravitational potential energy and kinetic energy.
B The car gains gravitational potential energy but loses kinetic energy.
C The car gains kinetic energy but loses gravitational potential energy.
D The care loses both gravitational potential energy and kinetic energy.

9 A man weighing 700 N runs up a flight of steps 6.0 m in height in 3.0 s.
What is the average power generated by the man?

A 230 W
B 350 W
C 1400 W
D 13000 W

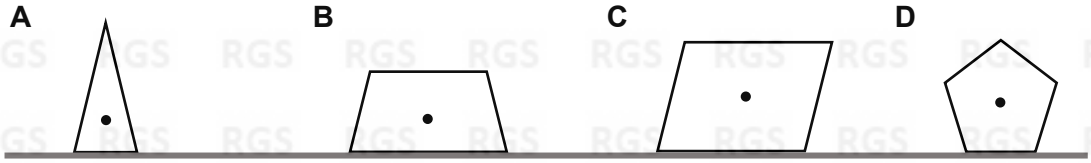
10 What are the energy changes in a hydroelectric power production?

A electrical energy → gravitational potential energy → kinetic energy
B electrical energy → kinetic energy → gravitational potential energy
C gravitational potential energy → kinetic energy → electrical energy
D kinetic energy → gravitational potential energy → electrical energy

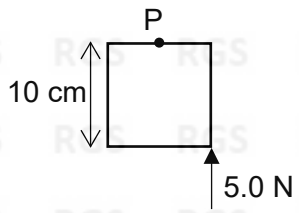
11 520 kJ of thermal energy was released when a vehicle braked to a stop. If the vehicle has a mass of 1800 kg, what is the speed of the vehicle just before the brakes were applied?

A 12 m s^{-1}
B 16 m s^{-1}
C 17 m s^{-1}
D 24 m s^{-1}

12 Which object is most stable?



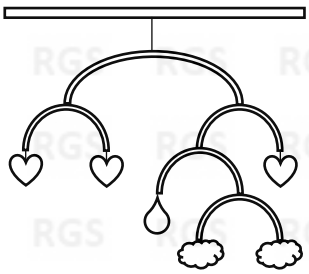
13 A square cardboard of side 10 cm is suspended from point P, a midpoint between two adjacent corners. It is pushed by a force of 5.0 N as shown in the diagram below.



What is the moment about P due to the force?

A 0 N cm
B 25 N cm
C 50 N cm
D 56 N cm

14 The diagram below shows a hanging toy for babies.



Which of the following shows the weight of each shape in increasing order?

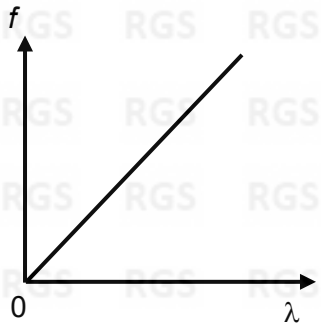
A cloud < raindrop < heart
B heart < cloud < raindrop
C heart < raindrop < cloud
D raindrop < cloud < heart

15 Which of the following waves is most suitable for destroying cancer cells?

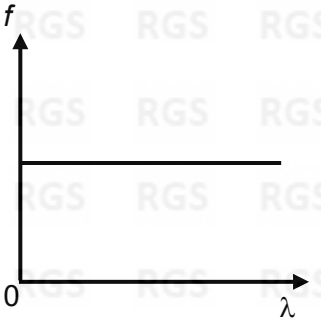
A gamma rays
B ultrasonic waves
C ultraviolet rays
D X-rays

16 Which of the following graphs shows the correct relationship between the frequency *f* of an electromagnetic wave and its wavelength λ?

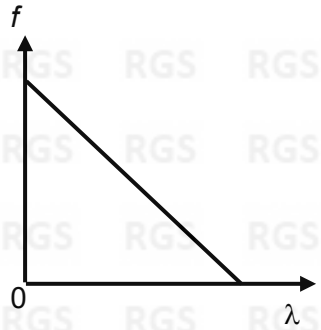
A



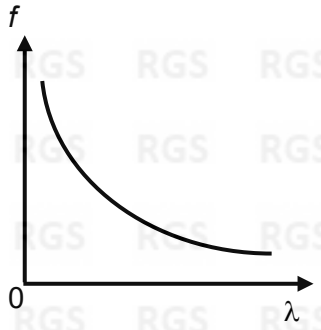
B



C



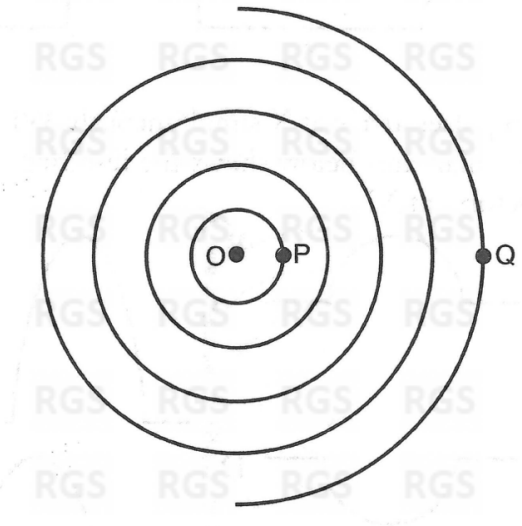
D



17 Which of the following waves consist of compressions and rarefactions?

A infra-red waves
B radio waves
C ultrasound waves
D visible light

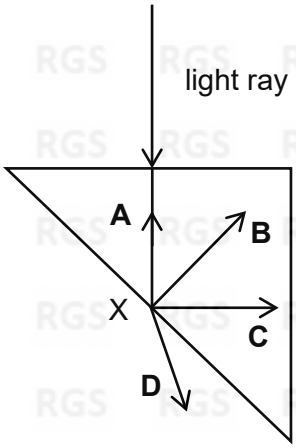
18 The following diagram shows circular wavefronts radiating from a point source O.



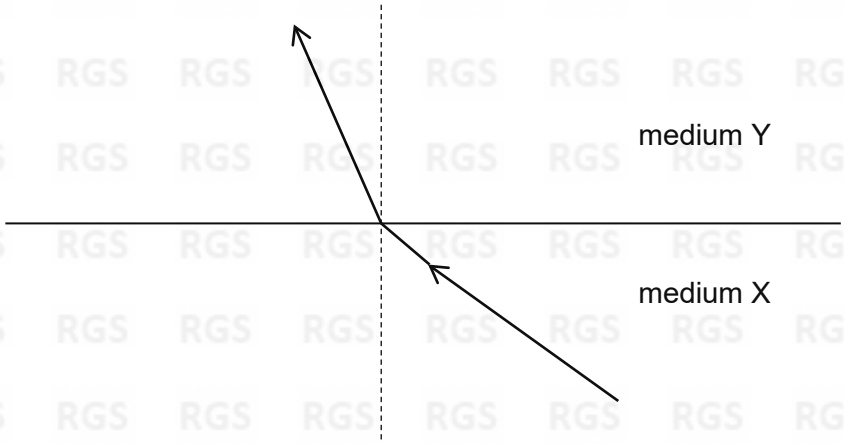
If the time taken for a wavelength to travel from P to Q is 10 s, and the wavelength of the waves is 2.0 m, what is the speed of the waves?

A 0.20 m s^{-1}
B 0.80 m s^{-1}
C 1.0 m s^{-1}
D 1.3 m s^{-1}

19 The diagram shows a light ray entering a glass prism. The light ray strikes the edge of the prism at X, at an angle of incidence greater than the critical angle. In which direction does the ray leave X?



20 The diagram shows a light ray travelling from medium X to medium Y.



Which row compares medium X with medium Y correctly?

	medium X	medium Y
A	light travels faster	higher refractive index
B	light travels faster	lower refractive index
C	light travels slower	higher refractive index
D	light travels slower	lower refractive index

SECTION B (60 marks)

Answer **ALL** questions.

21 Fig. 21.1 shows how the height of a falling object A varies with time.

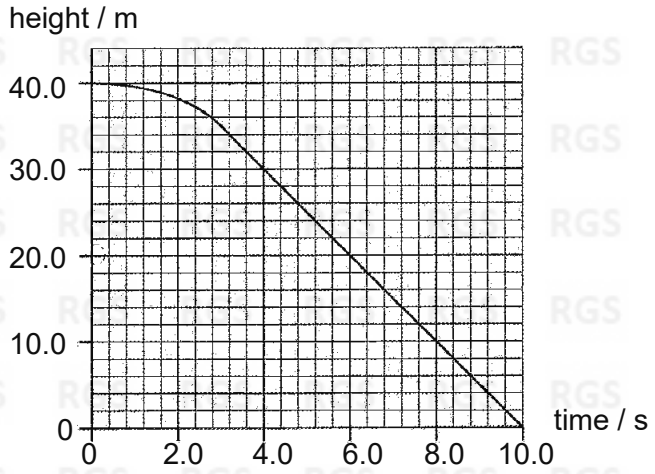


Fig. 21.1

(a) State the time during which the object is travelling with terminal velocity. [1]

……

(b) Another object B falls from a height of 15.0 m and experiences the same terminal velocity as object A. Draw on Fig. 21.1 to show how the height of B varies with time. [1]

(c) Object C falls from a tall building. Fig. 21.2 shows how the speed of a falling object varies until it reaches the ground.

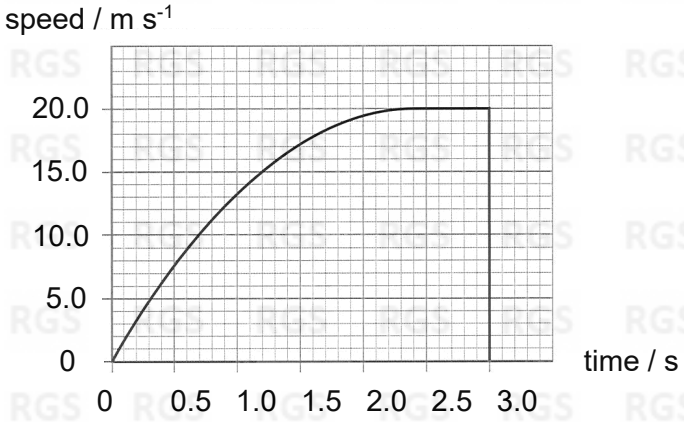


Fig. 21.2

Calculate the distance travelled in the last 0.5 s of its motion. [2]

(d) Determine the height of the building assuming object C travelled a distance of 35 m in the first 2.5 s of its journey. [2]

(e) Calculate the acceleration of the object for the first 0.3 s of its motion. [2]

(f) Draw on Fig. 21.2 to show how the speed of object C will vary with time if its acceleration remained constant from 0.3 s onwards. [1]

22 Two tugboats were used to pull a ship of mass 100 000 kg towards shore. Fig. 22.1 shows the forces F_1 and F_2 exerted by the two tugboats respectively.

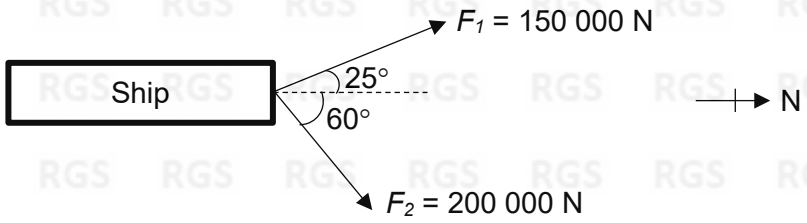


Fig. 22.1

(a) Draw a scale diagram to determine the magnitude of the resultant force exerted by the tugboats on the ship. [4]

(b) State whether the magnitude of F_2 should increase, decrease or remain the same if the direction of the resultant of F_1 and F_2 is to be northward. [1]

……..

(c) A resistive force of 120 000 N acts on the ship. Given that the resistive forces act in the opposite direction of the resultant force in (a), calculate the magnitude of the ship's acceleration. [3]

23 As shown in Fig. 23.1, a man dissipates energy at a rate of 82 W when he runs along a level path from A to B at a uniform velocity of 4.5 m s^{-1}.

Fig. 23.1

(a) Determine the force he applies when running at this uniform velocity. [2]

(b) The man now runs up a slope from B to C at a uniform speed of 3.2 m s^{-1}. The slope measures 45 m and it rises 2.5 m vertically. The mass of the man is 63 kg.

(i) Calculate the change in the man's gravitational potential energy as he reaches C. [2]

(ii) If the friction on the slope is 25 N, calculate the work he does to overcome friction in running from B to C? [2]

(iii) Determine the time he takes to run up the slope. [2]

(iv) Calculate the average power of the man in running from B to C. [2]

24 A metre rule was suspended from the ceiling using two cables at points X and Y as shown in Fig 24.1.

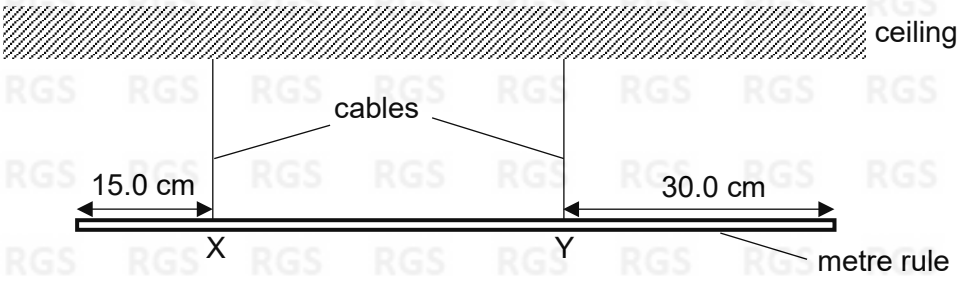


Fig. 24.1

The uniform metre rule has a mass of 225 g.

(a) Draw an arrow on Fig. 24.1 to show the weight acting on the metre rule. [1]

(b) State the *principle of moments*. [2]

……..

……..

……..

(c) Calculate the moment due to the metre rule's weight about Y. [2]

(d) Hence or otherwise, determine

(i) the force exerted by the cable at X, and [2]

(ii) the force exerted by the cable at Y. [2]

(e) State how the magnitude of the force at X changes when the cable at Y is moved towards the right. [1]

……

25 A rope has two ends M and N. A girl holds the end M and end N is fixed to a pole. The girl moves the rope up and down 12 times every five seconds. The horizontal length MN is 3.6 m and the rope moves through a vertical height of 0.98 m as shown in Fig. 25.1.

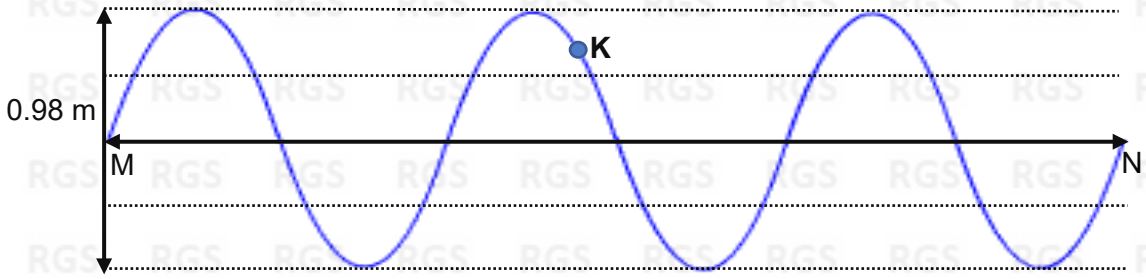


Fig. 25.1

(a) Explain why the rope wave in Fig. 25.1 is known as a transverse wave. [1]

……..

……..

(b) Name one other example of a transverse wave. [1]

……

(c) State the amplitude and wavelength of the rope wave. [2]

amplitude: ……

wavelength: ……

(d) Determine the frequency of the rope wave. [1]

(e) Calculate the speed of the rope wave. [2]

(f) The rope wave is moving to the right.
State the direction of motion of particle K at this instant. [1]

……

(g) Suggest one way to change the speed of the rope wave. [1]

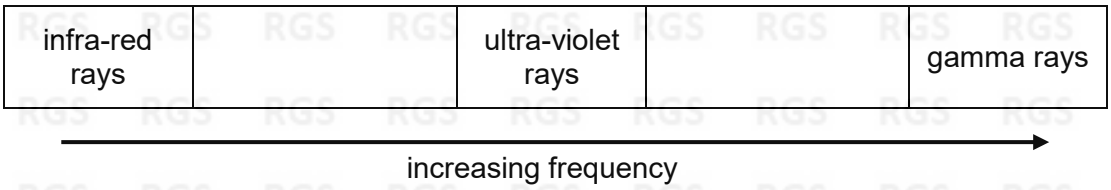
……

(h) Sketch on Fig. 25.1 another wave that has twice the wavelength and half the amplitude. [2]

26 Microwaves travel in vacuum with a frequency of 1.5×10^8 Hz.

(a) Calculate the time it takes for microwaves to travel 25000 km. [2]

(b) The following shows parts of the electromagnetic spectrum.
Complete the diagram by filling in the two blanks. [2]



27 Light is incident on a rectangular transparent block as shown in Fig 27.1.

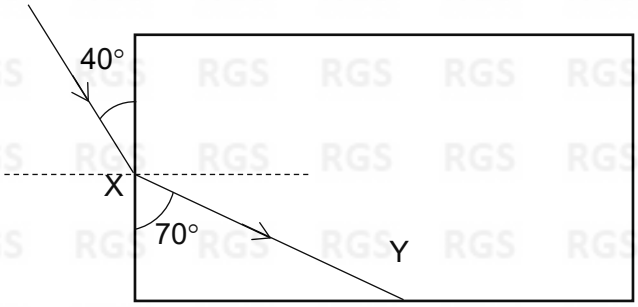


Fig. 27.1

(a) State the angle of incidence and refraction at X. [1]

angle of incidence = …….

angle of refraction = …….

(b) Calculate the refractive index of the transparent block. [2]

(c) Define *critical angle*. [1]

……

……

(d) Calculate the critical angle of the transparent block. [2]

(e) Hence, complete the path of the light ray from Y until it leaves the block. [2]

End of Paper