BRIDGING EXEMPTION TEST
SEMESTER I, SESSION 2020/2021

COURSE	:	PHYSICS
PROGRAMME	:	BRIDGING PROGRAMME
DURATION	:	2 HOURS
DATE	:	OCTOBER 2020

INSTRUCTIONS TO CANDIDATE:

1. Answer all the questions.
2. All answers must be written in the answer booklet provided. Use a new page for each question.
3. The full marks for each question or section are shown in the bracket at the end of the question.
4. All steps must be shown clearly.
5. Only non-programmable and non-graphing scientific calculators can be used.
6. Answers may be given in the form of π, e, surd, fractions, or up to four significant figures, where appropriate, unless stated otherwise in the question.
7. You are not permitted to take the exam paper and the answer booklet(s) out of the exam hall.

1. (20 marks)

a) You calculate 2.5 cm x 3.2 cm. You should write the result as 8 cm^2 or as 8.0 cm^2? Justify your answer. **[4 Marks]**

b) The sun is about 93 million miles from Earth. How many meters is that if 1 mile equals to 1609 meter? Write the answer using scientific notation. **[4 Marks]**

c) Given vector ***A*** and ***B*** in terms of unit vector as $\vec{A} = 3\hat{\imath} + \hat{\jmath} - 2\hat{k}$ and $\vec{B} = \hat{\imath} + \widehat{2\jmath} + \hat{k}$. Determine the cross product of vector $\vec{A}$ and $\vec{B}$. **[4 Marks]**

d) A ball is thrown vertically downwards with initial velocity 14 ms^{-1} from a height of 10 m building as shown in Figure 1. The velocity of the ball right before it strikes the ground is 20 ms^{-1}. Calculate the time taken to reach the ground. **[4 Marks]**

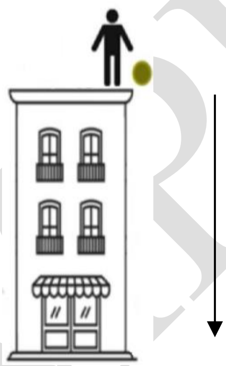

Figure 1

e) A projectile is launched at angle $\theta = 30°$ from horizontal axis with initial speed of 20 m/s. Calculate the range of the projectile. **[4 Marks]**

2. (20 marks)

a) Two-body system is shown in the following Figure 2. The 2 kg block which accelerates across a rough surface is attached by a string to a 4 kg object which is suspended over a pulley. The coefficient of kinetic friction is 0.20. **[10 Marks]**

i) Draw two free body diagrams
ii) Calculate the acceleration of the objects.

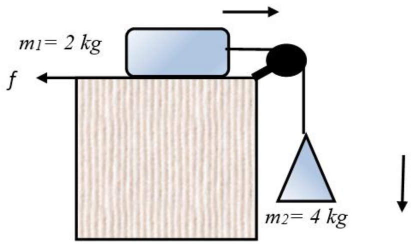

Figure 2

b) Figure 3 shows a child with mass 22.5 kg going to play on a merry-go-round of radius, $R = 1.20$m that moves with a speed of $v = 1.3$ m/s. Calculate

[10 Marks]

i) the centripetal acceleration of the child
ii) the net horizontal force exerted on the child

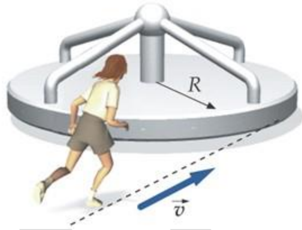

Figure 3

3. (20 marks)

a) A box of mass 6.0 kg is accelerated from rest by a force across a smooth horizontal floor at a rate of 2.0 m/s^2 for 7.0 s as shown in Figure 4 below.

[8 Marks]

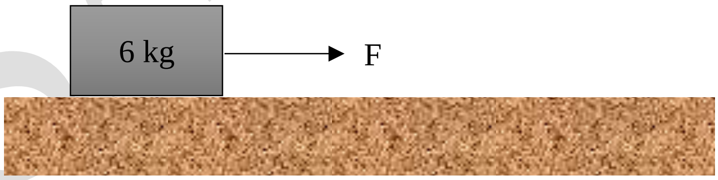

Figure 4

i) Calculate the net work done on the box.
ii) Determine the final kinetic energy of the box.

b) Particle A of mass $m_A = 200$ g moving with velocity $v_A = 4$ m/s collides head-on with particle B of mass $m_B = 400$ g moving with velocity $v_B = 1$ m/s. After the collision, it is found that the velocity of particle B increases to 3 m/s.
[12 Marks]

i) Calculate the velocity of particle A, $v_A{}'$ after the collision.
ii) Is the collision elastic or inelastic? Explain why.

4. (20 marks)

a) Figure 5 shows three particles with their respective masses and coordinates.

Determine the center of mass (CM) of the array of particles. **[4 Marks]**

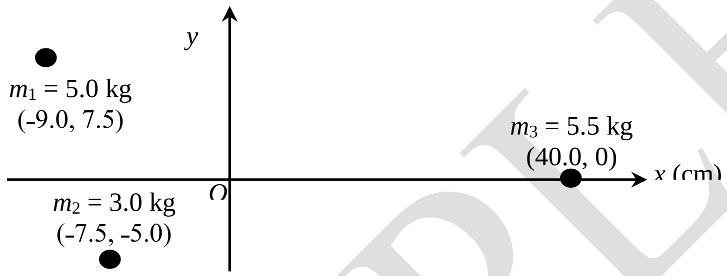

Figure 5

b) Figure 6 shows a 23 kg boy sitting down at one end of a 9.0 m long seesaw, balanced by a 73 kg man. The seesaw is a uniform beam of mass 15 kg. Calculate the distance of the man from the pivot. **[4 Marks]**

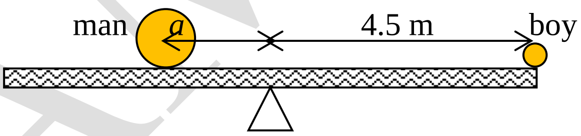

Figure 6

c) Given the density of water ρ = 1000 kg m^{-3} and the acceleration due to gravity g = 9.80 m s^{-2}, calculate the pressure at the bottom of a water column 5 m high.
[4 Marks]

d) Figure 7(a) shows a beaker is initially filled up with water up to its overflow spout. A 120 g metal sphere, tied to a 7 g wooden block, is lowered slowly into the beaker. The displaced water flows out into an empty measuring cylinder, as in Figure 7(b). The volume of water collected is 13.5 cm^3 when only the sphere is fully submerged, and 25.2 cm^3 when both are fully submerged. [The density of water is 1000 kg m^{-3} or 1.0 g cm^{-3}; g = 9.80 m s^{-2}] **[8 Marks]**

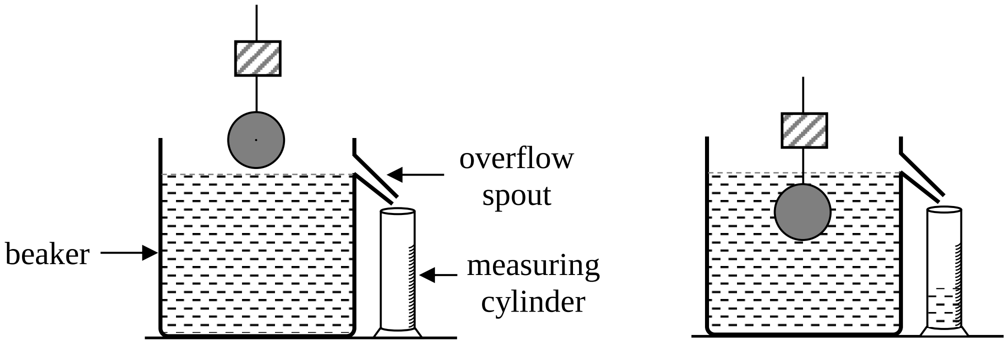

Figure 7

i) Calculate the buoyant force on both objects.
ii) Determine the density of the wooden block.

5. (20 marks)

a) i) State the Coulomb's law. **[2 marks]**

ii) Figure 8 shows an electron is orbiting a positively charged nucleus in a hydrogen atom. The radius of the orbit is 5.3×10^{-11}m, and the mass of electron is 9.1×10^{-31}kg. Calculate the orbital speed if the centripetal force is provided by the electrostatic pull on the electron. **[2 marks]**

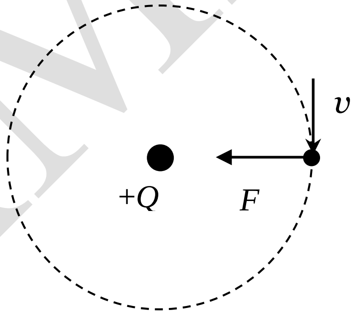

Figure 8

b) Figure 9 shows a proton being held stationary between two parallel plates 7 mm apart, connected to a battery. The mass of the proton is 1.67×10^{-27}kg and its charge is 1.63×10^{-19}C. Calculate the voltage of the battery. **[6 Marks]**

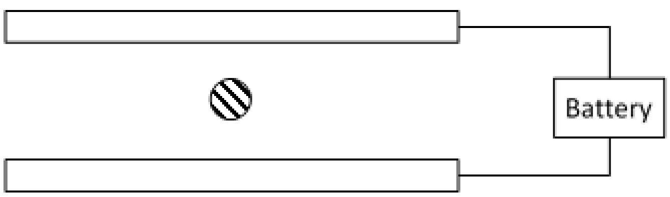

Figure 3

c) A 4.5 m long copper wire has a diameter of 1.5 mm. The resistivity of copper at room temperature of 25 °C is $1.68\times10^{-8}\Omega$ m. The temperature coefficient is 0.0068 $°C^{-1}$. Show that the resistance of the wire at room temperature is 42.8 mΩ. **[4 Marks].**

d) Figure 10 shows a network of three resistors R_1 = 10 Ω,R_2 = 3.2 Ω, R_3 = 30 Ω. The voltage between point A and B is kept at V_{AB} = 12 V. Calculate the current in each resistor. **[6 Marks]**

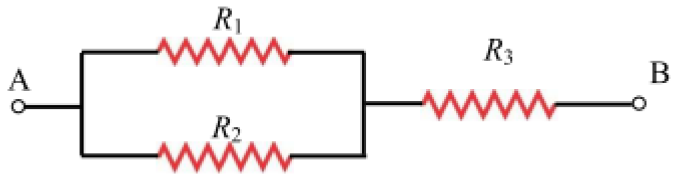

Figure 10

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