JAMES RUSE AGRICULTURAL HIGH SCHOOL

2020

PHYSICS

YEAR 11 EXAMINATION

General Instructions

- Reading time - 5 minutes
- Working time - 70 minutes
- Calculators approved by NESA may be used
- Write using black pen
- Draw diagrams using pencil
- A Data Sheet, Formulae Sheet and a Periodic Table are provided
- Write your Student Number in the space provided on the top of the first page of Part B.

Total: 60 marks

PART A 16 Multiple Choice Questions **16** marks Allow about 22 minutes

PART B Extended Response Questions **44** marks Allow about 48 minutes

Part A – 16 marks

Attempt Questions 1-16

Allow about 22 minutes for this part

Use the multiple choice answer sheet on page 11.

Select the alternative A, B, C or D that best answers the question. Fill in the response oval completely.

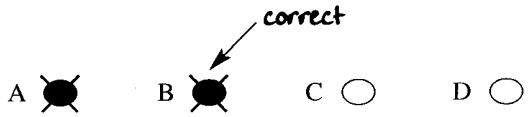
Sample: $2 + 4 =$ (A) 2 (B) 6 (C) 8 (D) 9

A ○ B ● C ○ D ○

If you think you have made a mistake, put a cross through the incorrect answer and fill in the new answer.

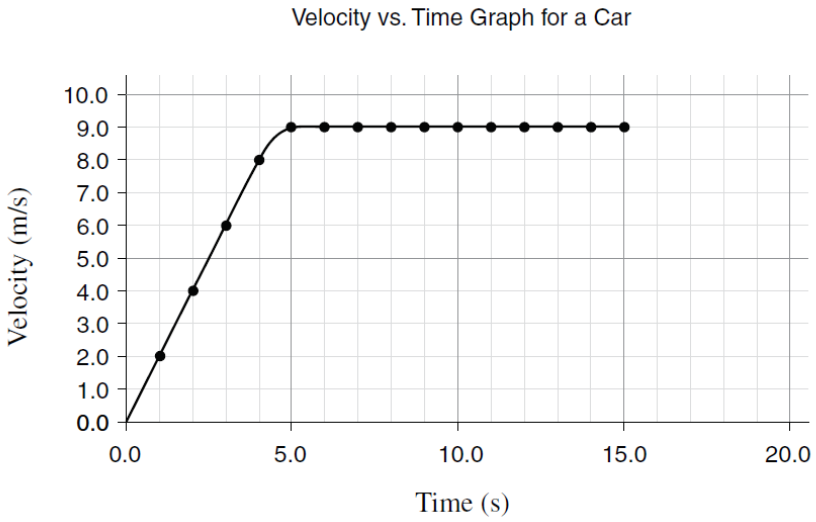
A ● B ⊗ C ○ D ○

If you change your mind and have crossed out what you consider to be the correct answer, then indicate the correct answer by writing the word **correct** and drawing an arrow as follows.



PART A 16 Multiple Choice Questions 16 marks.

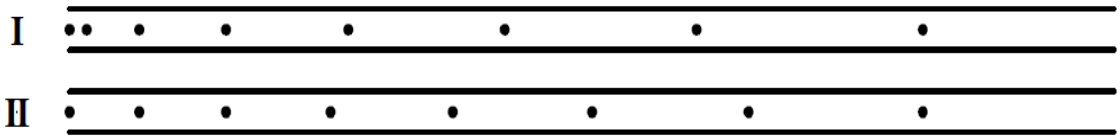
1. A car's motion is described by the velocity versus time graph shown below.



What is the total distance travelled by the car during its motion?

A. 23 m
B. 45 m
C. 90 m
D. 113 m

2. The picture below shows the pattern of dots made on ticker tapes connected to two different moving objects, I and II. Each timer was set to make the same number of dots per second and each tape is oriented so that the first dot that was made is at the left.



Which of the statements below best compares the motion of the two objects?

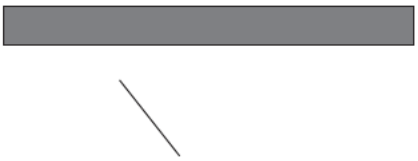
A. Object I has a smaller initial speed than object II and object I has a smaller average acceleration than object II

B. Object I has a smaller initial speed than object II, but object I has a larger average acceleration than object II

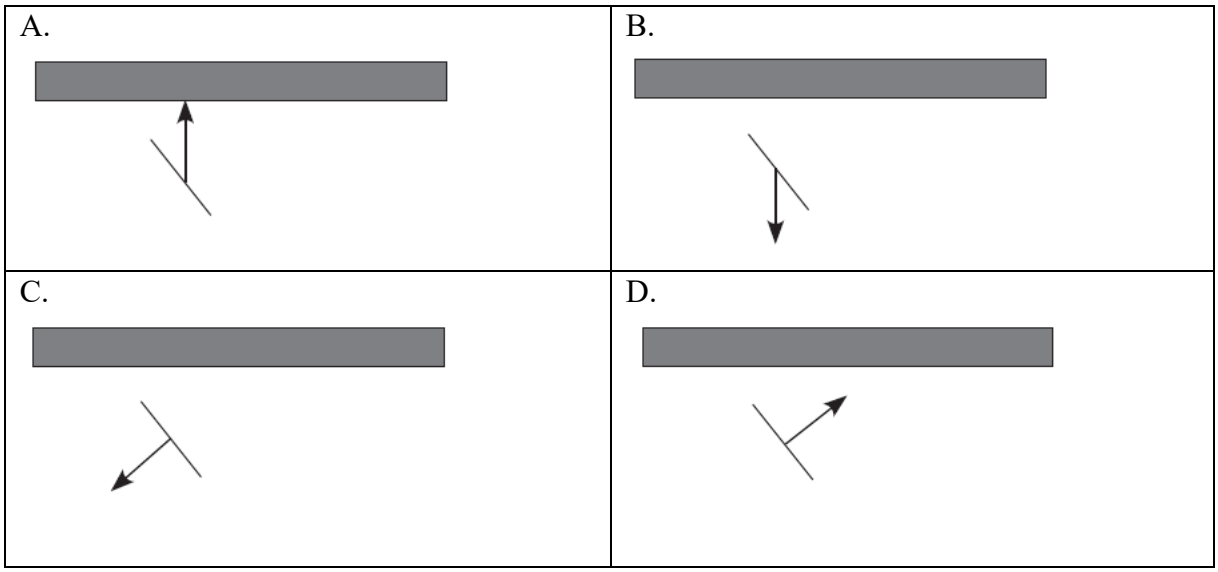
C. Object I has a larger initial speed than object II, but object I has a smaller average acceleration than object II

D. Object I has a larger initial speed than object II and object I has a larger average acceleration than object II

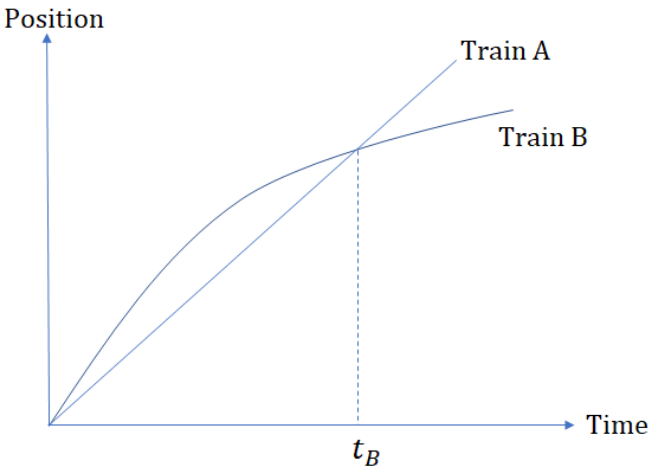
3. The diagram below shows an incident wavefront approaching a straight barrier.



Which diagram correctly shows the wave ray for the above wavefront?



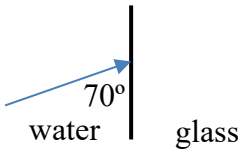
4. The graph shows the position as a function of time for two trains running on parallel tracks.



Which of the following statements is true about the trains?

A. Both trains speed up all the time.
B. At time t_B , both trains have the same velocity.
C. Both trains have the same velocity at some time before t_B.
D. Somewhere on the graph, both trains have the same acceleration.

5. A ray of light, travelling through water strikes a glass wall, as shown below.



If the refractive index of water is 1.33 and that of glass 1.52, what is the angle of refraction of the light ray in the glass wall?

A. 17.4°
B. 55.3°
C. 23.0°
D. 61.0°

6. Two students are discussing forces acting on objects.

Student A: "An object falling at a steady speed will slow down if the resultant force on it is zero".

Student B: "If a force acts on an object it must move"

Which of the following is true?

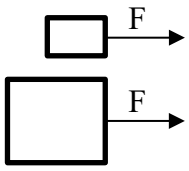
A. Only student A is correct
B. Only student B is correct
C. Both student A and student B are correct
D. Neither student A nor student B are correct

7. A 10 kg block is being pulled vertically upwards by a rope at an acceleration of 5 m s^{-2}.

What is the tension in the rope?

A. About 50 N
B. About 100 N
C. About 150 N
D. The tension increases as the block speeds up.

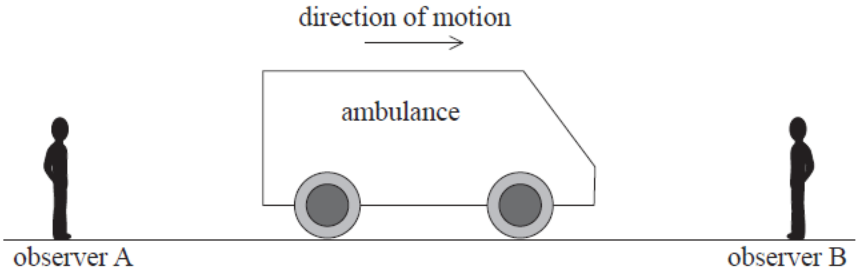
8. Two blocks of different masses are pulled sideways by identical forces on a frictionless surface:



After they have been pulled the same distance, which of the following is true?

A. The momentum of the smaller mass is higher.
B. The kinetic energy of the smaller mass is higher.
C. The power delivered to the smaller mass is higher.
D. The impulse delivered to the smaller mass is higher.

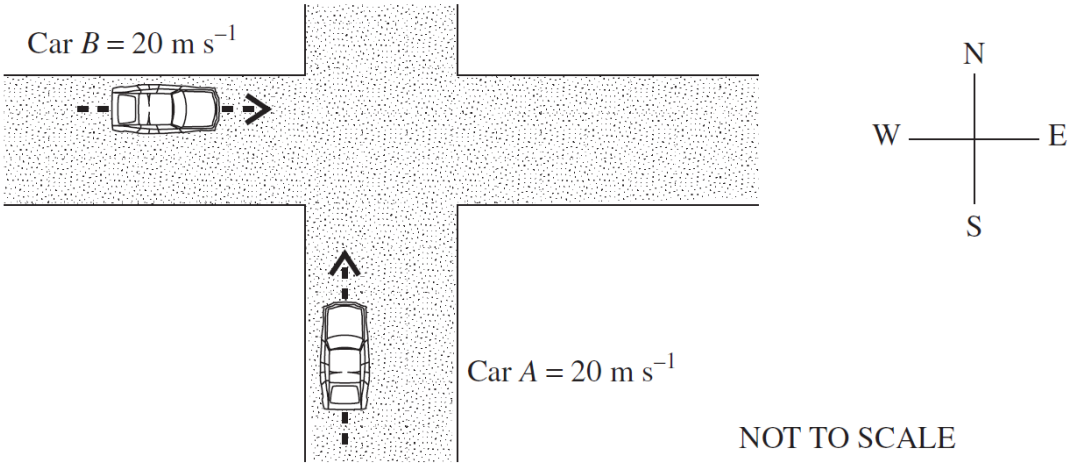
9. An ambulance emits a sound of frequency f as it travels along a straight road between stationary observers A and B.



Which of the following shows how the frequency of the sound heard by each observer compares with f ?

	Observer A	*Observer B*
A.	less than f	greater than f
B.	greater than f	less than f
C.	greater than f	greater than f
D.	less than f	less than f

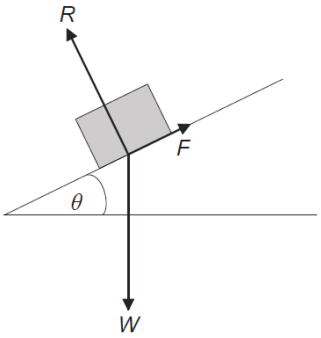
10. Car *A* and Car *B* approach an intersection as shown.



What is the approximate velocity of Car *B* relative to Car *A*?

A. 28 m s^{-1} SE
B. 28 m s^{-1} NW
C. 28 m s^{-1} NE
D. 28 m s^{-1} SW

11. The diagram shows the forces acting on a block resting on an inclined plane. The angle θ is adjusted until the block is just at the point of sliding. R is the normal reaction, W the weight of the block and F the maximum frictional force.

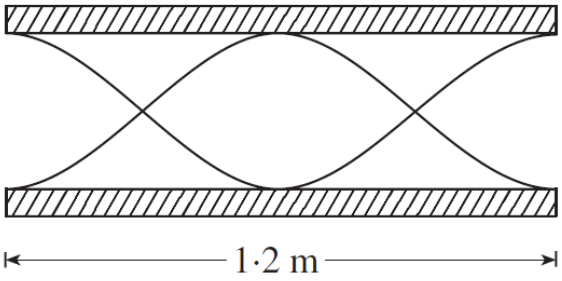


not to scale

What is the maximum coefficient of static friction between the block and the plane?

A. $\sin\theta$
B. $\cos\theta$
C. $\tan\theta$
D. 1

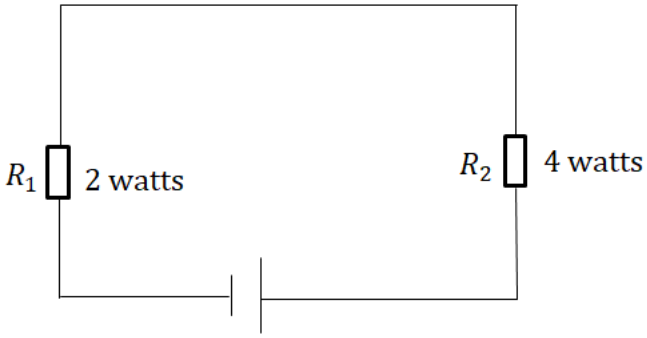
12. An organ is constructed so that it has open pipes. A note produced by one of these pipes has a frequency of 280 Hz. The length of this pipe is 1·2 m. A representation of a standing wave corresponding to this note is shown.



What is the frequency and wavelength of the fundamental resonance for this pipe?

	Frequency (Hz)	*Wavelength* (m)
A.	140	1.2
B.	140	2.4
C.	560	1.2
D.	560	2.4

13. The power produced by two resistors in the following circuit is shown.



Which row of the table is consistent with the information provided?

	$\frac{Current\ through\ R_1}{Current\ through\ R_2}$	$\frac{Resistance\ of\ R_1}{Resistance\ of\ R_2}$
A.	2	0.5
B.	2	2
C.	1	0.5
D.	1	2

14. Two charged particles X and Y have the same mass. They are in a vacuum and their centres are aligned horizontally. They are released from rest from the positions shown.

Which statement correctly compares the accelerations of X and Y?

A. The magnitude of the acceleration X is the same as that of Y and it will decrease as the particles move.

B. The magnitude of the acceleration X is the double that of Y and it will decrease as the particles move.

C. The magnitude of the acceleration X is the double that of Y and it will increase as the particles move.

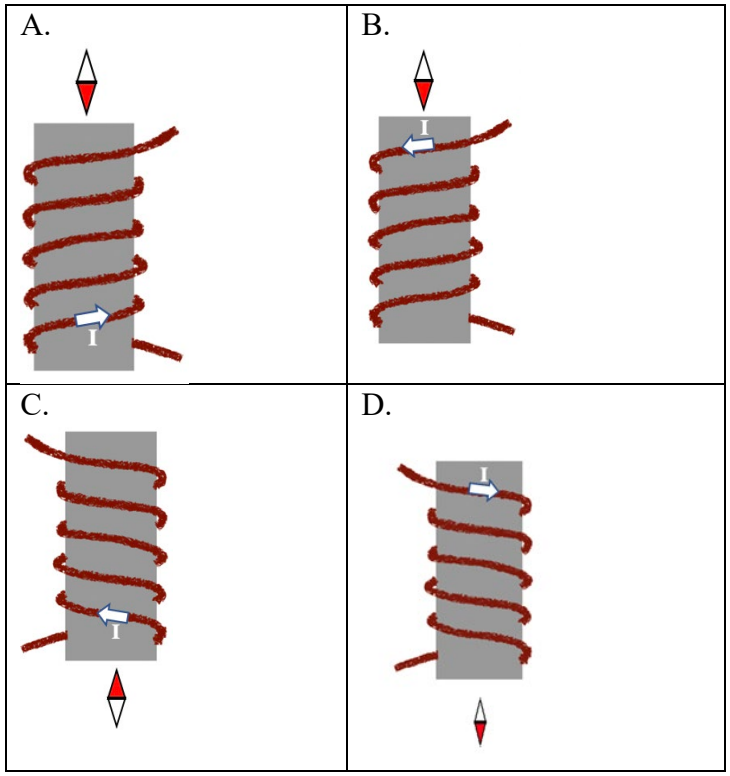
D. The magnitude of the acceleration X is the same as that of Y and it will increase as the particles move.

15. The diagram of a magnetic compass that could be used to investigate the effects of the current in the solenoid is shown when there is no current in the solenoid.

The long axis of the solenoids in the options is parallel to the compass needle shown in the diagram of the magnetic compass.

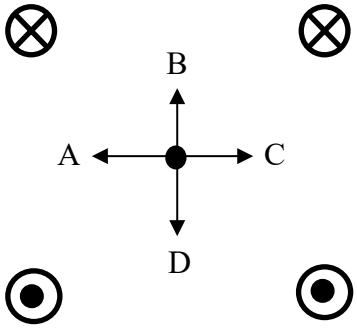
In which of the following diagrams can the orientation of the compass needle adjacent to the end of the solenoid be accounted for as being due ONLY to the effects of the current in the solenoid?

A.



B.

16. Four parallel current-carrying conductors are placed at the corners of a square as shown below.



If the magnitudes of the currents in the four conductors are the same, what is the direction of the net magnetic field at the centre of the square?

A. A
B. B
C. C
D. D

ANSWER BOOKLET

Student No. …….....

PART A Multiple Choice Answer Sheet **16 marks**

Choose the most appropriate answer and fill in the response oval completely.

1.	A ○	B ○	C ○	D ○
2.	A ○	B ○	C ○	D ○
3.	A ○	B ○	C ○	D ○
4.	A ○	B ○	C ○	D ○
5.	A ○	B ○	C ○	D ○
6.	A ○	B ○	C ○	D ○
7.	A ○	B ○	C ○	D ○
8.	A ○	B ○	C ○	D ○
9.	A ○	B ○	C ○	D ○
10.	A ○	B ○	C ○	D ○
11.	A ○	B ○	C ○	D ○
12.	A ○	B ○	C ○	D ○
13.	A ○	B ○	C ○	D ○
14.	A ○	B ○	C ○	D ○
15.	A ○	B ○	C ○	D ○
16.	A ○	B ○	C ○	D ○

PART B **Extended Response** **44 marks**

Attempt questions 17-29.

Allow about 48 minutes for this part.

Show all relevant working in questions involving calculations.

Question 17 (4 marks)

An explorer is caught in a whiteout (in which the snowfall is so thick that the ground cannot be distinguished from the sky) while returning to base camp. He was supposed to travel due north for 4.5 km , but when the snow clears, he discovers that he actually travelled 7.8 km at E 50° N. **4**

By drawing an accurate vector diagram to scale ($1\ \text{cm} \equiv 1\ \text{km}$), determine how far and in what direction must he now travel to reach base camp?

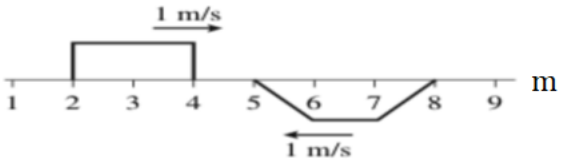
NOTE: No marks will be awarded if algebraic techniques are used.

How Far: _____

What Direction: _____

Question 18 (3 marks)

Two waves on a string, at $t = 0$, are moving towards each other at a speed of $1\ \text{m s}^{-1}$, as shown below. **3**



Draw the appearance of the string at $t = 2$ s.

Question 19 (4 Marks)

(a) With reference to magnetic domains (moments), outline the difference between an unmagnetised magnetic material and a magnetised material. **2**

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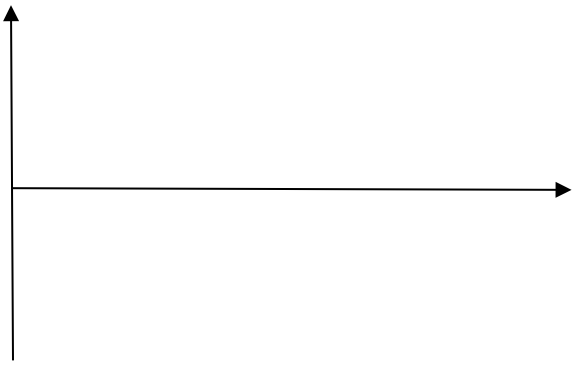
(b) Sketch a graph that clearly shows the relationship between the distance from a long current-carrying conductor and the magnitude of the magnetic field around the wire as a function of distance. **2**



Question 20 (3 marks)

A 1.5 kg picture frame is hanging on the wall by massless and inextensible strings as shown: **3**

By drawing a free body diagram of the forces acting on the frame, find the tension, T in the string.

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Question 21 (2 Marks)

A rubber ball is dropped from a height of 1 m and rebounds to the same height. **2**
Which of momentum and/or kinetic energy is conserved in the collision with the ground?

Justify your answer using physics principles.

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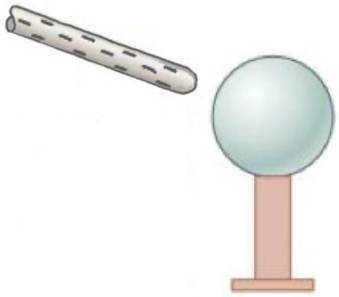
Question 22 (2 Marks)

Explain the charge on the metal sphere if it was initially neutral and it was charged by induction using the negatively charged rod.



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Question 23 (3 Marks)

Two trains, one of which is stationary, emit 424 Hz whistles. A passenger on the stationary train hears a 3 Hz beat frequency when the other train approaches. **3**

Calculate the speed of the moving train.

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Question 24 (6 Marks)

A driver of a car going 90 km h^{-1} suddenly sees the lights of a barrier 40.0 m ahead. It takes the driver 0.75 s before he applies the brakes. Once he does begin to brake, he slows down at a rate of 10 m s^{-1} every second.

a) Does he hit the barrier? Justify your answer by means of calculations. **3**

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b) What would be the maximum speed at which the car could travel and not hit the barrier 40.0 m ahead? Assume the same reaction time and braking rate. **3**

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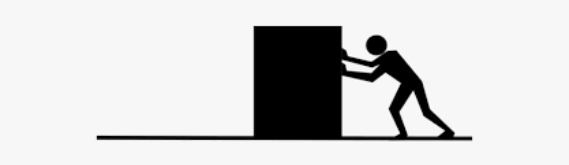
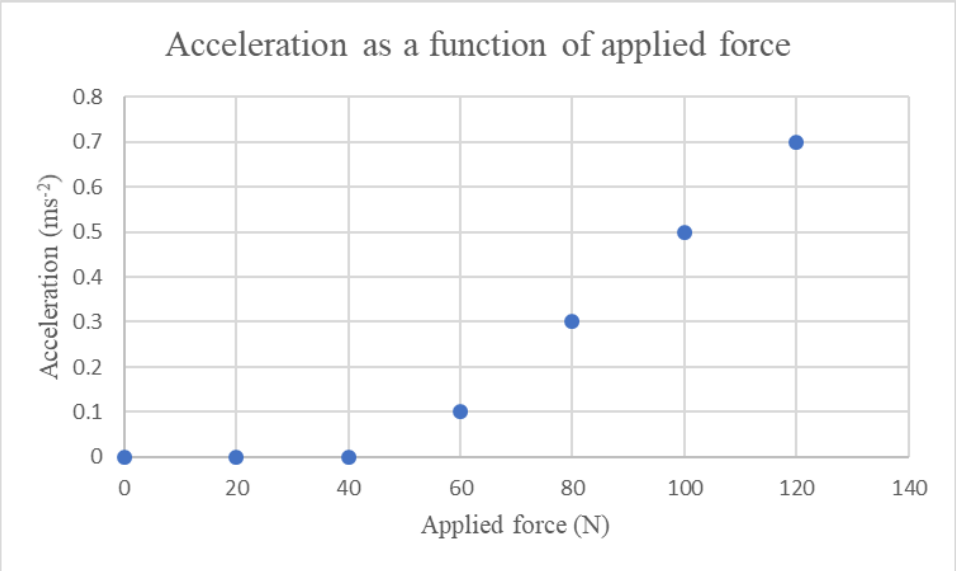
Question 25 (3 Marks)

A 100 kg box is pushed with varying forces on a lubricated rough surface and the corresponding accelerations measured. **3**



The graph below shows the acceleration of the box as a function of the applied force.



Use the graph to determine the coefficient of dynamic (kinetic) friction.

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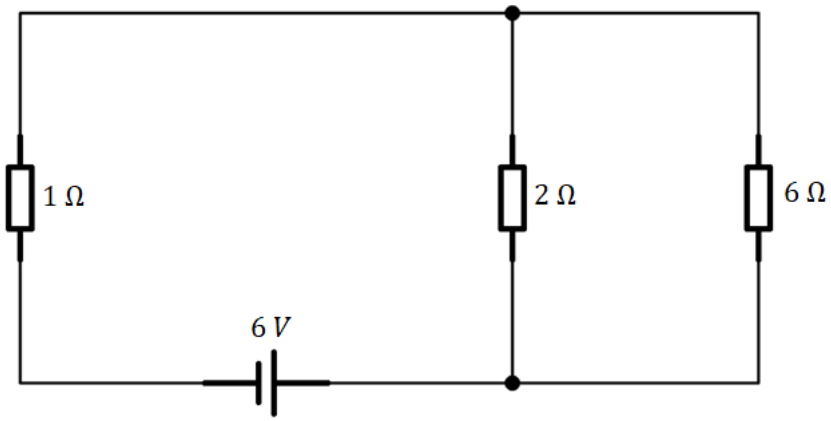
Question 26 (3 Marks)

Calculate the current that flows through the 6 Ω resistor in the circuit shown.



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Question 27 (3 marks)

At what distance apart should a $6\ \mu C$ charge be placed from a $-8\ \mu C$ charge so that they experience an attractive force of 1.11 N?

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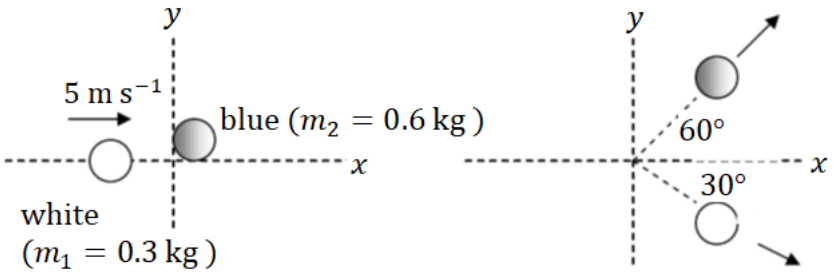
Question 28 (4 marks)

The diagram below shows a collision between a 0.3 kg white ball moving at $5\ m\ s^{-1}$ horizontally and a 0.6 kg blue ball which is initially at rest. The collision is not head-on, so the balls bounce off of each other at the angles shown. **4**



Find the final speed of each ball after the collision.
(Let the speed of the blue ball be v_2 and the white ball be v_1.)

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Question 29 (4 Marks)

Dr Sendt recently acquired a lamp, like the one shown below, to help her cross stitch at night. A biconvex lens is surrounded by a circle of lights, equivalent to the light output of the overhead ceiling light in the room.

Using relevant Physics principles, explain why this tool will help Dr Sendt to see her stitches. **4**

Use appropriate diagrams to support your answer.

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END OF EXAMINATION ☺