

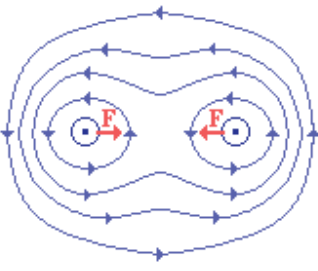
Preliminary Exam 2020  
Paper 1

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

Physics P2

|      |                                                                                                                                                                                                                                                                                                                                                |             |
|------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------|
| 1(a) | Gravitational field strength is the force of gravity on an object per unit mass.                                                                                                                                                                                                                                                               | 1           |
| b    | Resultant force = 400 N<br>$F = ma$<br>$400 = 60 \times a$<br>$a = 6.67 \text{ m/s}^2$                                                                                                                                                                                                                                                         | 1<br><br>1  |
| c    | Decreasing acceleration<br>Constant speed<br>Speed = 5 m/s                                                                                                                                                                                                                                                                                     | 1<br>1<br>1 |
| 2a   | Taking pivot about $T_2$ ,<br>$24\,000 \times 0.40 = T_1 \times 1.60$<br>$T_1 = 6\,000 \text{ N}$                                                                                                                                                                                                                                              | 1<br>1      |
| bi   | In Fig. 2.3, the pressure is greater. The same amount of force is applied <b>but on a smaller base area.</b>                                                                                                                                                                                                                                   | 1           |
| ii   | The base of the pivot acts as a pivot. When the boy tilt further <b>backwards</b> , the line of action of his weight lies outside the base area.<br>The weight causes an anticlockwise moment that <b>causes the boy to fall.</b>                                                                                                              | 1<br>1      |
| 3a   | Infra red and visible light                                                                                                                                                                                                                                                                                                                    | 1           |
| bi   | Heat is mainly transferred to the <b>glass bulb by radiation.</b> Matt black is a <b>better absorber</b> of radiation.<br>The liquid column in the <b>glass tube connected to the matt black bulb will be lower.</b>                                                                                                                           | 1<br>1      |
| ii   | The air in the liquid column in the glass tube connected to the matt black bulb will be at a higher pressure.<br>The air <b>molecules gain more kinetic energy and hit the surface of the liquid with a greater force.</b><br>The rate of collision of the air molecules with the surface of the liquid also increases <b>relatively more.</b> | 1<br>1<br>1 |
| iii  | $P = \rho gh$<br>$1.2 \times 10^4 = 12\,600 \times 10 \times h$<br>$H = 0.095 \text{ m}$                                                                                                                                                                                                                                                       | 1           |
| 4a)  | 0.8 m                                                                                                                                                                                                                                                                                                                                          | 1           |
| b    | $V = f \lambda$<br>$1.8 = f \times 0.8$<br>$f = 2.25 \text{ Hz}$<br><br>$T = 1 / 2.25 = 0.4 \text{ s}$                                                                                                                                                                                                                                         | 1<br><br>1  |
| c    | Particle moves up to the crest <i>at 0.1 s</i> , then moves to the trough <i>at 0.3s</i> and back to the rest position <i>at 0.4 s</i> .                                                                                                                                                                                                       | 1,1         |
| ii   | $1/8 \times 0.4 = 0.05 \text{ s}$                                                                                                                                                                                                                                                                                                              | 1           |
| 5a   | Critical angle is the <i>angle of incidence in the denser medium</i> where the angle of refraction is $90^\circ$ .                                                                                                                                                                                                                             | 1<br>1      |
| b    | $n = 1/\sin c = 1 / \sin 24 = 2.458 = 2.5$                                                                                                                                                                                                                                                                                                     | 1           |
| ci   | Light is not refracted when it enters the denser medium at angle of incidence of $0^\circ$ .                                                                                                                                                                                                                                                   | 1           |



|     |                                                                                                                                                                                             |             |
|-----|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------|
| 8a) |  <p>Diagram<br/>Magnetic field around the wires in correct direction<br/>Resultant force of attraction</p> | 1<br>1<br>1 |
| b i | KL will move upwards.<br>Using Fleming's left hand rule, the magnetic field is to the left, current is into the paper and force is upwards                                                  | 1<br>1      |
| ii  | Split ring commutator<br>It enables the direction of the current in the coil to change every 180°. This enables the coil to turn continuously.                                              | 1<br>1      |

## Section B

|     |                                                                                                                                                                                                                                                                                                                                                                                           |                  |
|-----|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------|
| 9a  | Compression = 0.080 m<br>$\frac{1}{2} \times 6.40 \times 0.08$<br>= 0.256 J                                                                                                                                                                                                                                                                                                               | 1<br>1           |
| b   | Gradient = $8 / 0.100 = 80$<br>$\frac{1}{2} \times 80 \times 0.080 \times 0.080 = 0.256 \text{ J}$                                                                                                                                                                                                                                                                                        | 1<br>1           |
| ci  | GPE = $mgh = 0.042 \times 10 \times 0.500 = 0.210 \text{ J}$                                                                                                                                                                                                                                                                                                                              | 1                |
| ii  | KE = $0.256 - 0.210 = 0.046 \text{ J}$<br>$0.046 = \frac{1}{2} \times 0.042 \times v^2$<br>$v = 1.48 \text{ m/s}$                                                                                                                                                                                                                                                                         | 1<br>1           |
| d   | The speed will be the lower.<br><br>For a bigger mass, more of the elastic energy is converted to the gravitational potential energy. Lesser Kinetic energy is left at P                                                                                                                                                                                                                  | 1<br>1           |
| 10a | Iron which is a soft magnetic material.<br><br>It is easy to magnetized and easy to demagnetized.                                                                                                                                                                                                                                                                                         | 1<br>1           |
| B   | South and South                                                                                                                                                                                                                                                                                                                                                                           | 1                |
| c   | Different current will results in different strength of the magnetic field.<br><br>The attraction force of the diaphragm will change and cause it to vibrate and produce sound.<br>The vibration of the diaphragm will cause the air particles beside it to vibrate.<br>This form a series of compression and rarefaction. The sound energy is transmitted through the longitudinal wave. | 1<br>1<br>1<br>1 |
| Di  | $f = 1/0.02 = 50 \text{ Hz}$                                                                                                                                                                                                                                                                                                                                                              | 1                |

|           |                                                                                                                                                                                                                                                                                                      |                                |
|-----------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------|
| ii        | Smaller period will result with a higher frequency of the voltage.<br>Higher frequency will produce sound with a higher pitch.                                                                                                                                                                       | 1<br>1                         |
| 11a       | $V = RI$<br>$3 = 1050 \times I$<br>$I = 3/1050$<br><br>$V = RI$<br>$2 = R \times 3/1050$<br>$R = 700 \Omega$                                                                                                                                                                                         | 1<br><br><br><br><br>1         |
| bi        | When the temperature decrease, the resistance of the thermistor increases,<br>Voltage across increases, voltage across external circuit increases.                                                                                                                                                   | 1<br>1                         |
| ii        | It will take a greater decrease in temperature to achieve the same voltage across the thermistor and to switch on the external circuit.                                                                                                                                                              | 1                              |
| iii       | To enable convection current to take place. Hot water rises, cold water sink.<br>Hot water has lower density than cold water.                                                                                                                                                                        | 1<br>1                         |
| iv<br>(1) | $P = IV$<br>$800 = I \times 230$<br>$I = 3.478 = 3.48 \text{ A}$<br><br>Fuse rating = 5 A                                                                                                                                                                                                            | <br><br><br><br><br>1          |
| (2)       | $E = Pt$<br>$= 0.800 \times 2 \times 7$<br>$= 11.2$<br><br>Cost = $11.2 \times \$0.28 = \$3.136 = \$3.14$                                                                                                                                                                                            | <br><br><br><br><br>1<br><br>1 |
| Or<br>A i | $1/R = 3/40$<br>$R = 13.3\Omega$<br><br>Total resistance = $33.3 \Omega$                                                                                                                                                                                                                             | <br><br><br><br>1<br>1         |
| ii        | $V_2$ is equal to $V_3$ because they are parallel.<br>Current through the resistor connected to $V_1$ is bigger before it is split at the branch.<br>$V = RI$ , therefore the $20 \Omega$ resistance will have a bigger voltage than the $20 \Omega$ that is in parallel. $V_1$ is bigger than $V_2$ | 1<br>1<br>1                    |
| B i       | $45\% \times 920 = 414 \text{ W}$<br><br>$E = 414 \times 3 \times 60 = 74\,520 \text{ J}$<br>$74\,520 = 2.3 \times 10^6 \times m$<br>$m = 0.0324 \text{ kg} = 0.032 \text{ kg}$                                                                                                                      | 1<br><br>1<br><br>1            |
| ii        | The switch and fuse will be connected to the live wire.<br>Even when the switch is off or the fuse blows, the appliance is still connected to the high voltage supply. User may get electric shock when touching the appliance.                                                                      | 1<br>1                         |

