INNOVA JUNIOR COLLEGE
JC 2 PRELIMINARY EXAMINATION 2
in preparation for General Certificate of Education Advanced Level
Higher 2

PHYSICS 9646/01

Paper 1 Multiple Choice **16 Sep 2013**

1 hour

Additional Materials: Multiple choice answer sheet

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

1 ANSWER – A

$$\frac{[Q]}{[t]} = [k][A]\frac{[T]}{[L]}$$

$$[k] = \frac{[Q]}{[t]}\frac{[L]}{[T]}\frac{1}{[A]}$$

$$= \frac{[P][t]}{[t]}\frac{[L]}{[T]}\frac{1}{[A]}$$

$$= \frac{\mathrm{Wm}}{\mathrm{m^2k}} = \mathrm{Wm^{-1}K^{-1}}$$

2 ANSWER – A

$$\frac{\Delta v}{v} = \frac{\Delta x}{x} + \frac{\Delta t}{t}$$

$$\Delta v = \left(\frac{\Delta x}{x} + \frac{\Delta t}{t}\right) \times v$$

$$= \left(\frac{0.2}{100} + \frac{0.5}{10}\right) \times 10 = 0.5 \text{ m s}^{-1} \text{ (1 s.f)} \Rightarrow v = (10.0 \pm 0.5) \text{ m s}^{-1}$$

3 ANSWER – B

Using $s = ut + \frac{1}{2} a t^2$, where s = L, u = 0, t = T, a = g, and taking downwards as positive.

(1): $L = \frac{1}{2} g T^2$,

Let the distance fallen be S at the time t = 0.50 T.

(2): $S = \frac{1}{2} g (0.5T)^2$,

(2)/(1): S/L = ¼

S = ¼ L or 0.25 L

4 ANSWER – D

At the highest point, the speed is at its minimum and is non-zero. The value of the speed at any point in the projectile motion will also be continuous.

5 ANSWER – C

$$F_R = v\frac{dm}{dt}$$

$$= v\frac{d(\rho \cdot Vol)}{dt} = v\rho\frac{d(Vol)}{dt}$$

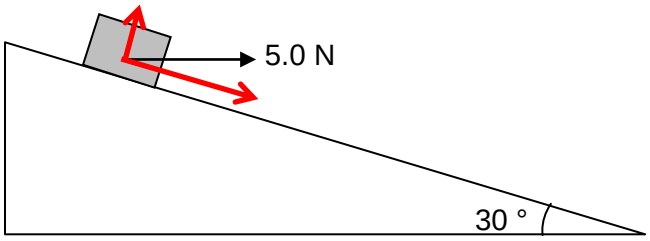
$$= v\rho\frac{d(x \cdot A)}{dt} = v\rho A\frac{dx}{dt}$$

$$P = \frac{F_R}{A}$$

$$= \frac{v\rho A\frac{dx}{dt}}{A} = v\rho\frac{dx}{dt}$$

$$= 10 \times 1.0 \times 10^3 \times \frac{40 \times 10^{-3}}{60 \times 60} = 0.11 \text{ Pa}$$

6 ANSWER – C



$F_R = F_{parallel} + W_{parallel}$
$= 5.0 \cos 30° + (1.0)(9.81) \sin 30°$
$= 9.235 \text{ N}$
$F_R = m \cdot a$
$9.235 = 1 \cdot a$
$a = 9.235 \text{ m s}^{-2}$
$v^2 = u^2 + 2as$
$v = \sqrt{2(9.235)(1.0)} = 4.29 \text{ m s}^{-1}$

7 ANSWER – A

$m_{bullet}u_b + m_{wooden\,block}u_w = m_{bullet}v_b + m_{wooden\,block}v_w$
$(0.00425)(375) + (1.12)(0) = (0.00425)(122) + 1.12v_w$
$1.12v_w = 1.07525$
$v_w = 0.96 \text{ m s}^{-1}$

8 ANSWER – B

All the forces must pass through a common point, **and** they formed a close cyclic polygon.

9 ANSWER – C

Loss in G.P.E. by Y = gain in G.P.E. by X + gain in K.E. by X and Y

$$3.0 \times 9.81 \times 3.0 \sin 40° = 2.0 \times 9.81 \times 3.0 \sin 30° + \frac{1}{2}(2.0 + 3.0)v^2$$

$v \approx 3.3 \text{ m s}^{-1}$

10 ANSWER – B

$$useful\ power = \frac{mgh}{t} = \frac{\rho \cdot Vol \cdot gh}{t}$$
$$= \frac{1000 \cdot 0.10 \cdot 9.81 \cdot 5.0}{10 \times 60} = 8.175\ \text{W}$$
$$\eta = \frac{P_{useful}}{P_{in}}$$
$$0.60 = \frac{8.175}{P_{in}}$$
$$P_{in} = 13.625\ \text{W}$$

11 ANSWER – A

Linear velocity is a vector, and it is varying due to its varying direction although its speed is constant. Angular velocity is constant as it is moving in a constant direction and magnitude. Kinetic energy is constant as it is a scalar quantity.

12 ANSWER – D

Both points P and Q will have negative potential, and hence the mass at P and Q will be negative potential energy. As Q is further away, numerically Q is less negative and hence greater than P.

13 ANSWER – C.

14 ANSWER – C

15 ANSWER – B

A The maximum potential energy of oscillator Q is greater than oscillator R.

$K.E._{max} = P.E._{max}$

$K.E._{max,Q} = K.E._{max,R}$

$P.E._{max,Q} = P.E._{max,R}$

B The maximum linear momentum of oscillator P is the largest.

$K.E._{max,P} > K.E._{max,R}$ & $K.E._{max,Q}$

$K.E._{max,P} = \frac{1}{2}mv^2$

Since they have the same mass, $V_{max,P}$ is the largest.

C The angular frequency of oscillator Q is the largest.

$K.E._{max,P} > K.E._{max,Q}$

$K.E._{max,Q} = \frac{1}{2}mv^2 = \frac{1}{2}m_Q{\omega_Q}^2{x_{0,Q}}^2$

$$K.E._{max,P} = \frac{1}{2}mv^2 = \frac{1}{2}m_P\omega_P{}^2x_{0,P}{}^2$$

$$\frac{1}{2}m_P\omega_P{}^2x_{0,P}{}^2 > \frac{1}{2}m_Q\omega_Q{}^2x_{0,Q}{}^2$$

Since they have the same mass and the same amplitude, X_0

$$\omega_P{}^2 > \omega_Q{}^2$$

D The angular frequency of oscillator R is smaller than oscillator Q.

$$K.E._{max,R} = K.E._{max,Q}$$

$$K.E._{max,Q} = \frac{1}{2}mv^2 = \frac{1}{2}m_Q\omega_Q{}^2x_{0,Q}{}^2$$

$$K.E._{max,R} = \frac{1}{2}mv^2 = \frac{1}{2}m_R\omega_R{}^2x_{0,R}{}^2$$

$$\frac{1}{2}m_R\omega_R{}^2x_{0,R}{}^2 = \frac{1}{2}m_Q\omega_Q{}^2x_{0,Q}{}^2$$

Since they have the same mass and $X_{0,R} < X_{0,Q}$

$$\omega_R{}^2 > \omega_Q{}^2$$

16 **ANSWER – D**

Point X is at the equilibrium position. Point Y is at the maximum positive displacement.
The phase angle between X and Y will be 180 + 90 = 270^o.

17 **ANSWER – C**

Period of E is ~ 1.3 ms, and frequency is 0.75 Hz.
Period of G is 1.0 ms, and frequency is 1.0 Hz.
Waves E and G have the same amplitude, y_o, and hence they will have the same intensity.
Wavelength of wave E will be longer than wave G, as frequency of E is less than G.

18 **ANSWER – C**

Using, d sin θ = nλ
λ = (d sinθ) / n
For the question, n = 1, θ = 70 / 2 = 35^o, d = 10^{-6} m,
λ = (10^{-6}) (sin 35) / (1)
= 574 nm

19 **ANSWER – B**

There will be antinodes at both ends of the pipe. This means that there will be a total of 1.5 wavelengths over a distance of 1.0 m.
Wavelength = 1.0 / 1.5 = 0.667 m

[Turn over

Frequency = speed / wavelength
= 330 / 0.667 = 495 Hz

20 **ANSWER – D**

The force on an electron is in the opposite direction to the tangent of the electric field at that point.

21 **ANSWER – A**

For parallel plates, E = V / x, E is inversely proportional to x.

22 **ANSWER – D**

Power loss in cables = $I^2(R/2 + R/2) = (P/V)^2 R$
Power delivered to factory = *P* output from generator – *P* loss in cables
$= P - (P/V)^2 R$

23 **ANSWER – B**

When switch is open, voltmeter reads the emf of cell → emf = 12 V
When switch is closed, voltmeter read p.d. across 2 Ω resistor
→ P.d. across 2 Ω resistor = 8 V = 2/(2+r) x 12 V
→ r = 1 Ω

24 **ANSWER – C**

The p.d. across the lamp in C will always be equal to the emf of the supply.

25 **ANSWER – D**

The p.d. across the wire XY = *ER/(R+2r)*
Since balance length is one-third of the wire XY, the p.d. (which is proportional to the length) will be also one-third of the p.d. across wire XY.
Hence, p.d. across balance length = *ER/3(R+2r*) = emf of cell (since current through it is zero)

26 **ANSWER – D**

Let the distance between the conductors be x cm

Distance PR = $\sqrt{2}x$

Field due to R at P = $B_R = \frac{kI_R}{\sqrt{2}x}$

Sum of force on P due to Q and S = $= \sqrt{2}BIL = \sqrt{2}\left(\frac{kI}{x}\right)IL$

Force on P due to R = $B_R IL = \left(\frac{kI_R}{\sqrt{2}x}\right)IL$

Force on P due to Q and S = Force on P due to R

Solving, $I_R = 2I$

27 **ANSWER – D**

Magnetic force provides centripetal force

$Bqv = mr\omega^2$,

$Bqr\omega = mr\omega^2$,

$Bq = 2\pi m/T$

$T = \frac{2\pi m}{eB}$

28 **ANSWER – C**

As triangle enters into magnetic field, area increases at an increasing rate, thus induced emf increases and induced current increases until the whole triangle is inside the magnetic field.

As triangle exits from the magnetic field, area decreases at an increasing rate, and induced current increases to maximum until the triangle leaves the magnetic field.

29 **ANSWER – C**

The tube with the highest conductivity will induce the largest current and hence the largest opposing force to its downward motion and hence falls the slowest, thus rubber falls the fastest, followed by lead, then copper.

30 **ANSWER – D**

Mean current = average current = 0 since the current is alternating and the net area in one cycle is zero.

Mean power = max power/2 = P/2

31 **ANSWER – C**

Power generated = VI = 7200 W

Output current = 1.6 A

Power lost = i2R = 5.12 W

Percentage power lost = 5.12/7200 × 100% = 0.071%

32 **ANSWER – B**

The maximum energy of electrons depend only on the energy of each photon ($E = hf$) and the work function energy of the metal. Changing the intensity merely changes the rate at which electrons are incident on the metal, but not the energy of each photon.

33 **ANSWER – A**

Red light will be associated with a difference in energy that is less than ($E_4 – E_2$) since red light has a longer wavelength and hence lower energy than blue light.
An absorption involves transition from lower to higher energy levels.
Hence, E_2 to E_3.

34 **ANSWER – B**

To have the same wavelength means to have the same particle momentum. The one with the largest mass will have the smallest velocity.

35 **ANSWER – C**

Applying HUP energy-time:
$\Delta E \times \Delta t > h/4\pi \rightarrow h\Delta f \times \Delta t > h/4\pi$
$\Delta f > 1/4\pi(9.3 \times 10^{-3}) = 8.557$ Hz
% uncertainty in freq = $8.557/(200 \times 10^{6}) \times 100 = 4.3 \times 10^{-6}$

36 **ANSWER – D**

$k = \text{squareroot } [8\pi^2 \times 9.11 \times 10^{-31} \times (6.0 – 2.0) \times 1.6 \times 10^{-19}] / (6.63 \times 10^{-34}) = 1.023 \times 10^{10}$
$R = 1 – e^{-2kd} = 0.87$
$e^{2kd} = 0.13$
$d = 1.0 \times 10^{-10}$ m

37 **ANSWER – C**

Photons having same energy would imply having the same frequency and wavelength of radiation.

38 **ANSWER – A**

The total current flow is the sum of both the ‘hole’ and ‘electron’ current.

39 **ANSWER – A**

Option A: in region P, fusion occurs not fission, there statement is NOT true.

40 **ANSWER – D**

When the number of active nuclei in the two sources are equal, $N_1 = N_2$

$$N = \left(\frac{1}{2}\right)^{\frac{t}{t_{1.2}}} N_0$$

$$\left(\frac{1}{2}\right)^{\frac{t}{2}} (64) = \left(\frac{1}{2}\right)^{\frac{t}{3}} (8)$$

$$\left(\frac{1}{2}\right)^{\frac{t}{2}-\frac{t}{3}} = 2^{3-6}$$

$$\frac{t}{6} = 3$$

$$t = 18 \text{ days}$$

END