BBSS Prelim 6091 Physics P1 2020 Answer

Qns	Ans
1	D
2	D
3	C
4	B
5	D
6	C
7	C
8	A
9	B
10	A
11	B
12	C
13	B
14	C
15	C
16	D
17	C
18	D
19	B
20	D
21	B
22	A
23	C
24	B
25	A
26	C
27	A
28	A
29	A
30	B
31	C
32	D
33	C
34	A
35	A
36	D
37	D
38	A
39	D
40	A

A:12 **B:9** **C:10** **D:9**

Name: …….. Index no. ……. Class……..

Bukit Batok Secondary School
PRELIMINARY EXAMINATION 2020
SECONDARY 4 EXPRESS
MARK SCHEME

PHYSICS **6091/02**

Paper 2 Theory

General marking instructions:

1. If students leave their answers in 1sf, penalise one mark for the **entire** question.
2. If students leave out the units, penalise one mark for **every** question.
3. Exercise ecf for calculation questions which require the answer from the previous section. Students will receive full marks if the substitution and calculation is correct based on the wrong value in the previous section(s).

Section A

1 **(a)** From t= 0 s to t = 18 s, the velocity of the rocket is in the **upward positive direction** and the rocket is experiencing a **constant positive acceleration**. [1] [accept answer: rocket's velocity is constantly increasing]

From t = 18 s to t = 50 s, the velocity of the rocket continues to be in the **upwards positive direction** however the rocket is experiencing an acceleration in the **opposite direction (downwards)** causing the rocket to **decelerate constantly.** [1]

At t = 50s, the **instantaneous velocity of the rocket is 0 m/s** with an **acceleration in the downward direction** [1]

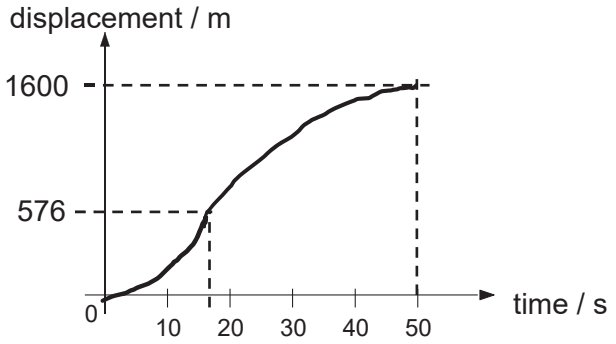
[no direction indicated deduct one mark] [3]

(b) Acceleration of free fall = (v - u)/t
= (- 80 - 0)/ 40 [1]
= - 2.0 m/s^2 [1]

- Penalise 1 mark if students omit the negative sign [2]

(c) Displacement for t = 0 to t = 18 s = 576 [1]
Displacement from t = 18 s to t = 50 s = 1024 [1]

- If students are able to show some form of calculation for displacement, award the marks.

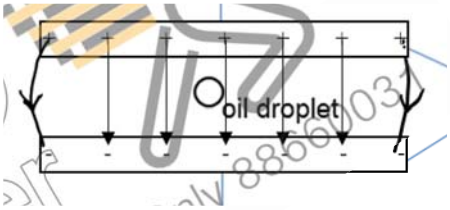


- 1 mark awarded for correct shape and displacement values. If students indicate the value as 960 on the Y-axis. No mark awarded. [1] [3]

2 **(a)** negatively charged. [1]

(b) On Fig. 2.1, label the charges on the plates and draw the field lines between the two plates.

- Arrows direction [1]
- Curve field at the sides [1]



[2]

(c) The **sum of the upward repulsion and attraction forces** between the two charged plates and the **negatively charged oil droplet** is **equal** to the **weight of the oil droplet that is acting downwards** [1].

The **resultant force** acting on the oil drop is **0 N**. Since the initial velocity of the oil drop is 0 m/s, the oil drop remained stationary [1]. [2]

3 **(a)** Kinetic energy is the energy of an object when in motion and is directly proportional to the square of its velocity.

Gravitational potential energy is the energy an object possessed with respect to the vertical position or height of the object from a reference position. [2]

[no marks if students just stated the formulas]

(b) Work done = m x g x h
= 54 x 10 x 2.5 [1]
= 1350 J [1] [2]

(c) Power = WD/ t
= 1350/ (0.05 x 60) [1]
= 450 W [1] Allow ecf [2]

(d) In real life situation, there is friction in the pulley/ system which resulted in the generation of thermal energy as the cable is being pulled upwards [1]. Hence a greater amount of work done is needed to overcome the additional thermal energy generated [1] in order to lift the bricks to the same height. [2]

4 **(a)** Since the pressure on the LHS is higher than the pressure on the RHS, there is a resultant force on the LHS of the manometer [1] which pushes the liquid downwards. [1]

(b) Pressure due to force F = Pressure difference
= 1000 x 10 x 0.6 [1] + [1: conversion]
= 6000 Pa [1] [3]

(c) F = P x A
= 6 000 x 0.10 [1]
= 600 N [1] Allow ecf [2]

(d) Since liquid pressure is affected by the density of the liquid, for the same length of tube, the range of pressure difference could be measured greater using a denser liquid. [1]

5 **(a)** Longitudinal wave; Mechanical wave; Physical [1]

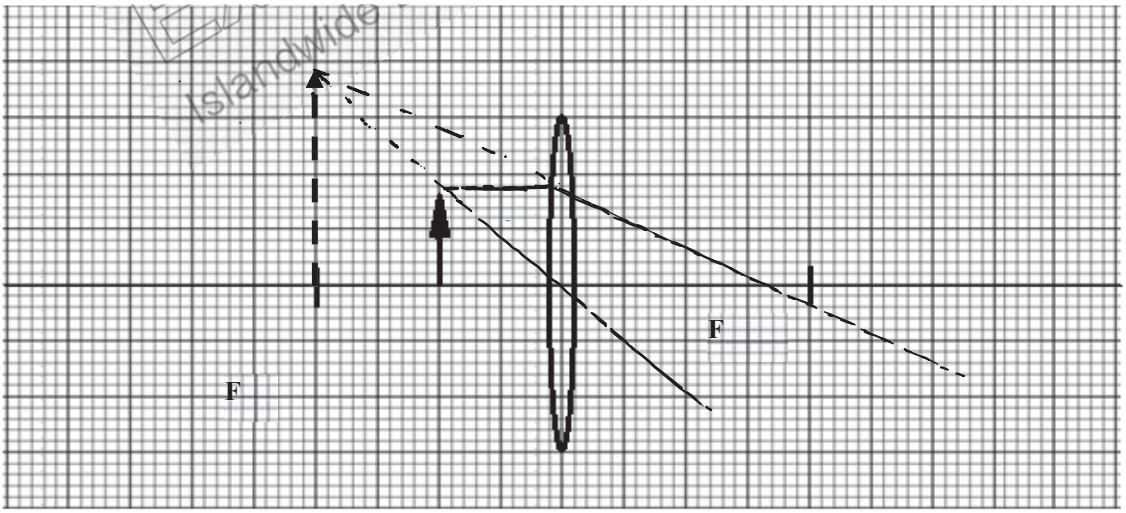
(b) There are 660 complete waves in 1 second. [1]

(c) **(i)** the wavelength = 0.50 m [1]

(ii) the amplitude = 0.50 mm [1]

(d) V = f x lambda
= 660 x 0.50 [1]
= 330 m/s [1] allow ecf [2]

6 Fig. 6.1 is drawn to full scale. An object O is placed in front of a converging lens L. The lens forms an image of the object O.



(a) **(i)** draw two rays from the top of the object to locate the top of image.
- Dotted line [1] and solid lines [1]
- If students did not draw the arrows, award the mark. [2]

(ii) draw and label the image **I** [1]
- Dotted image with an arrow head.

(b) By drawing the converging rays from the object to the image as dotted lines. [1]

(c) 1. Image will be real [1]
2. Image will be inverted [1]
3. Size of the image is also accepted depending on where the students played the image. To award this mark, students need to state the object distance with respect to focal lengths. [2]

7

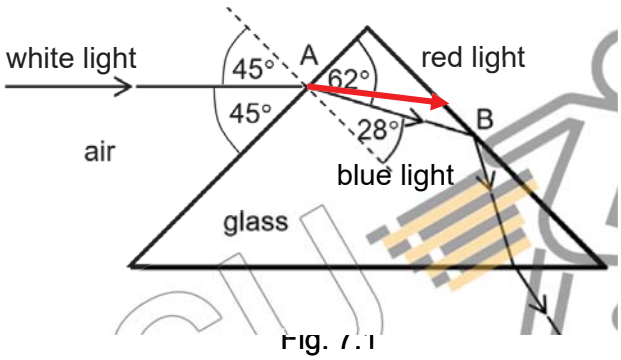


Fig. 7.1

(a) angle of incidence = 45 º
angle of refraction = 28 º
- Both correct award 1 mark [1]

(b) Since the refractive index for red light is smaller than blue light, the red light will **bend lesser towards the normal** than blue light. [1] Hence the angle of refraction for red light is larger than blue light. [1] [2]

(c) On Fig. 7.1, draw the path of a ray of red light inside the glass prism at point A. [no ecf] [1]

8 **(a)** Charge rod brought near to uncharged metal sphere but not touching it. [1]
The connection to earth is connected to the opposite end of the metal sphere. Once the metal sphere is charged, removed the connection to earth. [1]
The charged rod is now removed, the metal sphere becomes negatively charged. [1] [3]

(b) The negative charges are **initially attracted** by the positively charged rod when it is brought near to the metal sphere. When the connection to earth is connected, **the negative charges will move from the earth to the metal sphere**, resulting in excess electrons on the metal sphere. [1]
The metal sphere **remains negatively charged** after the connection to earth and rod are sequentially removed. [1] [2]

(c) Charge = 1.2×10^{-9} C, time = 2.5 s
$Q = I \times t \Rightarrow I = 1.2 \times 10^{-9} / 2.5 = 4.8 \times 10^{-10}$ A [1] [1]

Section B

9 **(a)** Amount of heat energy gained to increase in temperature by 1 °C or 1K or lost to decrease in temperature by 1 °C or 1K per unit mass of the substance. [1]

(b) **(i)** $Q = mc\Delta\theta_{milk} + mc\Delta\theta_{glass}$

$Q = 0.300 \times 4200 \times (55 - 20) + 0.100 \times 837 \times (55 - 20) = 47029.50$

$Q = 47000J$ [2]

(ii) $Q = mc\Delta\theta_{steam} + ml_v + mc\Delta\theta_{water}$

$47029.5 = m[2010 \times (120 - 100) + 2.26 \times 10^6 + 4200 \times (100 - 55)]$

$m = 0.01889 = 0.019kg$ [2]

(c) **(i)** The temperature of the heated milk decreases as the time increases. [1]

(ii) The **higher kinetic energy** milk molecules on the top surface of the cup **gained sufficient energy from the surrounding** to overcome the **force of attraction between the molecules and push against the atmosphere** to change to the gaseous state. [1]
The **remaining milk molecules** possess a **lower kinetic energy**.[1]
Since **kinetic energy is proportionate to temperature**. The temperature of the remaining milk molecules decreases. [1] [3]

(iii) Heat loss due to:
Conduction between the glass of milk and the table [1],
Infra-red radiation from the sides of the glass cup [1],
Convection due to the convection current formed at the top surface of the cup. [1] [3]

10 **(a)** **(i)** South pole [1]

(ii) Current travels from A to B [1]

(iii) Using FLHR, the interaction between the magnetic field produced by the solenoids and the magnetic field due to current in coil AB, produced a **resultant force in the upward direction** on the side AB [1] and a downward **direction on the side CD** [1]. The two forces produce a **resultant moment** which cause coil ABCD to rotate in the clockwise direction.

[if answer make direct reference to the application of FLHR – award marks] [2]

(b) **(i)** On each side
$M_{resultant} = F_{resultant} \times d$
$0.10/2 = F_{resultant} \times 0.025$ [1]
$F_{resultant} = 2.0$ N [1]

- Penalise one mark if students leave their answers as 1sf.

[2]

(ii) Part E is the split ring commutator. The split ring communicator changes the direction of the current flowing in the coil every half a rotation [1]. This caused a constant downwards resultant force on side AB and constant upward resultant force on side CD. Hence the coil continues to rotate in the anti-clockwise direction [1]. [2]

11 EITHER

(a) As temperature increases, resistance decreases at a decreasing rate. [1]

(b) 95 Ω [1]

(c) **(i)** Combined R = 50 + 95 = 145 Ω
I = V ÷ R
= 20 ÷ 145 [1]
= 0.138 A [1] Allow ecf from part b [2]

(ii) V = I x R
= 0.138 x 95 [1]
= 13.1 V [1]
Or
V = (95 / [95+50]) x 20 V [1]
= 13.1 V [1] Allow ecf from part ci [2]

(d) I = V / R
= 5 V / 50 Ω
= 0.1 A [1]
Resistance of TR1 = 15 V / 0.1 A = 150 Ω [1]
From graph, temp = 13.0 °C [1] [3]

(e) The minimum temperature to activate the alarm will increase. [1]

11 OR

(a) F × 0.50 m = 50.0 × 0.10 [1]
$F_{downward}$ = 10 N [1] [2]

(b) 50/20 = F_{upward}/800 [1]
F_{upward} = 2000 N [1] [2]

(c) (20)(10) = (800)d [1]
d = 0.25 cm [1] [2]

(d) The force of the load on piston Q [1] and the force of piston Q on the load [1].
- no mark awarded is students mentioned weight of load [2]

(e) One way identical: Both forces are of the same magnitude. [1]
One way different: Action-reaction pair is opposite in direction. [1] [2]
- accept any plausible answers

END OF PAPER