BA PROVINCIAL FREE BIRD INSTITUTE
ANNUAL EXAMINATION 2020
YEAR 12 PHYSICS
QUESTION PAPER

Time Allowed: 3 hours
(An extra 10 minutes is allowed for reading this paper)

INSTRUCTIONS

1. Write your **Index Number** on the front page of the **Answer Booklet**.
2. Write all your answers in the **Answer Booklet** provided.
3. Answer all the questions with blue or black ink pen. Do not use red ink. You may use a pencil only for drawing.
4. You may use a calculator, provided it is silent, battery operated and non – programmable.
5. **All questions are compulsory**.

Note:

- Physics Formulae and Constants which may be useful during the examination are given on page 17 of this **Question paper.**
- Diagrams in this paper are **not** drawn to scale.

SUMMARY OF QUESTIONS

STRANDS		MARKS	SUGGESTED TIME
1	Mechanics	40	72 minutes
2	Energy	10	18 minutes
3	Fluids	8	14 minutes
4	Geometrical Optics and Wave Motion	10	18 minutes
5	Electricity	14	26 minutes
6	Electromagnetism	10	18 minutes
7	Atomic Physics	8	14 minutes
TOTAL		**100**	**180 minutes**

INSTRUCTIONS FOR MULTIPLE-CHOICE QUESTIONS

Each question is worth 1 mark.

1. In your **Answer Booklet, circle** the letter which represents the best answer. If you change your mind, put a line through your first choice and circle the letter of your next choice.

For example:

2	A	~~B~~	(C)	D

2. If you change your mind again and like your first answer better, put a line through your second circle and tick (√) your first answer.

For example:

2	A	~~B~~ √	~~C~~	D

3. No mark will be given if you circle more than one letter for a question.

STRAND 1 **MECHANICS** **[40 marks]**

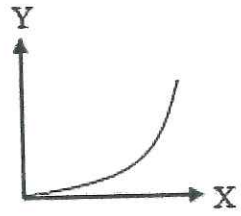
- This strand has **20** Questions.
- Show necessary working for questions **8 – 20** as partial marks will be awarded for correct working.

1) The number of significant figures in 0.700 is
   A. 1
   B. 2
   C. 3
   D. 4

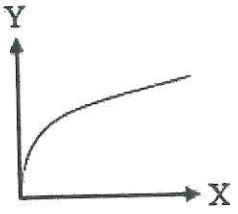
(1 mark)

2) Which one of the following Y versus X graphs depicts square root relationship?

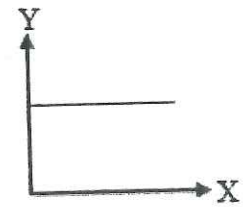
A.



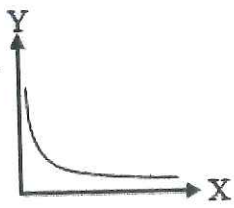
C.



B.



D.



(1 mark)

3) Precision of a vernier caliper is
   A. 0.01 m
   B. 0.1 cm
   C. 0.01 cm
   D. 0.01 mm

(1 mark)

4) The acceleration of an object is directly proportional to
   A. time.
   B. mass.
   C. force.
   D. displacement.

(1 mark)

5) Torque is given by the equation $\tau = \mathbf{F} \times \mathbf{d}$. What does **d** in the equation stand for?
   A. Distance from the pivot
   B. Distance between two masses
   C. Parallel distance from the pivot
   D. Perpendicular distance from the pivot

(1 mark)

6) An object accelerates from rest to a speed of 20 ms^{-1} in 5 s. Its acceleration in ms^{-2} is
   A. 4
   B. 5
   C. 25
   D. 100

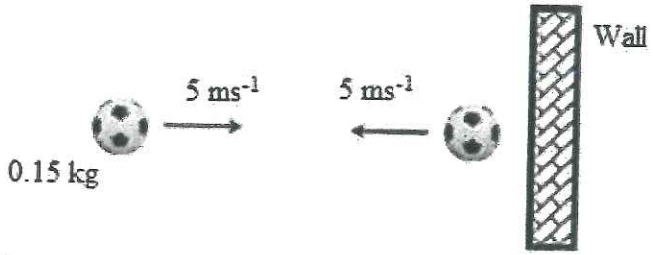
(1 mark)

7) The force that keeps an object moving around a circular path without slipping is known as
   A. friction force.
   B. reaction force.
   C. centripetal force.
   D. electromotive force.

(1 mark)

8) The dimensions of a microscope glass slide are given as follows:
   $l = (8.5 \pm 0.1)$ cm $w = (3.50 \pm 0.01)$ cm
   Calculate the perimeter of the slide with its appropriate absolute uncertainty. **(2 marks)**

9) A ball of mass 0.15 kg is kicked at 5 ms^{-1} towards the wall. The ball hits the wall and bounces back directly at 5 ms^{-1} as shown in the diagram given below.



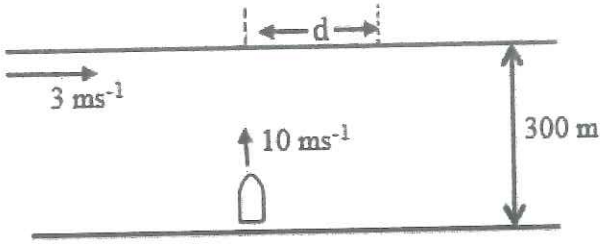
(i) Calculate the ball's change in velocity. **(1 mark)**
(ii) Calculate the acceleration of the ball, if the impact time of the ball with the wall was 0.2 seconds. **(1 mark)**

10) The equation of electric field is given by $\mathbf{E} = \frac{\mathbf{kq}}{\mathbf{r^2}}$.

(i) State the relationship between **E** and $\mathbf{r^2}$. **(1 mark)**

(ii) What happens to the value of electric field, **E** if **r** is tripled? **(1 mark)**

11) A man rows a boat at a steady speed of 10 ms^{-1}. He sets out at right angles to the section of a river which is 300 m wide. The river flows downstream at 3 ms^{-1}.



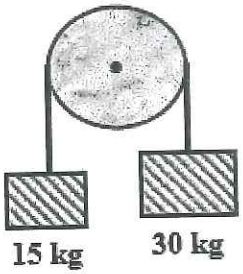
Calculate the

(i) time taken to cross the river. **(1 mark)**

(ii) distance, d moved downstream while crossing the river. **(1 mark)**

(iii) angle upstream the boat should head if it wants to land at a point directly opposite to where it started. **(1 mark)**

12) The system below shows masses of 15 kg and 30 kg hanging on opposite ends of a light inextensible string which passes over a frictionless pulley.

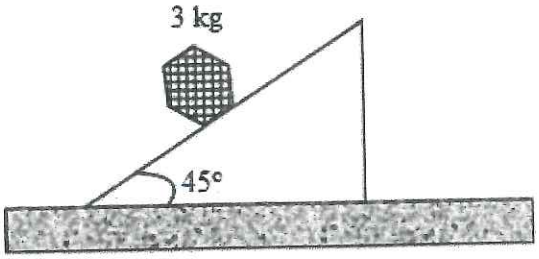


Calculate the:

(i) acceleration of the system. **(1½ marks)**

(ii) tension in the string. **(1 mark)**

13) A 3 kg object is placed on a frictionless inclined plane at an angle of 45° as shown in the diagram given below.



(i) Calculate the acceleration of the 3 kg object. **(1 mark)**

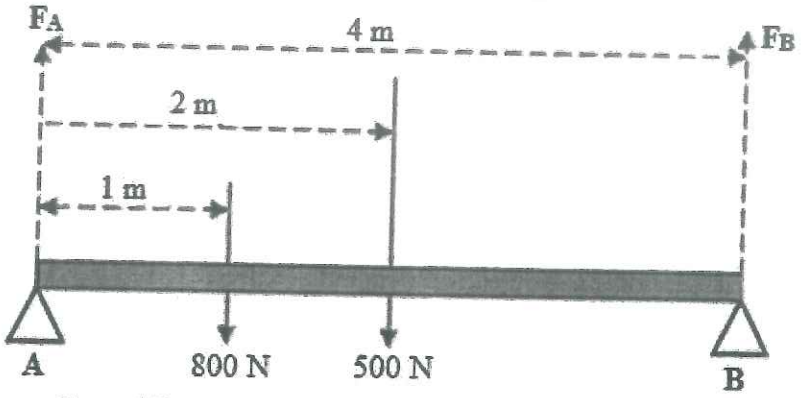
(ii) Determine the force required to prevent the 3 kg object from sliding down the inclined plane. **(1 mark)**

14) A car travelling at 45 ms^{-1} slows down and stops. The distance travelled is 90 m.

(i) What is the acceleration of the car? **(1 mark)**

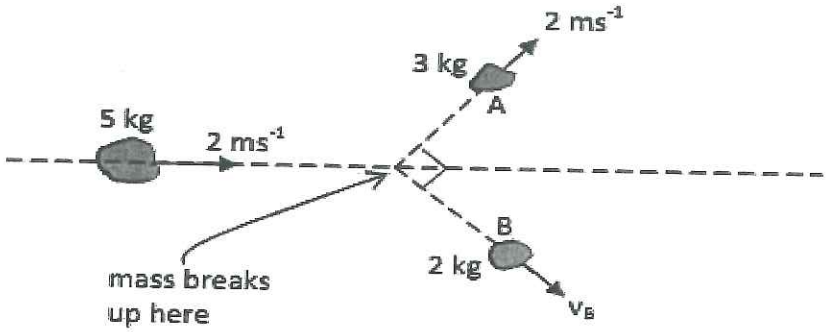
(ii) Determine the time taken by the car to stop. **(1 mark)**

15) A uniform wooden plank 4 m long and of weight 500 N is supported at both ends by trestles A and B. There is also a weight of 800 N at 1 m from trestle A.



Calculate the forces F_A and F_B. **(3 marks)**

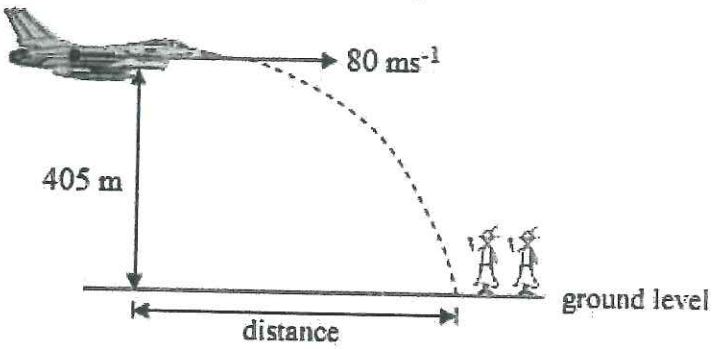
16) A 5 kg mass moves east at 2 ms^{-1} and breaks suddenly into two pieces, **A** and **B**, that move away at right angles to each other. **A** has a mass of 3 kg and a speed of 2 ms^{-1}



(i) State the condition that must be present in this explosion for momentum to be conserved. **(1 mark)**

(ii) Determine the magnitude of velocity, v_B. **(2 marks)**

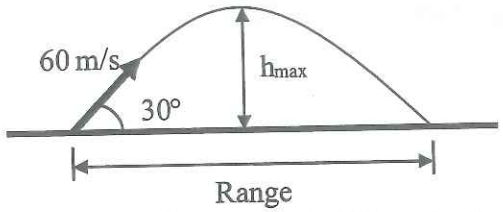
17) A Fiji Airways rescue plane drops a package of emergency rations to a stranded party of explorers, as shown in the diagram. The plane is travelling horizontally at 80 ms^{-1} at a height 405 m above the ground.



(i) Determine the time taken for the package to reach the ground. **(1 mark)**

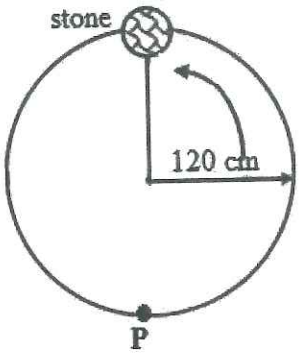
(ii) Calculate the horizontal distance from the group of explorers the package was released from the plane. **(1 mark)**

18) A projectile is launched with a velocity of 60 m/s at an angle of 30° to the horizontal as shown below.



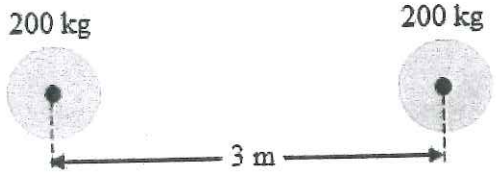
(i) Determine the vertical component of the velocity. **(1 mark)**
(ii) Determine the horizontal component of the velocity. **(1 mark)**
(iii) Calculate the time taken to reach the maximum height, h_{max}. **(1 mark)**
(iv) Calculate the maximum height, h_{max} reached by the projectile. **(1 mark)**
(v) Calculate the range. **(1 mark)**

19) The diagram given below shows a 0.6 kg stone being swung anti-clockwise in a horizontal circle of radius 120 cm. It completes one revolution in 40 seconds.



(i) Use an arrow to indicate the direction of velocity acting on the stone at point P. **(½ mark)**
(ii) Calculate the frequency of rotation. **(1 mark)**
(iii) Calculate the velocity of the stone. **(1 mark)**

20) Calculate the gravitational force between two 200 kg objects whose centres are 3 metres apart.



(2 marks)

STRAND 2 **ENERGY** **[10 marks]**

- This strand has 6 Questions.
- Show necessary working for questions 3 – 6 as partial marks will be awarded for correct working.

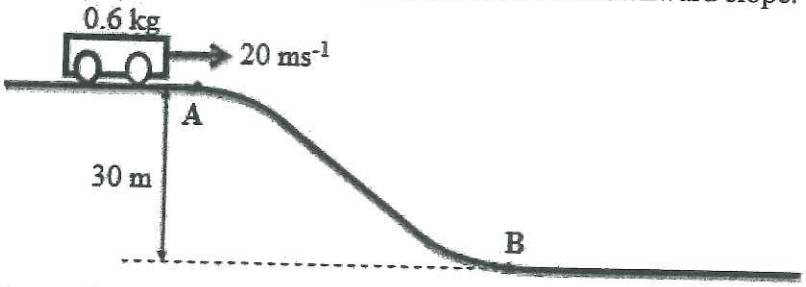
1) **Boyle's Law** states that, for a fixed mass of gas, pressure is
   A. directly proportional to volume if temperature is kept constant.
   B. inversely proportional to volume if temperature is kept constant.
   C. directly proportional to temperature if volume is kept constant.
   D. inversely proportional to temperature if volume is kept constant. **(1 mark)**

2) Albedo is the fraction of the total incident solar radiation received on earth that gets reflected into space. If Earth's albedo is increased, then the global mean surface temperature would probably
   A. increase.
   B. decrease.
   C. become zero.
   D. remain the same. **(1 mark)**

3) A car tyre, of volume 250 cm^3 is filled to an absolute pressure of 280 kPa at 27 °C. After driving some distance, the temperature of the air inside the tyre rises to 57 °C. Calculate the new volume of the tyre if there is no change in pressure. **(2 marks)**

4) A steel bearing ball with a mass of 0.017 kg requires 235 J of energy when heated from 23°C to 49°C. Calculate the specific heat capacity of the steel ball. **(2 marks)**

5) A trolley of mass 0.6 kg moves at 20 ms^{-1} until it comes to a downward slope.



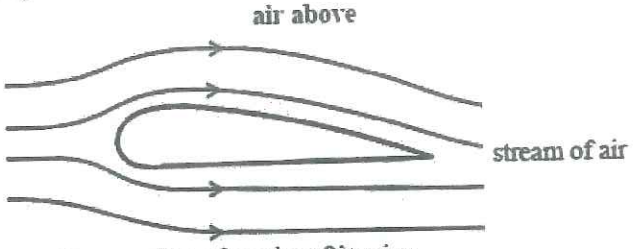
   (i) Calculate the total energy of the trolley at point A. **(2 marks)**
   (ii) Calculate the velocity of the trolley at point B. **(1 mark)**

6) State one assumption of kinetic theory of gases. **(1 mark)**

STRAND 3 FLUIDS [8 marks]

- This strand has 5 Questions.
- Show necessary working for questions 3 – 5 as partial marks will be awarded for correct working.

Use the diagram given below which shows a stream of air passing over the cross section of an aircraft's wing to answer **Question 1**.



Cross section of an aircraft's wing

1) Which of the following correctly describes the pressure and speed of **air above** the aircraft's wing?

	Pressure	**Speed**
A.	low	slow
B.	low	fast
C.	high	slow
D.	high	fast

(1 mark)

2) A liquid with a high viscosity
   A. flows slowly.
   B. flows quickly.
   C. does not move.
   D. has a definite shape.

(1 mark)

3) If the atmospheric pressure is 1.01×10^5 Pa and the density of water is 1000 kg/m^3, what is the total pressure experienced by a swimmer who is at a depth of 2 m in a swimming pool?

(2 marks)

4) Liquid viscosity can be viewed as kinematic viscosity and dynamic viscosity.
   (i) Define kinematic viscosity. **(1 mark)**
   (ii) State one unit that can be used for kinematic viscosity. **(1 mark)**

5) Using Bernoulli's effect, explain how perfume is drawn upwards in an atomizer. **(2 marks)**

STRAND 4 GEOMETRICAL OPTICS AND WAVE MOTION [10 marks]

- This strand has 6 Questions.
- Show necessary working for questions 3 – 6 as partial marks will be awarded for correct working.

1) The diagram represents some of the main parts of the electromagnetic spectrum.

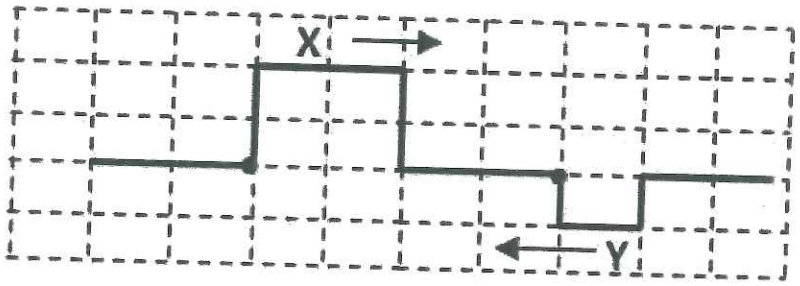
1	infra-red	2	3	x-rays	4

Which of the following correctly represents the numbered parts?

	1	2	3	4
A.	Radio waves	Ultraviolet	Visible light	Gamma rays
B.	Radio waves	Visible light	Ultraviolet	Gamma rays
C.	Visible light	Ultraviolet	Gamma-rays	Radio waves
D.	Visible light	Ultraviolet	Radio waves	Gamma Rays

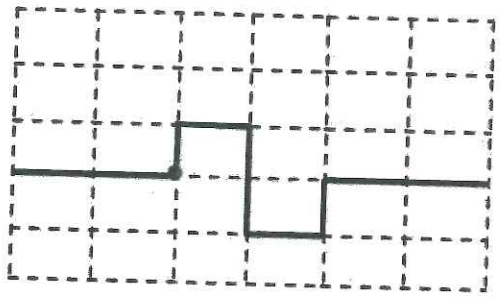
(1 mark)

2) Two wave pulses X and Y are travelling towards each other at 1 cms^{-1} as shown below.

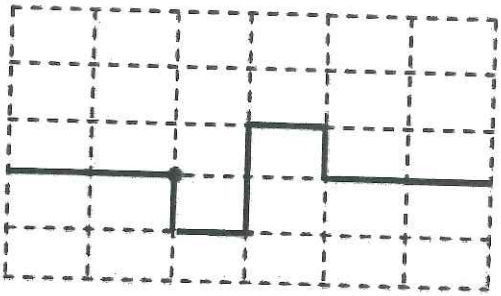


Identify the shape of the resultant wave after 2 seconds?

A.



B.



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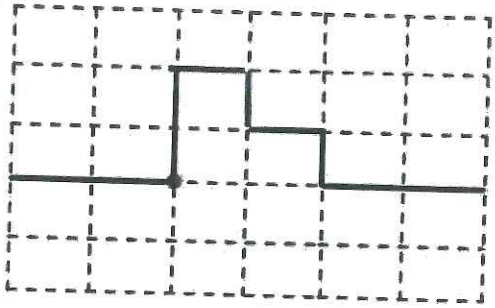
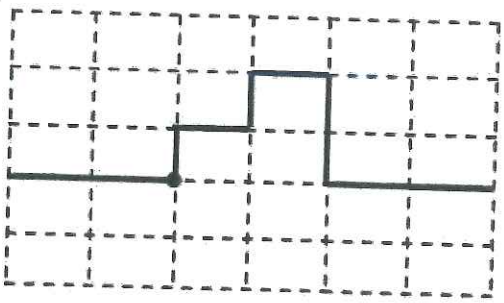


D.



(1 mark)