3.15 Physics: Forces, Motion and Energy Resources: 2-hour Pack

Total Marks

ISEB CE 13+ Science (Physics) · Calculator allowed · about 120 minutes

Name: _____ Date: ____ / ____ / _____

Answer ALL questions. Show all your working.

1 A turbine transfers 250 J of energy and 225 J of it is useful. Calculate its efficiency as a percentage.

- [ ] A) 900%
- [ ] B) 225%
- [ ] C) 90%
- [ ] D) 10%
- [ ] E) 9%

---

2 A go-kart of mass 2 kg accelerates at 2.5 m/s2. Calculate the resultant force on it in N.

- [ ] A) 4.5 N
- [ ] B) 5 N
- [ ] C) 1.25 N
- [ ] D) 0.8 N
- [ ] E) 50 N

---

3 A train moves at a steady 85 km/h for 3 hours. Calculate the distance it travels in km.

- [ ] A) 25.5 km
- [ ] B) 2550 km
- [ ] C) 88 km
- [ ] D) 510 km
- [ ] E) 255 km

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4 What type of charge does an electron carry?

- ☐ A) positive
- ☐ B) it varies
- ☐ C) double positive
- ☐ D) negative
- ☐ E) no charge

---

5 The density of sea water is 1025 kg/m^3. A storage tank has a mass of 3000 kg and a volume of 4.0 m³. Calculate the density of the tank, in kg/m^3. Use the equation: density = mass / volume.

(1)

---

6 A lorry travels 45 km in 1 hours, then a further 30 km in 0.5 hours. Calculate its average speed for the whole journey in km/h.

- ☐ A) 105 km/h
- ☐ B) 52.5 km/h
- ☐ C) 50 km/h
- ☐ D) 45 km/h
- ☐ E) 112.5 km/h

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7 A cyclist's distance from home is recorded every 60 seconds during a ride.
Time (s): 0, 60, 120, 180, 240, 300
Distance (m): 0, 240, 480, 480, 480, 720

(a) Identify the time interval during which the cyclist was stationary. **(1)**

(b) Calculate the cyclist's speed between 0 s and 120 s. **(2)**

(c) Calculate the cyclist's speed between 240 s and 300 s. **(2)**

(d) Without doing the full division, explain how you could tell directly from the numbers in the table that the speeds calculated in (b) and (c) must be equal. **(1)**

---

8 A crate of mass 25 kg is pushed forwards with a force of 135 N. Friction opposes the motion with a force of 10 N. Calculate its acceleration in m/s2.

- ☐ A) 0.2 m/s2
- ☐ B) 5 m/s2
- ☐ C) 5.8 m/s2
- ☐ D) 5.4 m/s2
- ☐ E) 3125 m/s2

---

9 A robot travels 352 m at a steady 22 m/s. Calculate the time taken in s.

- ☐ A) 16 s
- ☐ B) 7744 s
- ☐ C) 1.6 s
- ☐ D) 330 s
- ☐ E) 160 s

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10 Which of these also makes an electromagnet stronger?

- ☐ A) a wooden core
- ☐ B) a larger current
- ☐ C) fewer turns of wire
- ☐ D) a plastic core
- ☐ E) a lower current

---

11 The density of sea water is 1025 kg/m^3. An object has a mass of 2400 kg and a volume of 3.0 m^3. Calculate the density of the object, in kg/m^3. Use the equation: density = mass / volume.

(1)

---

12 A minibus travels 82 km in 2.5 hours, then a further 193 km in 3 hours. Calculate its average speed for the whole journey in km/h.

- ☐ A) 500 km/h
- ☐ B) 5 km/h
- ☐ C) 50 km/h
- ☐ D) 32.8 km/h
- ☐ E) 1512.5 km/h

---

13 A motor is 85% efficient and gives a useful output of 68 J. Calculate the total energy supplied in J.

- ☐ A) 153 J
- ☐ B) 10.2 J
- ☐ C) 57.8 J
- ☐ D) 80 J
- ☐ E) 5780 J

---

14 A ferry travels 45 km at a steady 60 km/h. Calculate the time taken in minutes.

- ☐ A) 0.75 minutes
- ☐ B) 45 minutes
- ☐ C) 2700 minutes
- ☐ D) 450 minutes
- ☐ E) 4.5 minutes

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15 In a series circuit, if one lamp is removed, what happens to the others?

- ☐ A) they flicker
- ☐ B) they stay on
- ☐ C) they get brighter
- ☐ D) they go out
- ☐ E) they get dimmer

---

16 Jake trains on a circular athletics track of length 250 m. He completes 8 laps of the track at a constant speed, taking a total time of 320 s. Calculate Jake's average speed.

(1)

---

17 A minibus travels 24 km in 1 hours, then a further 56 km in 3 hours. Calculate its average speed for the whole journey in km/h.

- ☐ A) 320 km/h
- ☐ B) 24 km/h
- ☐ C) 20 km/h
- ☐ D) 2 km/h
- ☐ E) 200 km/h

---

18 A engine is supplied with 120 J and wastes 48 J as heat and sound. Calculate its efficiency as a percentage.

- ☐ A) 40%
- ☐ B) 150%
- ☐ C) 600%
- ☐ D) 72%
- ☐ E) 60%

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19 A resultant force of 20 N acts on a bicycle and rider of mass 4 kg. Calculate its acceleration in m/s2.

- [ ] A) 5 m/s2
- [ ] B) 0.2 m/s2
- [ ] C) 80 m/s2
- [ ] D) 24 m/s2
- [ ] E) 16 m/s2

---

20 When a plastic rod is rubbed with a cloth and becomes negatively charged, what has moved onto it?

- [ ] A) neutrons
- [ ] B) electrons
- [ ] C) ions
- [ ] D) atoms
- [ ] E) protons

---

21 A car's distance from a fixed point is recorded every 10 seconds during a journey.
Time (s): 0, 10, 20, 30, 40, 50
Distance (m): 0, 80, 160, 160, 160, 240
Calculate the car's speed between 0 s and 20 s.

(1)

---

22 A family car travels 75 km in 2.5 hours, then a further 75 km in 0.5 hours. Calculate its average speed for the whole journey in km/h.

- [ ] A) 50 km/h
- [ ] B) 150 km/h
- [ ] C) 90 km/h
- [ ] D) 30 km/h
- [ ] E) 450 km/h

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23 A kettle transfers 500 J of energy and 150 J of it is useful. Calculate its efficiency as a percentage.

- [ ] A) 150%
- [ ] B) 3%
- [ ] C) 30%
- [ ] D) 300%
- [ ] E) 70%

---

24 A resultant force of 10 N acts on a go-kart of mass 4 kg. Calculate its acceleration in m/s2.

- [ ] A) 14 m/s2
- [ ] B) 0.4 m/s2
- [ ] C) 6 m/s2
- [ ] D) 40 m/s2
- [ ] E) 2.5 m/s2

---

25 A train travels 15 km in 36 minutes at a steady speed. Calculate its speed in km/h.

- [ ] A) 51 km/h
- [ ] B) 250 km/h
- [ ] C) 540 km/h
- [ ] D) 2.4 km/h
- [ ] E) 25 km/h

---

26 Which of these is a unit of power?

- [ ] A) the newton
- [ ] B) the joule
- [ ] C) the watt
- [ ] D) the volt
- [ ] E) the pascal

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27 A car's distance from its starting point is measured every 60 seconds.
Time (s): 0, 60, 120, 180, 240, 300
Distance (m): 0, 600, 1200, 1200, 1200, 1500
Calculate the car's speed between 0 s and 120 s.

(1)

---

28 A coach travels 67 km in 2.5 hours, then a further 158 km in 2 hours. Calculate its average speed for the whole journey in km/h.

- ☐ A) 105.8 km/h
- ☐ B) 52.9 km/h
- ☐ C) 1012.5 km/h
- ☐ D) 50 km/h
- ☐ E) 26.8 km/h

---

29 An engine is 85% efficient and is supplied with 500 J. Calculate the useful energy output in J.

- ☐ A) 4250 J
- ☐ B) 425 J
- ☐ C) 42500 J
- ☐ D) 415 J
- ☐ E) 75 J

---

30 A van of mass 25 kg accelerates at 2.5 m/s2. Calculate the resultant force on it in N.

- ☐ A) 62.5 N
- ☐ B) 0.1 N
- ☐ C) 625 N
- ☐ D) 27.5 N
- ☐ E) 10 N

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31 A toy car moves at a steady 8 m/s for 12 s. Calculate the distance it travels in m.

- [ ] A) 96 m
- [ ] B) 9.6 m
- [ ] C) 1.5 m
- [ ] D) 960 m
- [ ] E) 20 m

---

32 A boat's distance from the dock is recorded every 20 seconds during a journey.
Time (s): 0, 20, 40, 60, 80, 100
Distance (m): 0, 100, 200, 200, 200, 300
Calculate the boat's speed between 80 s and 100 s.

(1)

---

33 A motor is 25% efficient and gives a useful output of 100 J. Calculate the total energy supplied in J.

- [ ] A) 125 J
- [ ] B) 400 J
- [ ] C) 2500 J
- [ ] D) 75 J
- [ ] E) 25 J

---

34 A crate of mass 20 kg accelerates at 2.5 m/s2. Calculate the resultant force on it in N.

- [ ] A) 0.125 N
- [ ] B) 8 N
- [ ] C) 500 N
- [ ] D) 22.5 N
- [ ] E) 50 N

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35 A seesaw is balanced on a central pivot. Two children sit on the left: Dev, who weighs 320 N, sits 0.9 m from the pivot, and Emma, who weighs 180 N, sits 0.6 m from the pivot. Fiona sits on the right with a weight of 400 N. Calculate the distance she must sit from the pivot to balance the seesaw.

(1)

---

36 A coach travels 15 km in 15 minutes at a steady speed. Calculate its speed in km/h.

- ☐ A) 225 km/h
- ☐ B) 30 km/h
- ☐ C) 1 km/h
- ☐ D) 60 km/h
- ☐ E) 100 km/h

---

37 A car engine has a mass of 120 kg. Using g = 10 N/kg, calculate the weight of the engine.

(1)

---

38 A coach travels 108 km in 2 hours, then a further 72 km in 1 hours. Calculate its average speed for the whole journey in km/h.

- ☐ A) 540 km/h
- ☐ B) 72 km/h
- ☐ C) 126 km/h
- ☐ D) 54 km/h
- ☐ E) 60 km/h

---

39 A engine is 25% efficient and gives a useful output of 250 J. Calculate the total energy supplied in J.

- ☐ A) 62.5 J
- ☐ B) 6250 J
- ☐ C) 1000 J
- ☐ D) 275 J
- ☐ E) 187.5 J

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40 A cyclist travels 15 km at a steady 30 km/h. Calculate the time taken in hours.

- [ ] A) 0.5 hours
- [ ] B) 2 hours
- [ ] C) 0.05 hours
- [ ] D) 5 hours
- [ ] E) 450 hours

---

41 A person has a mass of 75 kg. Using g = 10 N/kg, calculate their weight on Earth.

(1)

---

42 A lorry travels 58 km in 1 hours, then a further 137 km in 2 hours. Calculate its average speed for the whole journey in km/h.

- [ ] A) 68.5 km/h
- [ ] B) 65 km/h
- [ ] C) 63.25 km/h
- [ ] D) 126.5 km/h
- [ ] E) 58 km/h

---

43 A minibus travels 144 km in 1 hours, then a further 96 km in 3 hours. Calculate its average speed for the whole journey in km/h.

- [ ] A) 32 km/h
- [ ] B) 88 km/h
- [ ] C) 176 km/h
- [ ] D) 144 km/h
- [ ] E) 60 km/h

---

44 A heater transfers 200 J of energy and 180 J of it is useful. Calculate its efficiency as a percentage.

- [ ] A) 90%
- [ ] B) 180%
- [ ] C) 9%
- [ ] D) 10%
- [ ] E) 900%

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45 A bicycle and rider of mass 10 kg accelerates at 1.5 m/s2. Calculate the resultant force on it in N.

- ☐ A) 0.15 N
- ☐ B) 15 N
- ☐ C) 11.5 N
- ☐ D) 1.5 N
- ☐ E) 150 N

---

46 Which of these is a renewable energy resource?

- ☐ A) oil
- ☐ B) coal
- ☐ C) geothermal
- ☐ D) natural gas
- ☐ E) uranium (nuclear fuel)

---

47 Which colour of surface is the best absorber of heat radiation?

- ☐ A) shiny silver
- ☐ B) shiny white
- ☐ C) matt black
- ☐ D) white
- ☐ E) pale yellow

---

48 A skater's distance is measured every 60 seconds.
Time (s): 0, 60, 120, 180, 240, 300
Distance (m): 0, 180, 360, 360, 360, 540
Calculate the skater's speed between 240 s and 300 s.

(1)

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49 A coach travels 30 km in 1 hours, then a further 30 km in 0.5 hours. Calculate its average speed for the whole journey in km/h.

- [ ] A) 40 km/h
- [ ] B) 45 km/h
- [ ] C) 30 km/h
- [ ] D) 90 km/h
- [ ] E) 60 km/h

---

50 Leah is a competitive swimmer. At the start of a race, she crouches down and pushes hard backwards against the wall of the pool with her feet.

(a) State Newton's third law of motion. **(1)**

(b) Leah pushes backwards on the pool wall with a force of 180 N. Using Newton's third law, state the size and direction of the force the wall exerts on Leah. **(2)**

---

51 A motor is 75% efficient and gives a useful output of 90 J. Calculate the total energy supplied in J.

- [ ] A) 22.5 J
- [ ] B) 120 J
- [ ] C) 165 J
- [ ] D) 6750 J
- [ ] E) 67.5 J

---

52 A trolley of mass 20 kg is pushed forwards with a force of 150 N. Friction opposes the motion with a force of 100 N. Calculate its acceleration in m/s2.

- [ ] A) 12.5 m/s2
- [ ] B) 7.5 m/s2
- [ ] C) 0.4 m/s2
- [ ] D) 1000 m/s2
- [ ] E) 2.5 m/s2

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53 Which of these is a renewable energy resource?

- [ ] A) uranium (nuclear fuel)
- [ ] B) oil
- [ ] C) tidal
- [ ] D) coal
- [ ] E) natural gas

---

54 Which type of surface is the worst emitter of heat radiation?

- [ ] A) matt grey
- [ ] B) dark brown
- [ ] C) matt black
- [ ] D) shiny silver
- [ ] E) dull red

---

55 Two teenagers sit on a balanced plank. One teenager has a weight of 550 N and sits 1.8 m from the pivot. The other teenager has a weight of 450 N and sits on the opposite side. Calculate the distance from the pivot at which the second teenager must sit.

(1)

---

56 A minibus travels 24 km in 1 hours, then a further 36 km in 2 hours. Calculate its average speed for the whole journey in km/h.

- [ ] A) 42 km/h
- [ ] B) 20 km/h
- [ ] C) 180 km/h
- [ ] D) 21 km/h
- [ ] E) 24 km/h

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57 A turbine transfers 120 J of energy and 60 J of it is useful. Calculate its efficiency as a percentage.

- [ ] A) 50%
- [ ] B) 100%
- [ ] C) 200%
- [ ] D) 500%
- [ ] E) 60%

---

58 A resultant force of 1200 N acts on a van of mass 800 kg. Calculate its acceleration in m/s2.

- [ ] A) 400 m/s2
- [ ] B) 960000 m/s2
- [ ] C) 2000 m/s2
- [ ] D) 15 m/s2
- [ ] E) 1.5 m/s2

---

59 A robot travels 240 m at a steady 12 m/s. Calculate the time taken in s.

- [ ] A) 200 s
- [ ] B) 0.05 s
- [ ] C) 228 s
- [ ] D) 20 s
- [ ] E) 2880 s

---

60 Which of these is a non-renewable energy resource?

- [ ] A) geothermal
- [ ] B) hydroelectric
- [ ] C) solar
- [ ] D) tidal
- [ ] E) uranium (nuclear fuel)

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61 What happens when two north poles of magnets are brought together?

- [ ] A) they repel
- [ ] B) they become demagnetised
- [ ] C) they attract
- [ ] D) nothing happens
- [ ] E) they spin round

---

62 A box of books has a mass of 30 kg. Using g = 10 N/kg, calculate the weight of the box. Use weight = mass x gravitational field strength.

(1)

---

63 A minibus travels 16 km in 1 hours, then a further 39 km in 1.5 hours, with a rest stop of 15 minutes in between. Calculate its average speed for the whole journey in km/h.

- [ ] A) 26 km/h
- [ ] B) 151.25 km/h
- [ ] C) 20 km/h
- [ ] D) 21 km/h
- [ ] E) 22 km/h

---

64 A kettle is 60% efficient and gives a useful output of 24 J. Calculate the total energy supplied in J.

- [ ] A) 1440 J
- [ ] B) 40 J
- [ ] C) 84 J
- [ ] D) 9.6 J
- [ ] E) 14.4 J

---

65 A resultant force of 2.5 N acts on a go-kart of mass 5 kg. Calculate its acceleration in m/s2.

- [ ] A) 7.5 m/s2
- [ ] B) 2 m/s2
- [ ] C) 12.5 m/s2
- [ ] D) 0.5 m/s2
- [ ] E) 5 m/s2

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66 A coach moves at a steady 80 km/h for 3 hours. Calculate the distance it travels in km.

- ☐ A) 240 km
- ☐ B) 83 km
- ☐ C) 2400 km
- ☐ D) 24 km
- ☐ E) 480 km

---

67 In a parallel circuit, if one lamp is removed, what happens to the others?

- ☐ A) they flicker
- ☐ B) they stay on
- ☐ C) they go out
- ☐ D) they all get brighter
- ☐ E) they get dimmer

---

68 A jogger covers 6 km in 30 minutes. Convert 30 minutes into seconds.

(1)

---

69 Marcus delivers parcels by bicycle. He cycles a distance of 5.4 km at a constant speed, taking 18 minutes. Use the equation: speed = distance / time.

(a) Convert 18 minutes into seconds. **(1)**

.....

(b) Calculate Marcus's average speed, giving your answer in m/s. **(3)**

.....

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70 A minibus travels 120 km in 2 hours, then a further 180 km in 1.5 hours, with a rest stop of 15 minutes in between. Calculate its average speed for the whole journey in km/h.

- [ ] A) 1125 km/h
- [ ] B) 180 km/h
- [ ] C) 120 km/h
- [ ] D) 90 km/h
- [ ] E) 80 km/h

---

71 A turbine is supplied with 400 J and wastes 320 J as heat and sound. Calculate its efficiency as a percentage.

- [ ] A) 25%
- [ ] B) 200%
- [ ] C) 80%
- [ ] D) 20%
- [ ] E) 500%

---

72 A resultant force of 200 N acts on a bicycle and rider of mass 40 kg. Calculate its acceleration in m/s2.

- [ ] A) 240 m/s2
- [ ] B) 5 m/s2
- [ ] C) 0.2 m/s2
- [ ] D) 160 m/s2
- [ ] E) 8000 m/s2

---

73 A lorry moves at a steady 40 km/h for 1.5 hours. Calculate the distance it travels in km.

- [ ] A) 60 km
- [ ] B) 6 km
- [ ] C) 600 km
- [ ] D) 41.5 km
- [ ] E) 120 km

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74 Which of these makes an electromagnet stronger?

- [ ] A) a lower current
- [ ] B) a plastic core
- [ ] C) more turns of wire
- [ ] D) fewer turns of wire
- [ ] E) a wooden core

---

75 A runner travels 8.4 km at a constant speed, taking 28 minutes. Convert 28 minutes into seconds.

(1)

---

76 A family car travels 112 km in 1 hours, then a further 168 km in 3 hours. Calculate its average speed for the whole journey in km/h.

- [ ] A) 70 km/h
- [ ] B) 56 km/h
- [ ] C) 84 km/h
- [ ] D) 1120 km/h
- [ ] E) 168 km/h

---

77 A kettle is supplied with 200 J and wastes 20 J as heat and sound. Calculate its efficiency as a percentage.

- [ ] A) 9%
- [ ] B) 180%
- [ ] C) 900%
- [ ] D) 90%
- [ ] E) 10%

---

78 A resultant force of 40 N acts on a crate of mass 20 kg. Calculate its acceleration in m/s2.

- [ ] A) 0.5 m/s2
- [ ] B) 2 m/s2
- [ ] C) 20 m/s2
- [ ] D) 800 m/s2
- [ ] E) 60 m/s2

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79 A coach moves at a steady 30 km/h for 0.5 hours. Calculate the distance it travels in km.

- [ ] A) 30.5 km
- [ ] B) 150 km
- [ ] C) 1.5 km
- [ ] D) 60 km
- [ ] E) 15 km

---

80 Which instrument is used to measure the size of a force?

- [ ] A) a stopwatch
- [ ] B) a voltmeter
- [ ] C) a thermometer
- [ ] D) a newtonmeter
- [ ] E) a measuring cylinder

---

81 A bag of soil has a mass of 50 kg. Take gravitational field strength on Earth, g = 10 N/kg. Calculate the weight of the bag. Use weight = mass x gravitational field strength.

(1)

---

82 A family car travels 78 km in 2 hours, then a further 117 km in 0.5 hours, with a rest stop of 30 minutes in between. Calculate its average speed for the whole journey in km/h.

- [ ] A) 273 km/h
- [ ] B) 234 km/h
- [ ] C) 136.5 km/h
- [ ] D) 78 km/h
- [ ] E) 65 km/h

---

83 A lamp transfers 1000 J of energy and 850 J of it is useful. Calculate its efficiency as a percentage.

- [ ] A) 15%
- [ ] B) 850%
- [ ] C) 85%
- [ ] D) 8.5%
- [ ] E) 170%

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84 A trolley of mass 4 kg accelerates at 2.5 m/s2. Calculate the resultant force on it in N.

- [ ] A) 10 N
- [ ] B) 0.625 N
- [ ] C) 6.5 N
- [ ] D) 1.6 N
- [ ] E) 100 N

---

85 A bus moves at a steady 25 km/h for 36 minutes. Calculate the distance it travels in km.

- [ ] A) 61 km
- [ ] B) 15 km
- [ ] C) 900 km
- [ ] D) 150 km
- [ ] E) 1.44 km

---

86 Which of these is a renewable energy resource?

- [ ] A) uranium (nuclear fuel)
- [ ] B) solar
- [ ] C) natural gas
- [ ] D) coal
- [ ] E) oil

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87 Priya trains on a circular athletics track of length 400 m. She completes 4 laps of the track at a constant speed, taking a total time of 320 s.

(a) Calculate the total distance Priya travels. **(2)**

(b) Calculate Priya's average speed. **(2)**

(c) Explain why, even though Priya's speed is constant throughout the run, her velocity is not constant. **(2)**

---

88 A water container has a mass of 25 kg. Take gravitational field strength on Earth, g = 10 N/kg. Using the equation: weight = mass x gravitational field strength, calculate the weight of the container on Earth.

(1)

---

89 A train travels 76 km in 1 hours, then a further 114 km in 3 hours, with a rest stop of 45 minutes in between. Calculate its average speed for the whole journey in km/h.

- ☐ A) 40 km/h
- ☐ B) 902.5 km/h
- ☐ C) 38 km/h
- ☐ D) 47.5 km/h
- ☐ E) 57 km/h

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90 A heater transfers 200 J of energy and 60 J of it is useful. Calculate its efficiency as a percentage.

- [ ] A) 3%
- [ ] B) 300%
- [ ] C) 70%
- [ ] D) 60%
- [ ] E) 30%

---

91 A resultant force of 400 N acts on a bicycle and rider of mass 100 kg. Calculate its acceleration in m/s2.

- [ ] A) 40000 m/s2
- [ ] B) 500 m/s2
- [ ] C) 4 m/s2
- [ ] D) 300 m/s2
- [ ] E) 0.25 m/s2

---

92 A coach travels 42 km in 36 minutes at a steady speed. Calculate its speed in km/h.

- [ ] A) 7 km/h
- [ ] B) 1512 km/h
- [ ] C) 78 km/h
- [ ] D) 70 km/h
- [ ] E) 700 km/h

---

93 Which of these is a non-renewable energy resource?

- [ ] A) natural gas
- [ ] B) hydroelectric
- [ ] C) geothermal
- [ ] D) wind
- [ ] E) solar

---

94 Tanya runs on a circular track of length 300 m. She completes 5 laps at a constant speed, taking 200 s in total. Calculate Tanya's average speed.

(1)

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95 A coach travels 189 km in 3 hours, then a further 126 km in 1 hours, with a rest stop of 30 minutes in between. Calculate its average speed for the whole journey in km/h.

- [ ] A) 1417.5 km/h
- [ ] B) 189 km/h
- [ ] C) 70 km/h
- [ ] D) 126 km/h
- [ ] E) 94.5 km/h

---

96 A motor transfers 500 J of energy and 200 J of it is useful. Calculate its efficiency as a percentage.

- [ ] A) 250%
- [ ] B) 40%
- [ ] C) 200%
- [ ] D) 60%
- [ ] E) 400%

---

97 A bicycle and rider of mass 4 kg accelerates at 1 m/s2. Calculate the resultant force on it in N.

- [ ] A) 40 N
- [ ] B) 0.25 N
- [ ] C) 4 N
- [ ] D) 0.4 N
- [ ] E) 5 N

---

98 A sledge moves at a steady 5 m/s for 5 s. Calculate the distance it travels in m.

- [ ] A) 250 m
- [ ] B) 25 m
- [ ] C) 10 m
- [ ] D) 1 m
- [ ] E) 2.5 m

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99 Which of these is a renewable energy resource?

- [ ] A) natural gas
- [ ] B) uranium (nuclear fuel)
- [ ] C) oil
- [ ] D) coal
- [ ] E) wind

---

100 A builder carries a load of bricks with a mass of 30 kg. Take gravitational field strength on Earth, g = 10 N/kg. Calculate the weight of the bricks on Earth. Use the equation: weight = mass x gravitational field strength.

(1)

---

101 A minibus travels 90 km in 2 hours, then a further 60 km in 3 hours. Calculate its average speed for the whole journey in km/h.

- [ ] A) 30 km/h
- [ ] B) 750 km/h
- [ ] C) 20 km/h
- [ ] D) 32.5 km/h
- [ ] E) 45 km/h

---

102 A lamp is 20% efficient and is supplied with 250 J. Calculate the useful energy output in J.

- [ ] A) 200 J
- [ ] B) 1250 J
- [ ] C) 230 J
- [ ] D) 50 J
- [ ] E) 5000 J

---

103 A crate of mass 25 kg accelerates at 2 m/s2. Calculate the resultant force on it in N.

- [ ] A) 27 N
- [ ] B) 50 N
- [ ] C) 500 N
- [ ] D) 12.5 N
- [ ] E) 0.08 N

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104 A cyclist travels 120 km at a steady 30 km/h. Calculate the time taken in hours.

- ☐ A) 3600 hours
- ☐ B) 90 hours
- ☐ C) 4 hours
- ☐ D) 40 hours
- ☐ E) 0.25 hours

---

105 Which of these is NOT a renewable energy resource?

- ☐ A) geothermal
- ☐ B) solar
- ☐ C) tidal
- ☐ D) hydroelectric
- ☐ E) natural gas

---

106 Kwame and Elsie sit on a uniform see-saw that is pivoted at its centre. Kwame has a weight of 350 N and sits 1.8 m from the pivot.

(a) State the principle of moments for a beam that is balanced (in equilibrium) on a pivot. **(1)**

(b) Calculate Kwame's moment about the pivot. **(2)**

.....

(c) Elsie has a weight of 450 N and sits on the other side of the pivot so that the see-saw is balanced. Calculate the distance from the pivot at which Elsie must sit. **(2)**

.....

---

107 Two people sit on a balanced seesaw. One person has a weight of 600 N and sits 1.5 m from the pivot. The other person has a weight of 500 N and sits on the opposite side. Calculate the distance from the pivot at which the second person must sit.

(1)

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108 A train travels 54 km in 3 hours, then a further 126 km in 1.5 hours. Calculate its average speed for the whole journey in km/h.

- [ ] A) 84 km/h
- [ ] B) 40 km/h
- [ ] C) 102 km/h
- [ ] D) 810 km/h
- [ ] E) 18 km/h

---

109 A motor is supplied with 500 J and wastes 150 J as heat and sound. Calculate its efficiency as a percentage.

- [ ] A) 70%
- [ ] B) 350%
- [ ] C) 700%
- [ ] D) 30%
- [ ] E) 7%

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Mark scheme · 3.15 Physics: Forces, Motion and Energy Resources: 2-hour Pack

Question 1

C (90%) **B1**

Answer: C) 90%

Question 2

B (5 N) **B1**

Answer: B) 5 N

Question 3

E (255 km) **B1**

Answer: E) 255 km

Question 4

D (negative) **B1**

Answer: D) negative

Question 5

750 kg/m^3 (oe) **B1**

Answer: 750 kg/m^3

Question 6

C (50 km/h) **B1**

Answer: C) 50 km/h

Question 7

(a) 120 s to 240 s, cao **B1**

(a) Answer: 120 s to 240 s

(b) 480 / 120 **M1**

(b) 4 m/s, cao **A1**

(b) Answer: 4 m/s

(c) (720 - 480) / (300 - 240), i.e. 240 / 60 **M1**

(c) 4 m/s, cao **A1**

(c) Answer: 4 m/s

(d) both pairs of values simplify to the same ratio of distance to time, 4:1 (480:120 and 240:60 both simplify to 4:1), oe **B1**

(d) Answer: 480:120 and 240:60 both simplify to the same ratio, 4:1, so the two speeds must be equal.

Question 8

B (5 m/s2) **B1**

Answer: B) 5 m/s2

Question 9

A (16 s) **B1**

Answer: A) 16 s

Question 10

B (a larger current) **B1**

Answer: B) a larger current

Question 11

800 kg/m^3 (oe) **B1**

Answer: 800 kg/m^3

Question 12

C (50 km/h) **B1**

Answer: C) 50 km/h

Question 13

D (80 J) **B1**

Answer: D) 80 J

Question 14

B (45 minutes) **B1**

Answer: B) 45 minutes

Question 15

D (they go out) **B1**

Answer: D) they go out

Question 16

6.25 m/s (oe) **B1**

Answer: 6.25 m/s

Question 17

C (20 km/h) **B1**

Answer: C) 20 km/h

Question 18

E (60%) **B1**

Answer: E) 60%

Question 19

A (5 m/s2) **B1**

Answer: A) 5 m/s2

Question 20

B (electrons) **B1**

Answer: B) electrons

Question 21

8 m/s (oe) **B1**

Answer: 8 m/s

Question 22

A (50 km/h) **B1**

Answer: A) 50 km/h

Question 23

C (30%) **B1**

Answer: C) 30%

Question 24

E (2.5 m/s2) **B1**

Answer: E) 2.5 m/s2

Question 25

E (25 km/h) **B1**

Answer: E) 25 km/h

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Question 26

C (the watt) **B1**

Answer: C) the watt

Question 27

10 m/s (oe) **B1**

Answer: 10 m/s

Question 28

D (50 km/h) **B1**

Answer: D) 50 km/h

Question 29

B (425 J) **B1**

Answer: B) 425 J

Question 30

A (62.5 N) **B1**

Answer: A) 62.5 N

Question 31

A (96 m) **B1**

Answer: A) 96 m

Question 32

5 m/s (oe) **B1**

Answer: 5 m/s

Question 33

B (400 J) **B1**

Answer: B) 400 J

Question 34

E (50 N) **B1**

Answer: E) 50 N

Question 35

0.99 m (oe) **B1**

Answer: 0.99 m

Question 36

D (60 km/h) **B1**

Answer: D) 60 km/h

Question 37

1200 N (oe) **B1**

Answer: 1200 N

Question 38

E (60 km/h) **B1**

Answer: E) 60 km/h

Question 39

C (1000 J) **B1**

Answer: C) 1000 J

Question 40

A (0.5 hours) **B1**

Answer: A) 0.5 hours

Question 41

750 N (oe) **B1**

Answer: 750 N

Question 42

B (65 km/h) **B1**

Answer: B) 65 km/h

Question 43

E (60 km/h) **B1**

Answer: E) 60 km/h

Question 44

A (90%) **B1**

Answer: A) 90%

Question 45

B (15 N) **B1**

Answer: B) 15 N

Question 46

C (geothermal) **B1**

Answer: C) geothermal

Question 47

C (matt black) **B1**

Answer: C) matt black

Question 48

3 m/s (oe) **B1**

Answer: 3 m/s

Question 49

A (40 km/h) **B1**

Answer: A) 40 km/h

Question 50

(a) when one object exerts a force on a second object, the second object exerts an equal and opposite force back on the first object, oe **B1**

(a) Answer: When one object exerts a force on a second object, the second object exerts an equal and opposite force back on the first object.

(b) 180 N, cao **B1**

(b) direction: forwards, away from the wall (in the direction Leah swims / opposite to the direction she pushed), oe **B1**

(b) Answer: 180 N, acting forwards, away from the wall.

Question 51

B (120 J) **B1**

Answer: B) 120 J

Question 52

E (2.5 m/s2) **B1**

Answer: E) 2.5 m/s2

Question 53

C (tidal) **B1**

Answer: C) tidal

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Question 54

D (shiny silver) **B1**

Answer: D) shiny silver

Question 55

2.2 m (oe) **B1**

Answer: 2.2 m

Question 56

B (20 km/h) **B1**

Answer: B) 20 km/h

Question 57

A (50%) **B1**

Answer: A) 50%

Question 58

E (1.5 m/s2) **B1**

Answer: E) 1.5 m/s2

Question 59

D (20 s) **B1**

Answer: D) 20 s

Question 60

E (uranium (nuclear fuel)) **B1**

Answer: E) uranium (nuclear fuel)

Question 61

A (they repel) **B1**

Answer: A) they repel

Question 62

300 N (oe) **B1**

Answer: 300 N

Question 63

C (20 km/h) **B1**

Answer: C) 20 km/h

Question 64

B (40 J) **B1**

Answer: B) 40 J

Question 65

D (0.5 m/s2) **B1**

Answer: D) 0.5 m/s2

Question 66

A (240 km) **B1**

Answer: A) 240 km

Question 67

B (they stay on) **B1**

Answer: B) they stay on

Question 68

1800 s (oe) **B1**

Answer: 1800 s

Question 69

(a) 1080 s, cao **B1**

(a) Answer: 1080 s

(b) convert 5.4 km to metres, 5400 m **M1**

(b) speed = distance / time, 5400 / their (a) **M1**

(b) 5 m/s, cao, ft **A1**

(b) Answer: 5 m/s

Question 70

E (80 km/h) **B1**

Answer: E) 80 km/h

Question 71

D (20%) **B1**

Answer: D) 20%

Question 72

B (5 m/s2) **B1**

Answer: B) 5 m/s2

Question 73

A (60 km) **B1**

Answer: A) 60 km

Question 74

C (more turns of wire) **B1**

Answer: C) more turns of wire

Question 75

1680 s (oe) **B1**

Answer: 1680 s

Question 76

A (70 km/h) **B1**

Answer: A) 70 km/h

Question 77

D (90%) **B1**

Answer: D) 90%

Question 78

B (2 m/s2) **B1**

Answer: B) 2 m/s2

Question 79

E (15 km) **B1**

Answer: E) 15 km

Question 80

D (a newtonmeter) **B1**

Answer: D) a newtonmeter

Question 81

500 N (oe) **B1**

Answer: 500 N

Question 82

E (65 km/h) **B1**

Answer: E) 65 km/h

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Question 83

C (85%) **B1**

Answer: C) 85%

Question 84

A (10 N) **B1**

Answer: A) 10 N

Question 85

B (15 km) **B1**

Answer: B) 15 km

Question 86

B (solar) **B1**

Answer: B) solar

Question 87

(a) 4 x 400 **M1**

(a) 1600 m, cao **A1**

(a) Answer: 1600 m

(b) speed = their (a) / 320 **M1**

(b) 5 m/s, cao, ft **A1**

(b) Answer: 5 m/s

(c) velocity is speed in a stated (given) direction, oe **B1**

(c) because the track is circular, Priya's direction of travel is continually changing as she runs, so her velocity keeps changing even though her speed stays the same, oe **B1**

(c) Answer: Velocity is speed in a given direction. Because Priya runs around a circular track, her direction keeps changing, so her velocity changes even though her speed stays constant.

Question 88

250 N (oe) **B1**

Answer: 250 N

Question 89

A (40 km/h) **B1**

Answer: A) 40 km/h

Question 90

E (30%) **B1**

Answer: E) 30%

Question 91

C (4 m/s2) **B1**

Answer: C) 4 m/s2

Question 92

D (70 km/h) **B1**

Answer: D) 70 km/h

Question 93

A (natural gas) **B1**

Answer: A) natural gas

Question 94

7.5 m/s (oe) **B1**

Answer: 7.5 m/s

Question 95

C (70 km/h) **B1**

Answer: C) 70 km/h

Question 96

B (40%) **B1**

Answer: B) 40%

Question 97

C (4 N) **B1**

Answer: C) 4 N

Question 98

B (25 m) **B1**

Answer: B) 25 m

Question 99

E (wind) **B1**

Answer: E) wind

Question 100

300 N (oe) **B1**

Answer: 300 N

Question 101

A (30 km/h) **B1**

Answer: A) 30 km/h

Question 102

D (50 J) **B1**

Answer: D) 50 J

Question 103

B (50 N) **B1**

Answer: B) 50 N

Question 104

C (4 hours) **B1**

Answer: C) 4 hours

Question 105

E (natural gas) **B1**

Answer: E) natural gas

Question 106

(a) when a beam is balanced, the sum of the clockwise moments about the pivot equals the sum of the anticlockwise moments, oe **B1**

(a) Answer: When a beam is balanced, the sum of the clockwise moments about the pivot equals the sum of the anticlockwise moments.

(b) 350 x 1.8 **M1**

(b) 630 Nm, cao **A1**

(b) Answer: 630 Nm

(c) 450 x d = their (b), rearrange to d = their (b) / 450 **M1**

(c) 1.4 m, cao, ft **A1**

(c) Answer: 1.4 m

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Question 107

1.8 m (oe) **B1**

Answer: 1.8 m

Question 108

B (40 km/h) **B1**

Answer: B) 40 km/h

Question 109

A (70%) **B1**

Answer: A) 70%

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