ALEXANDER ROAD HIGH SCHOOL

MARCH 2019 1 HOUR

PHYSICAL SCIENCE CONTROL TEST

CO, JA, MH TOTAL = 60

GRADE 12

Instructions

- The question paper consists of 7 questions.
- Answer all the questions.
- Answer section A on the answer sheet provided AND section B on folio sheets.
- Rule off after each question in Section B.
- A non-programmable calculator may be used.
- Number the answers correctly according to the numbering system.
- Round off to two (2) decimal places where necessary.
- Formulas and a periodic table have been included at the end of the question paper or on the back of the answer sheet.

SECTION A

- Answer on the answer sheet -

QUESTION 1: Multiple choice

Four possible options are provided as answers to the following questions. Each question has only 1 correct answer. Choose the correct answer and write the letter (A – D) next to the relevant question number (1.1 – 1.6) on the answer sheet.

1.1 A ball is thrown upwards. When it reaches maximum height:

i) its velocity and acceleration are both zero
ii) its velocity is zero, but the acceleration is NOT zero
iii) its acceleration changes from 9,8 $m.s^{-2}$ to -9,8 $m.s^{-2}$

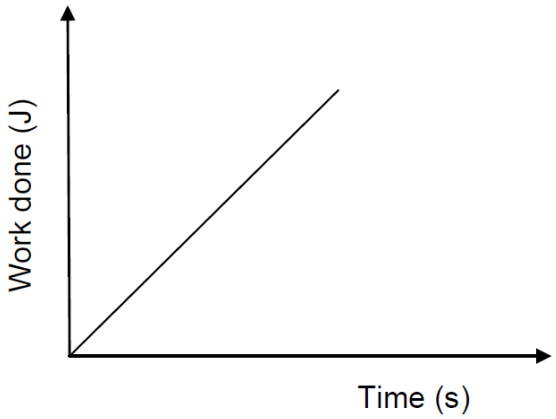
A only i) is true

B only ii) is true

C only iii) is true

D both i) and iii) are true

1.2 The graph below represents the relationship between the work done on an object and the time taken for the work to be done.



The gradient of the graph represents…

A …change in kinetic energy (ΔE_k).

B …change in mechanical energy (ΔE_p).

B …momentum (p).

D …power (P).

1.3 A missile, initially at rest, is launched vertically into space. The missile's engine develops a power of 288,12 kW for the first 30 s after the launch. Given that the force applied by the engine is double the weight of the missile, the mass of the rocket is…

A 0,1 kg **B** 50 kg **C** 100 kg **D** 200kg

1.4 Which ONE of the following half reactions occurs at the anode during the electrolysis of an aqueous AgCℓ solution?

A $C\ell_2 + 2e^- \rightarrow 2C\ell^-$

B $Ag^+ + e^- \rightarrow Ag$

C $2C\ell^- \rightarrow C\ell_2 + 2e^-$

D $Ag \rightarrow Ag^+ + e^-$

1.5 Chlorine gas ($C\ell_2$) is bubbled through a potassium iodide solution (KI). The reducing agent in this reaction is:

A Potassium ions

B Chlorine gas

C Iodide ions

D Chloride ions

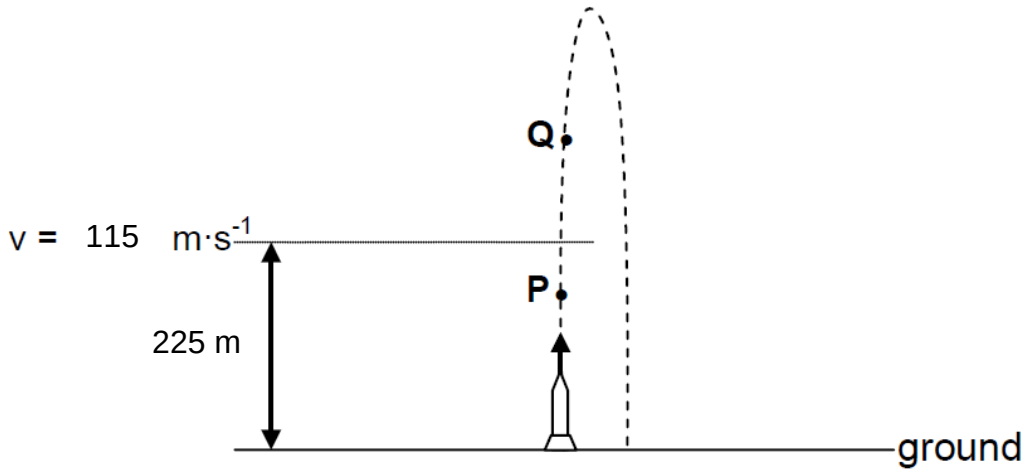
[5x2=10]

SECTION B

QUESTION 2

2.1 A stationary rocket on the ground is launched vertically upwards. After 5 s, the rocket's fuel is used up and it is 225 m above the ground. At this instant the velocity of the rocket is 115 $m \cdot s^{-1}$. The diagram below shows the path followed by the rocket.

Ignore the effects of air friction.



2.1 Write down the **DIRECTION** of the acceleration of the rocket at point:

2.1.1 **P** (1)

2.1.2 **Q** (1)

2.2 At which point (**P** or **Q**) is the rocket in free fall? Give a reason for the answer. (2)

2.3 Calculate the time taken from the moment the rocket is launched until it strikes the ground. (7)

2.4 Sketch a **velocity versus time** graph for the motion of the rocket from the moment it reached its maximum height, until it strikes the ground.

Take the time when the rocket reaches the maximum height as t = 0 s.

Indicate the time at which the rocket strikes the ground.

(2)
[13]

QUESTION 3

3.1 Define *momentum*. (1)

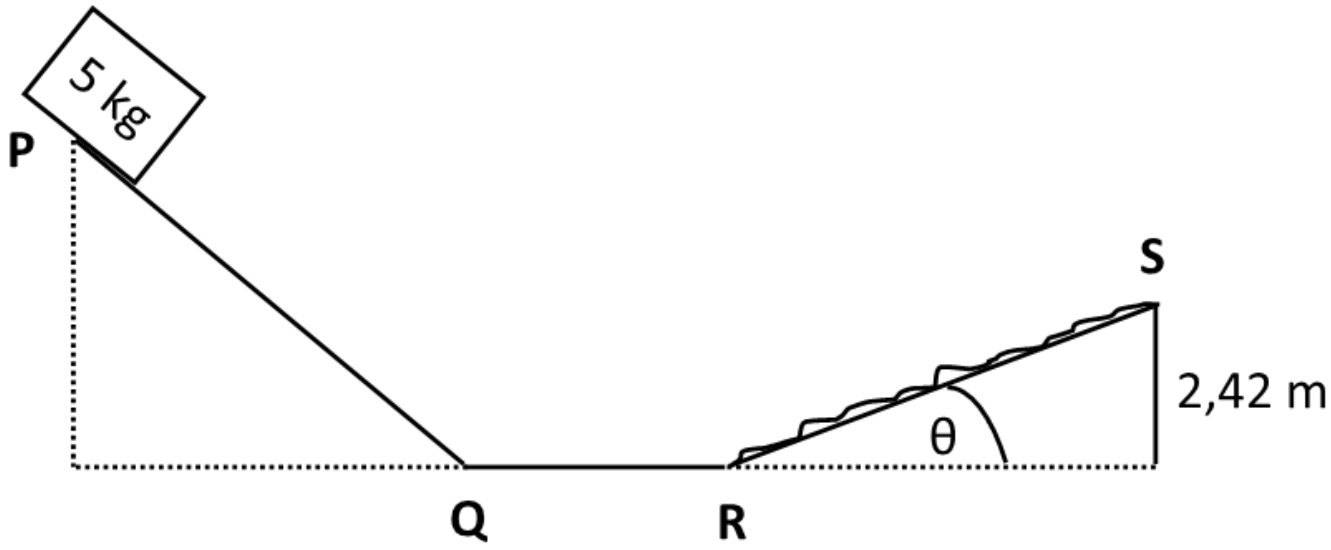
3.2 A 25 g bullet is fired from a 6 kg stationary rifle. Assume that the bullet moves horizontally and the system is isolated. Immediately after firing, the rifle recoils (moves back) with a velocity of 1,2 $m.s^{-1}$. Use the *principle of conservation of linear momentum* to calculate the speed of the bullet. (4)

[5]

QUESTION 4:

4.1 State the *work-energy theorem* in words. (2)

4.2 A 5 kg block is released from rest at point P. The block slides down slope PQ and across horizontal plane QR, both of which are frictionless. Finally, the block slides up rough incline RS coming to rest at point S which has a height of 2,42 m. The angle of inclination of RS is θ.



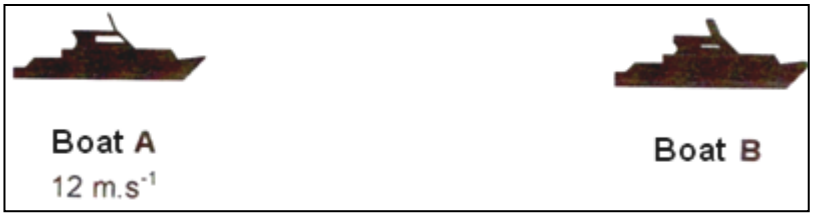
4.2.1 If the gravitational potential energy of the block is 245 J at point P, calculate the speed of the block at point Q. (3)

4.2.2 If the force of friction between the block and surface RS is 18 N, calculate θ. (6)

[11]

QUESTION 5

Boat B is anchored in the quiet, calm waters of the Indian Ocean of Algoa Bay while taking part in the Tuna Classic fishing competition. Boat A is moving at 12 $m.s^{-1}$ towards boat B and sounds a siren with a frequency 850 Hz. Accept that the speed of sound in air is 340 $m.s^{-1}$.



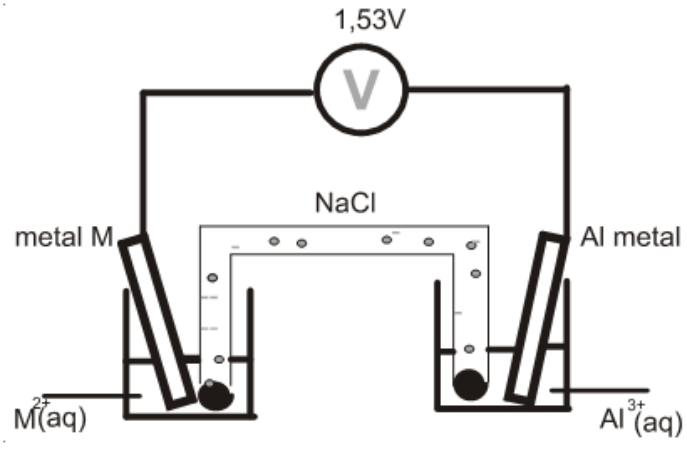
5.1 Calculate the frequency of the siren's sound (of Boat A) that is heard by the captain of boat B. (4)

5.2 Boat A moves ahead of the stationary boat B. Boat A sounds the siren again. How will the frequency of the sound of the siren heard by the captain of boat B compare to the frequency at which the sound was emitted by boat A. (Choose one of the following: HIGHER, LOWER or the SAME). (1)

[5]

QUESTION 6

A group of learners constructs a certain galvanic cell as follows:
A strip of aluminium metal in contact with a solution of $A\ell^{3+}$ ions; a strip of an unknown metal M in contact with M^{2+} ions in solution; a voltmeter and a NaCℓ-salt bridge. The reading on the voltmeter is 1,53 V under standard conditions. The $A\ell^{3+}/A\ell$ redox pair acts as the ANODE of the cell.



6.1 Show by calculation that the unknown redox pair is Pb^{2+}/Pb. (5)

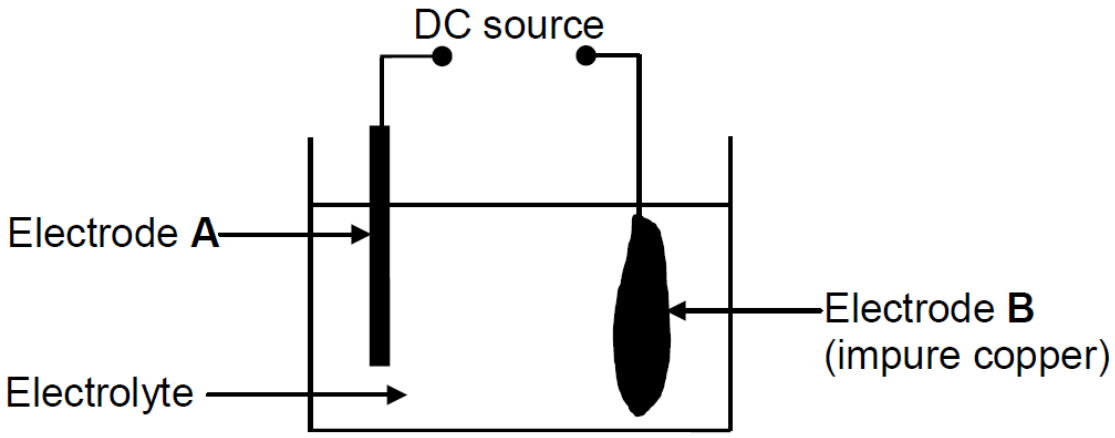
6.2 Give the symbolic representation (notation) of the cell according to the Standard Cell Convention. (3)

6.3 State ONE function of the salt bridge in the operation of the cell. (1)

[9]

QUESTION 7

The simplified diagram below represents an electrochemical cell used for the purification of copper.



7.1 Define the term *electrolysis.* (2)

7.2 Give a reason why a direct-current (DC) source is used in this experiment. (1)

7.3 Write down the half-reaction which takes place at electrode **A**. (2)

7.4 Due to small amounts of zinc impurities in the impure copper, the electrolyte becomes contaminated with Zn^{2+} ions.

Refer to the attached Table of Standard Reduction Potentials to explain why the Zn^{2+} ions will not influence the purity of the copper obtained during this process. (2)

[7]