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PARKTOWN HIGH SCHOOL FOR GIRLS

GRADE 12 PHYSICAL SCIENCES PRELIMINARY EXAMINATION

EXAMINER: F Patel

INTERNAL MODERATOR: L Rens

EXTERNAL MODERATOR: I Pelser

DATE: 17/08/2020

TOTAL: 150

TIME: 3 Hours

SUBJECT: Physics P I

Instructions:

1. Rule off after each question.
2. Refer to the data sheet when necessary.
3. Show all working out. Answers only will not necessarily be awarded full marks.
4. Round off answers to two decimal places unless otherwise stated.
5. Detach this cover page and staple this cover page to the front of your answers.

Question 1 is to be answered on the reverse side of this page.

NAME: _____

TEACHER: PATEL/RENS KEY: _____

Question	Topic	Total	Mark
1	MCQ's	20	
2	Newton	19	
3	VPM	16	
4	Momentum	15	
5	Work Energy Power	23	
6	Electrostatics	13	
7	Doppler	12	
8	Circuits	20	
10	Photoelectric effect	12	
	Total	150	

Question 1 Multiple Choice Questions. Place a cross on your selected option

1.1	A	B	C	D
1.2	A	B	C	D
1.3	A	B	C	D
1.4	A	B	C	D
1.5	A	B	C	D
1.6	A	B	C	D
1.7	A	B	C	D
1.8	A	B	C	D
1.9	A	B	C	D
1.10	A	B	C	D

(20)

QUESTION 1

Multiple Choice Questions

20

Choose the correct response to each of the following options. Answer this question on the reverse side of the cover page.

1.1 Consider the formula for work, $W = F \Delta x \cos\theta$. How many scalar and how many vector quantities does this equation contain ?

- A one scalar and two vector B two scalar and one vector
C three scalar D three vector

1.2 A sound source approaches a stationary observer at constant velocity.

Which ONE of the following describes how the observed frequency and wavelength differ from that of the sound source ?

	Observed wavelength	Observed frequency
A	Greater than	Greater than
B	Less than	Less than
C	Greater than	Less than
D	Less than	Greater than

1.3 Which of the following units is NOT equivalent to the Joule (J)?

- A N.m B N.s C W.s D V.C

1.4 Two charged bodies, carrying charges of +4 nC and +6 nC respectively are allowed to touch, then separated. The amount of charge that is transferred is

- A 5 nC B 1 nC C 10 nC D 2 nC

1.5 Two identical spheres with mass m , travelling at the same speed v , moving towards each other in an isolated system, are involved in a head-on collision. Which statement is correct for the collision above ?

- A The spheres stick together on impact.
- B The total kinetic energy after impact is mv^2 .
- C The total kinetic energy before impact is zero.
- D The total momentum before impact is $2mv$.

1.6 A particle of mass M and speed V is moving through a vacuum. The kinetic energy of the particle is increased by a factor of 4. What will be the new speed of the particle ?

- A $2V$
- B $4V$
- C $8V$
- D $16V$

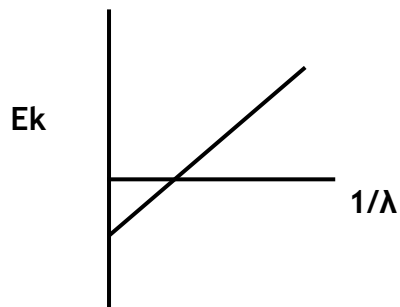
1.7 A rocket of mass M has a weight W on the surface of the earth. The rocket is blasted off to a height equal to twice the earth's radius. At this point the mass of the rocket has diminished to $\frac{1}{2}M$ because some of the fuel has been used up. The gravitational force of attraction between the rocket and the earth at this height is:

- A. $18W$
- B. $2W$
- C. $\frac{W}{8}$
- D. $\frac{W}{18}$

1.8 The spectrum of an element from a star shows some absorption lines. These lines are produced because...

- A electrons absorb energy when moving from an excited state to a lower energy state
- B a cold gas absorbs certain frequencies of light passing through it.
- C a hot gas absorbs certain frequencies of light passing through it.
- D electrons release energy when moving from an excited state to a lower energy state.

1.9 The graph below is obtained from an experiment on the photoelectric effect.



Which one of the following represents the gradient of the graph ?

- A hc B h C E_k/λ D W_0

1.10 Three $6\ \Omega$ resistors are used in different combinations in series, parallel and mixed series-parallel circuits.

Which of the following CANNOT represent the total resistance of the combination when the three resistors are used ?

- A $18\ \Omega$ B $12\ \Omega$ C $9\ \Omega$ D $2\ \Omega$

QUESTION 2

Newton

19

2.1 Little Gontse is pushing her pram of mass 2 kg at a constant speed in a straight line over a flat grass surface with a force of 40 N. The force is directed along the handle of the pram. The handle is set at an angle of 30° to the horizontal. Refer to the diagram below.



2.1.1 Draw a labelled free body diagram for the pram. (4)

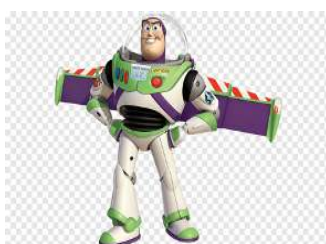
2.1.2 Is the moving pram in equilibrium? Explain. (2)

2.1.3 Calculate the magnitude of the coefficient of friction between the grass and the pram. (7)

2.2 Little Yaseera is watching Toy Story. She sees Buzz Lightyear of mass 80 kg land on Planet Pizza. The radius of this planet is half that of the earth, and has a mass that is three times that of earth.

2.2.1 What is the force of attraction of Planet Pizza on Buzz ? (4)

2.2.2 Compare the force that Buzz exerts on the planet. State greater than, less than or equal to your answer in 2.2.1. Explain your answer. (2)

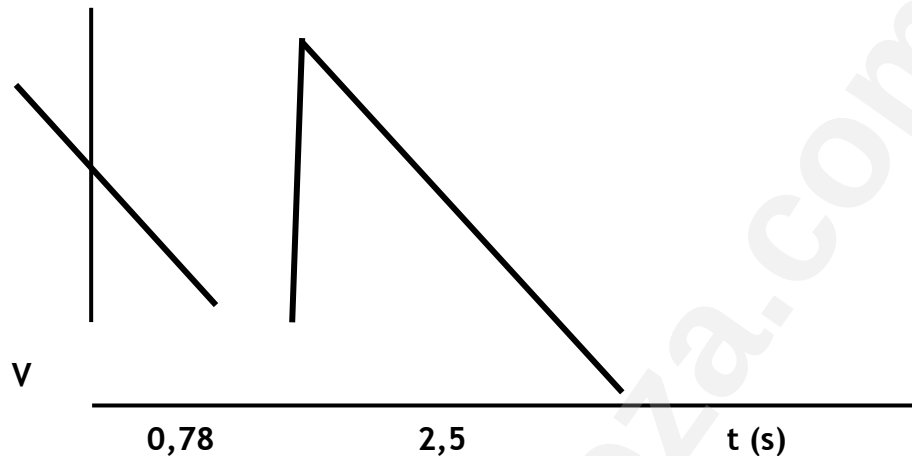


QUESTION 3

Vertical Projectile Motion

16

Little Annabel is jumping on the trampoline. The graph below describes her velocity as she starts jumping up and bouncing on the trampoline. Ignore air resistance.



3.1 What direction has been taken positive ? (1)

3.2 How many times did she bounce ? (1)

Using the graph determine:

3.3.1 her initial velocity as she jumped up the first time. (3)

3.3.2 her velocity when she rebounded. (5)

3.4 Draw a corresponding displacement/time graph for her motion. Use the trampoline as reference. Insert any relevant values. (6)



QUESTION 4

Momentum

15

4.1 Little Thati (mass 26 g) is sitting in a wagon (mass 4 kg) which is moving along at 2 m.s^{-1} . Little Vongai (mass 24 kg) is hanging from a branch of a tree. When Thati rolls past, Vongai drops down at 1 m.s^{-1} and lands in the wagon, and they continue rolling.



4.1.1 State the law of conservation of momentum. (2)

4.1.2 Calculate their velocity after Vongai drops down. (4)

4.2 Little Gadija, Elmarie and Ammaarah (future captains) are comparing their squash racquet, hockey stick and tennis racquet respectively. Each one thinks her hitting tool can hit a ball the furthest. An investigation is carried out, with Melissa throwing a ball of mass 100 g at each of them from the same distance. The distance travelled after hitting the ball is measured.

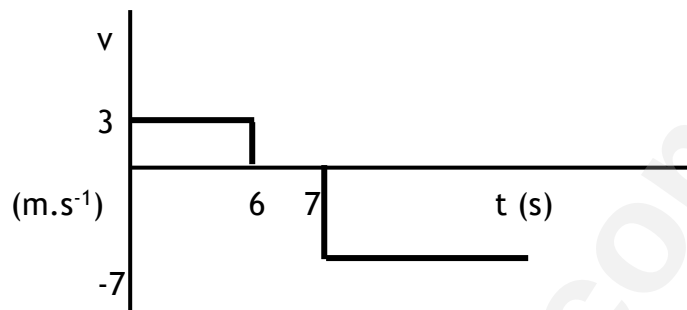


4.2.1 Name the independent and the dependent variable (in that order). (2)

4.2.2 List a variable that was not controlled in this investigation (1)

4.2.3 State an investigative question for this investigation. (2)

The graph below represents the motion of the ball from the time it left Melissa's hand to after it left Elmarie's stick.



4.2.4 Calculate the force that Elmarie's stick imparted to the ball. (4)

QUESTION 5

Work Energy Power

23

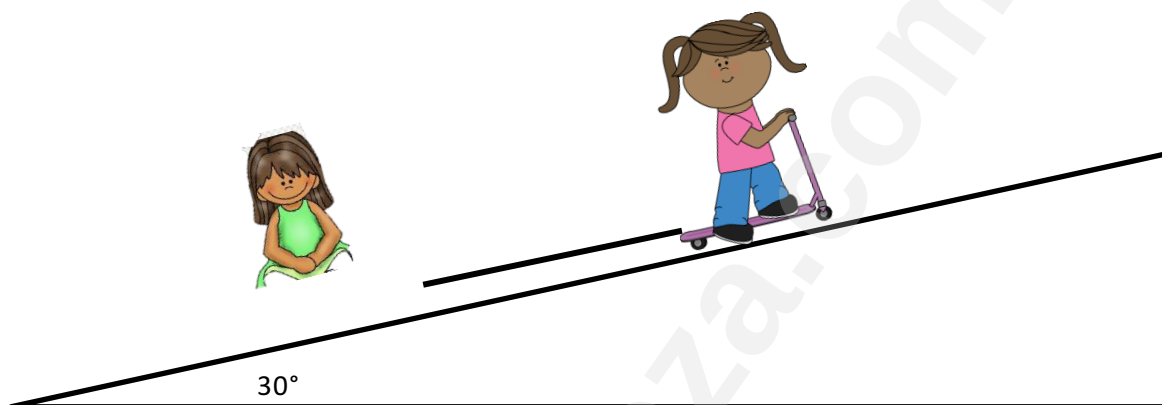
5.1 Little Holly (mass 20 kg) is sitting at the top of a slide that is 3 m high above the ground. She slides down from rest and reaches the bottom of the slide at 6 m.s^{-1} . The bottom of the slide is 0,5 m above the ground.



5.1.1 State the Law of conservation of mechanical energy. (2)

5.1.2 Determine the amount of work done by friction. (6)

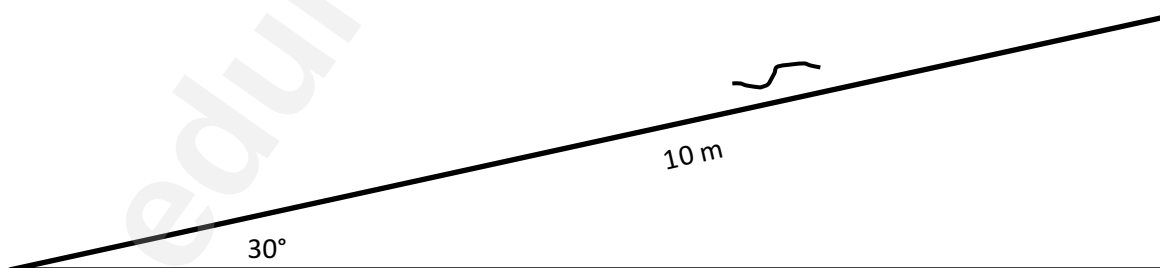
5.2 Little Chichi is riding her scooter (combined mass 26 kg), while towing little Maryam who is sitting in her wagon (combined mass 28 kg) up a 30° incline that is 10 m long, at constant velocity. The scooter and wagon are connected by a rope. The coefficient of friction is 0,1.



5.2.1 Calculate the tension in the rope. (5)

5.2.2 Use the work energy theorem to determine the total work done by Chichi. (7)

The rope breaks, separating the wagon and the scooter.



5.2.3 Draw a sketch graph of acceleration vs time for Chichi on her scooter and Maryam in her wagon on the same system of axes for the time prior and after the rope breaking. Use a different colour for each girl. No values are necessary. (3)

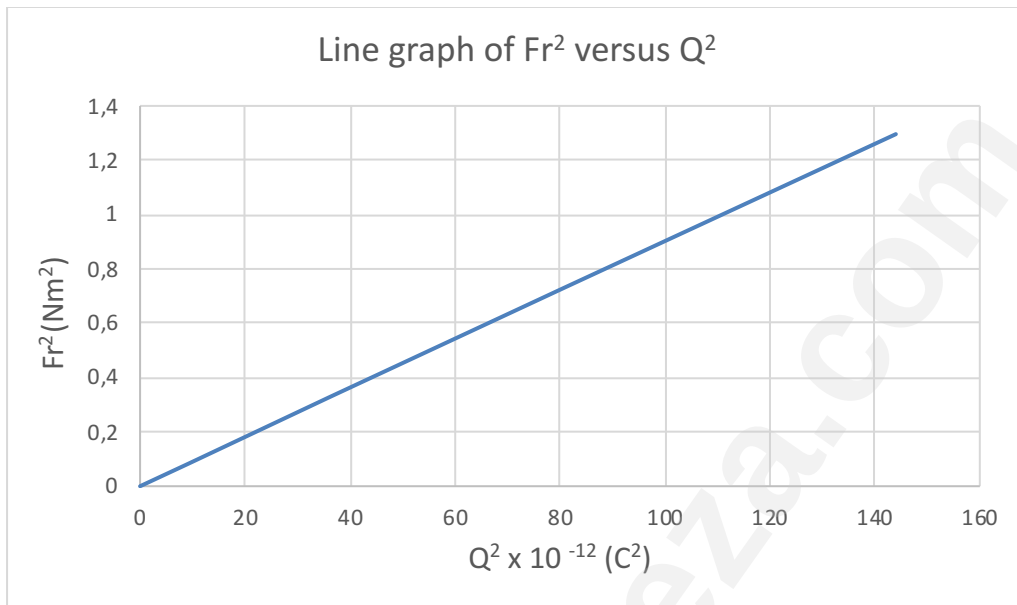
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QUESTION 6

Electrostatics

13

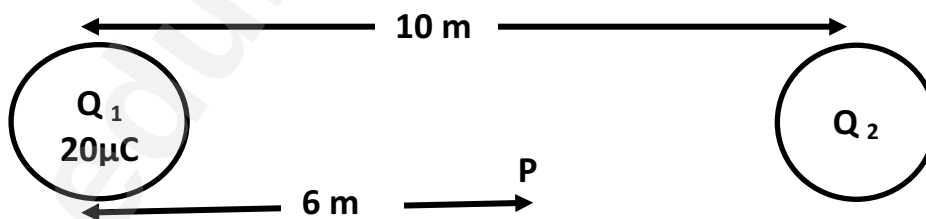
6.1 The graph below is a Fr^2 vs Q^2 graph, for two identical charges.



6.1.1 State Coulomb's law. (2)

6.1.2 Use the graph to determine Coulomb's constant. (4)

6.2 The net electric field strength at point P in the diagram is 8500 N.C^{-1} to the right.



Calculate the magnitude and nature of the charge on Q_2 . (7)

QUESTION 7

Doppler

12

7.1 Sihle and Temoso and friends are sitting on the field during lunchbreak. Sihle is singing “In the classroom” and running past Temoso at a velocity of 4 m.s^{-1} . Her frequency changes by 20 Hz as she approaches and passes Temoso. Take the speed of sound in air as 343 m.s^{-1} .



7.1.1 State the Doppler Effect. (2)

7.1.2 Calculate the frequency of the Sihle's voice. (7)

7.2 When a line in a hydrogen spectrum is measured in the laboratory, it has a wavelength of $1,32 \times 10^{-15} \text{ m}$. The same line in the light of a star has a wavelength of $1,38 \times 10^{-15} \text{ m}$.

7.2.1 Is the star moving TOWARDS or AWAY from the earth? Explain. (2)

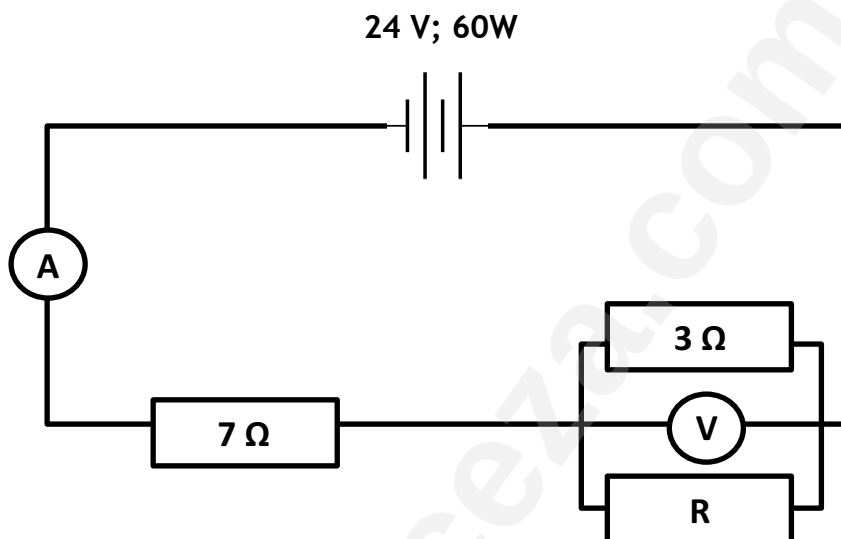
7.2.2 What is this phenomenon called ? (1)

QUESTION 8

Circuits

20

In the circuit diagram below, the battery has an emf of 24 V and it supplies 60 W of power. It has negligible internal resistance. The resistance of resistor R is unknown.



8.1 Define power. (2)

8.2 Determine the reading on the ammeter. (3)

8.3 State Ohm's Law (2)

Calculate

8.4.1 the potential difference across the 7 Ω resistor. (3)

8.4.2 the reading on the voltmeter. (2)

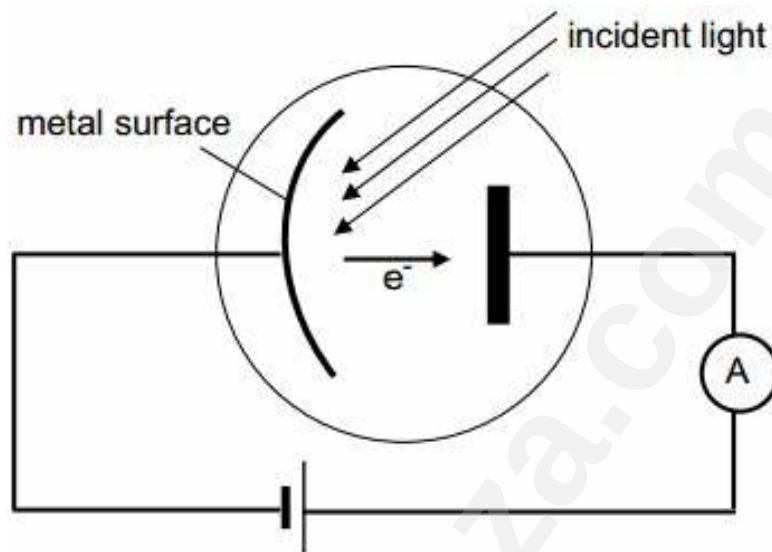
8.5 Determine the current through R. (5)

8.6 Hence calculate R. (3)

Question 9 Photoelectric effect

12

The apparatus below was used to demonstrate the photoelectric effect.



The incident monochromatic light transferred $3,044 \times 10^{-18} \text{ J}$ of energy in one second onto the surface of the emitter. The wavelength of a photon in the incident light is 260 nm. One photon releases one electron.

- 9.1 Calculate the frequency of the photon. (3)
- 9.2 Determine energy of the photon. (3)
- 9.3 Hence determine the number of electrons released from the surface of the emitter in one second. (2)
- 9.4 Calculate the current that is produced (4)

The End.

All masses of all girls are fictitious

Taxonomy

Cognitive level	Description	Percentage (%)
1	Recall	15
2	Comprehension	35
3	Applying and analysing	40
4	Evaluating and creating	10

Question	Level 1	Level 2	Level 3	Level 4
1.1, 1.2, 1.8	6			
1.5, 1.6, 1.3, 1.4		8		
1.7, 1.9, 1.10			6	
2.1		10		
2.2.1			5	
2.2.2		2		
3.1, 3.2	2			
3.3.1		3		
3.3.2			5	
3.4				6
4.1.1	2			
4.1.2		4		
4.2			11	
5.1.1	2			
5.1.2			6	
5.2.1, 5.2.2			12	
5.2.3				3
6.1.1	2			
6.1.2				4
6.2			8	
7.1.1	2			
7.1.2				8
7.2		3		
8.1, 8.3	4			
8.2		2		
8.4		5		
8.5, 8.6			7	
9.1, 9.2		6		
9.3, 9.4			6	
	20	43	66	21
	22	52	60	15