Global challenges – 2021/20 GCSE Gateway Physics A

1. Nov/2021/Paper_J249/02/No.12

This question is about electricity at power stations and at homes.

Which row in the table is correct?

	Voltage at the power station (V)	Voltage in the home (V)
A	230	50
B	230	230
C	25000	50
D	25000	230

Your answer ☐ **[1]**

2. Nov/2021/Paper_J249/02/No.16

This question is about the solar system.

(a) Describe how a planet's orbit is different compared to a moon's orbit.

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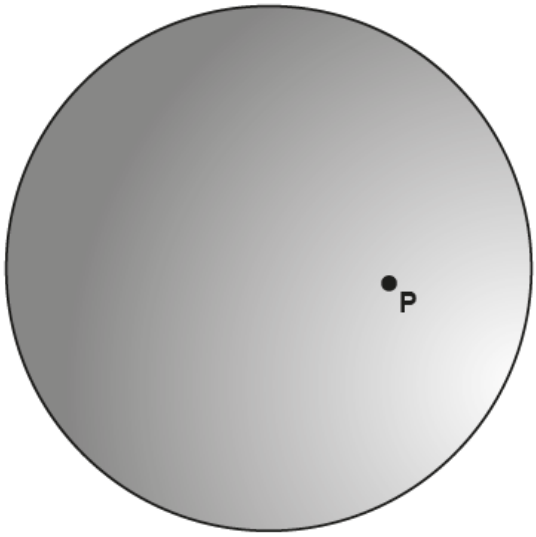
..... **[2]**

(b) The diagram shows the Sun.



Point **P** is inside the Sun.

(i) Draw an arrow at **P** to show the direction of the force of gravity at **P**.

Label the arrow **F**. **[1]**

(ii) Nuclear fusion reactions take place in the Sun. The energy released creates a force.

Draw an arrow at **P** to show the direction of this force.

Label the arrow **R**. **[1]**

(iii) Explain why the size of the Sun does **not** change.

Write about force **F** and force **R** in your answer.

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..... **[2]**

(iv) Complete the sentences using the words below.

You can use each word once, more than once, or not at all.

black hole **neutron star** **planetary nebula** **red giant**

red super giant **supernova** **white dwarf**

Towards the end of its life the Sun will expand.

The Sun becomes a ..... .

The Sun then gives off its outer layers of gas. This is called a

..... .

After this, the Sun will become a ..... .

[3]

3. Nov/2021/Paper_J249/02/No.23

A solar cell changes light into electricity. Solar panels contain solar cells.

(a) A student investigates a solar cell:

- They change the intensity of the light.
- They measure the potential difference across the solar cell.

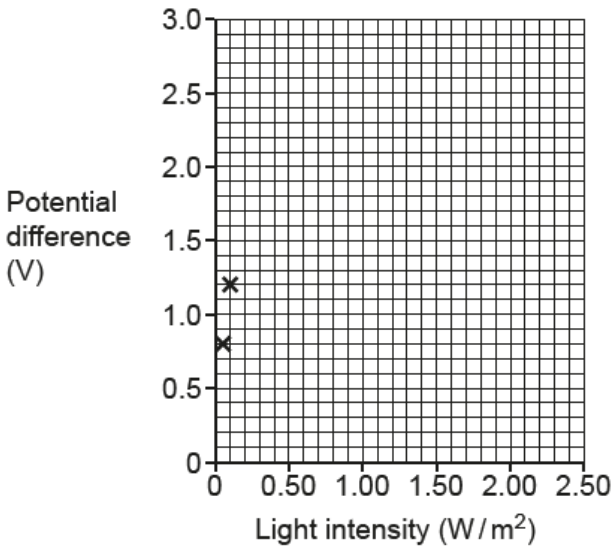
(i) **Table 23.1** shows the student's results:

Light intensity (W/m^2)	Potential difference (V)
0.05	0.8
0.10	1.2
0.20	1.5
0.40	1.8
0.80	2.2
1.60	2.5

Table 23.1

Plot a graph of the results from **Table 23.1**. Two results have already been plotted for you.

Draw a line of best fit. **[3]**



(ii) The light intensity is changed to $2.00\,W/m^2$.

Use your graph to predict the potential difference of the solar cell.

Show your working on the graph.

Potential difference = ... V **[2]**

(iii) Suggest **one** way the student could improve their investigation.

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..... **[1]**

(b) (i) More people use solar panels to generate electricity compared to twenty years ago.

Suggest **two** reasons why.

1 .....

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2 .....

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[2]

(ii) A homeowner fits solar panels to the roof of their house.

Table 23.2 gives the energy values for the house for **one** day:

Area of one solar panel	$1.6\,m^2$
Area of roof that can be used	$24\,m^2$
Maximum energy output of one solar panel	26 MJ
Energy needed by all appliances in the house	364 MJ

Table 23.2

Explain whether the energy needed by all the appliances can be generated using **only** solar panels.

Use **Table 23.2** and your knowledge of solar panels to explain your answer.

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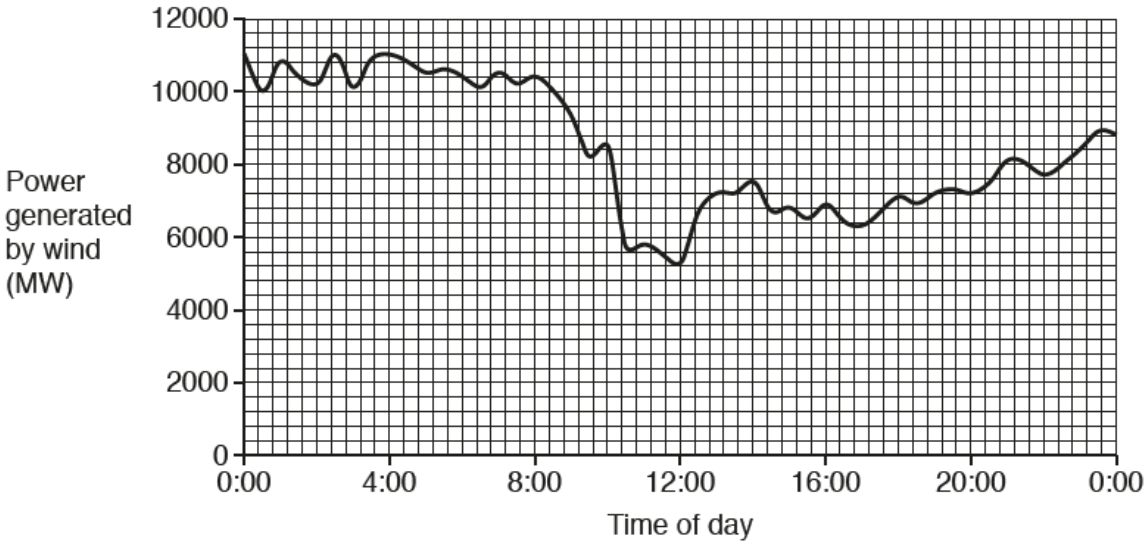
4. Nov/2020/Paper_J249/02/No.4

The graph shows how the power generated by the wind in the UK varied over one day.



Which row in the table is correct?

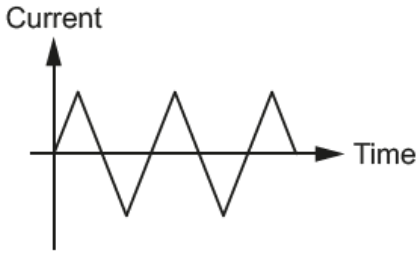
	Maximum power generated (MW)	Reliability of wind power
A	5200	Reliable
B	5200	Unreliable
C	11 000	Reliable
D	11 000	Unreliable

Your answer ☐ **[1]**

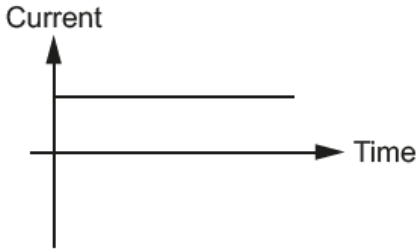
5. Nov/2020/Paper_J249/02/No.8

Which graph shows an alternating current (a.c.)?

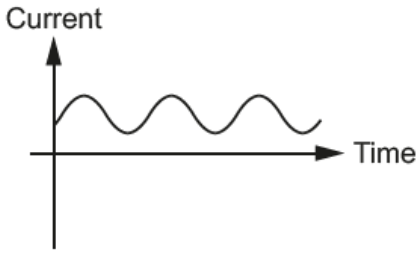
A



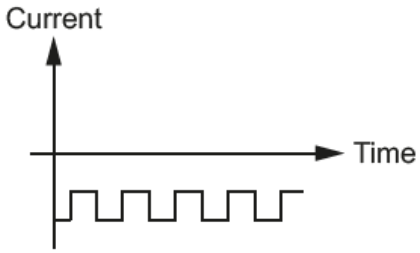
B



C



D



Your answer ☐ **[1]**

6. Nov/2020/Paper_J249/02/No.14

Which row in the table is correct for a **step-down** transformer?

	Current	Potential difference
A	Decreases	Decreases
B	Decreases	Increases
C	Increases	Decreases
D	Increases	Increases

Your answer ☐ **[1]**

7. Nov/2020/Paper_J249/02/No.16(c)

(c) Use the words from the list to complete the sentences about the Universe.

You may use each word once, more than once, or not at all.

Big-Bang **Contracting** **CMBR** **Expanding**

LDR **Red giant** **Red shift** **Solar system**

The ..... is a model of how the universe began.

Light from distant galaxies has a longer wavelength when it reaches Earth than when it was emitted.

This is called ..... .

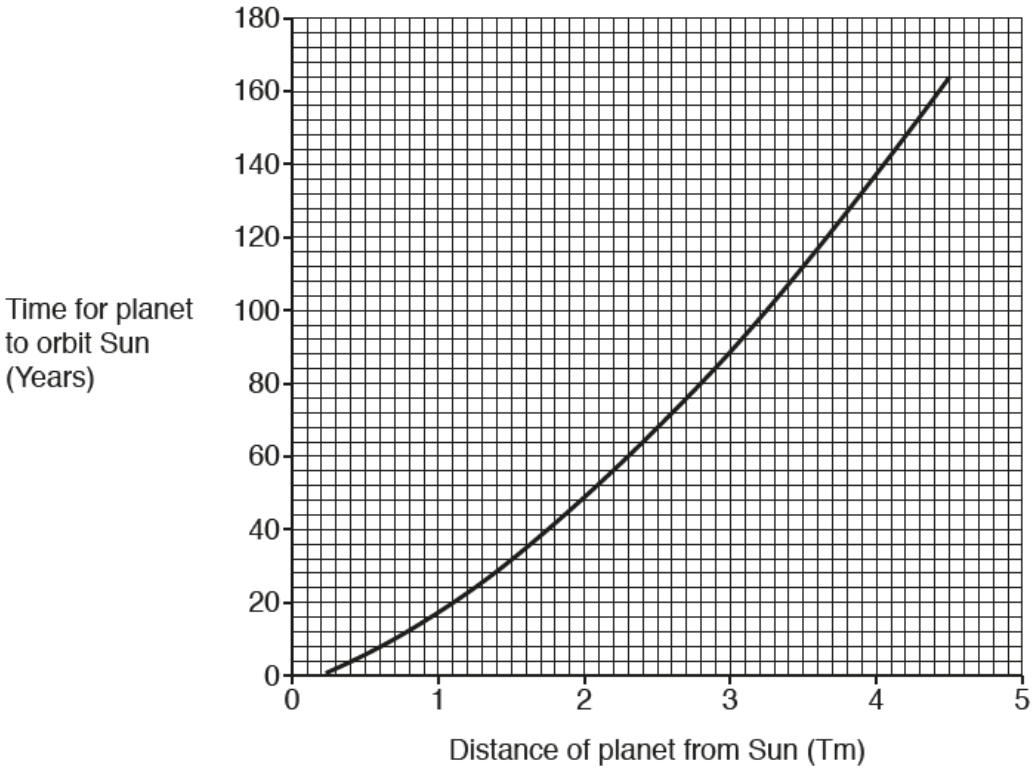
Distant galaxies are moving away faster so the universe is

..... .

[3]

8. Nov/2020/Paper_J249/02/No.20

This graph shows how a planet's orbit time changes with distance from the Sun in our solar system.



Describe and explain the relationship shown by the graph.

Use data from the graph and ideas about our solar system in your answer.

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9. Nov/2021/Paper_J249/04/No.7

The two statements describe the mains electricity supply:

- The a.c. potential difference between the earth wire and the live wire is **X** volts.
- The a.c. potential difference between the earth wire and the neutral wire is **Y** volts.

Which row of the table correctly completes the sentences?

	X	Y
A	0	0
B	0	230
C	230	0
D	230	230

Your answer ☐ **[1]**

10. Nov/2021/Paper_J249/04/No.8

Four stages in the lifecycle of a star are P, Q, R and S:

P	Nuclear fusion starts.
Q	The core collapses to form a white dwarf.
R	Dust and gas are pulled together by gravity.
S	The star expands to form a red giant.

What is the correct order of these stages?

A P → R → Q → S

B P → S → R → Q

C R → P → S → Q

D R → Q → P → S

Your answer ☐ **[1]**

11. Nov/2021/Paper_J249/04/No.17

A solar cell changes light into electricity. Solar panels contain solar cells.

(a) A student investigates a solar cell:

- They change the intensity of the light.
- They measure the potential difference across the solar cell.

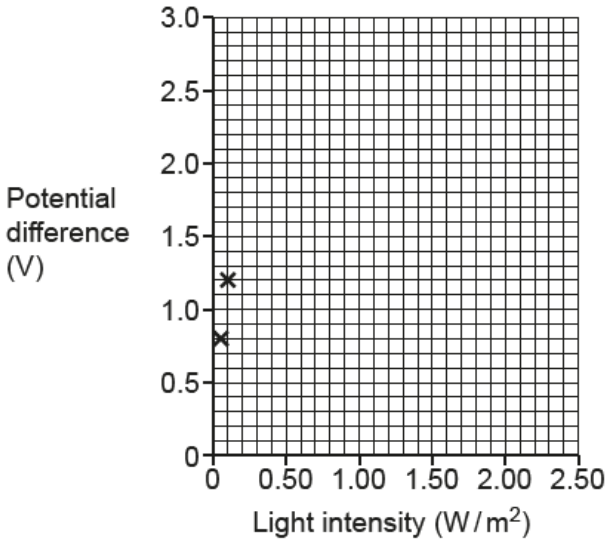
(i) **Table 17.1** shows the student's results:

Light intensity (W/m^2)	Potential difference (V)
0.05	0.8
0.10	1.2
0.20	1.5
0.40	1.8
0.80	2.2
1.60	2.5

Table 17.1

Plot a graph of the results from **Table 17.1**. Two results have already been plotted for you.

Draw a line of best fit. **[3]**



(ii) The light intensity is changed to $2.00\,W/m^2$.

Use your graph to predict the potential difference of the solar cell.

Show your working on the graph.

Potential difference = ... V **[2]**

(iii) Suggest **one** way the student could improve their investigation.

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..... **[1]**

(b) (i) More people use solar panels to generate electricity compared to twenty years ago.

Suggest **two** reasons why.

1 .....

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2 .....

..... **[2]**

(ii) A homeowner fits solar panels to the roof of their house.

Table 17.2 gives the energy values for the house for **one** day:

Area of one solar panel	$1.6\,m^2$
Area of roof that can be used	$24\,m^2$
Maximum energy output of one solar panel	26 MJ
Energy needed by all appliances in the house	364 MJ

Table 17.2

Explain whether the energy needed by all the appliances can be generated using **only** solar panels.

Use **Table 17.2** and your knowledge of solar panels to explain your answer.

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..... **[3]**

12. Nov/2021/Paper_J249/04/No.19

A radio signal is sent to Mars.

(a) **Table 19.1** shows the distance from the Sun to Earth and the distance from the Sun to Mars, when Mars and Earth are closest.

Distance from the Sun to Earth	1.50×10^{11} m
Distance from the Sun to Mars	2.28×10^{11} m

Table 19.1

The radio signal travels at 300 000 000 m/s.

Calculate the minimum time for the radio signal to travel from Earth to Mars.

Use the data in **Table 19.1** and the equation: distance = speed × time

Time = ... s **[4]**

(b) The average surface temperature on Earth is 15 °C.

Suggest whether the average temperature on Mars is higher or lower than 15 °C.

Use the data in **Table 19.1** to explain your answer.

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..... **[2]**

13. Nov/2021/Paper_J249/04/No.23

This question is about infra red (IR) and ultra violet (UV) radiation.

(a) It took humans a long time to discover IR and UV radiation.

Suggest **two** reasons why.

1 .....

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2 .....

..... **[2]**

(b) Look at the information about some UV radiation:

- The wavelength of the UV radiation is 0.18 μm.
- The wave speed of the UV radiation is 3.0×10^8 m.

Calculate the frequency of the UV radiation.

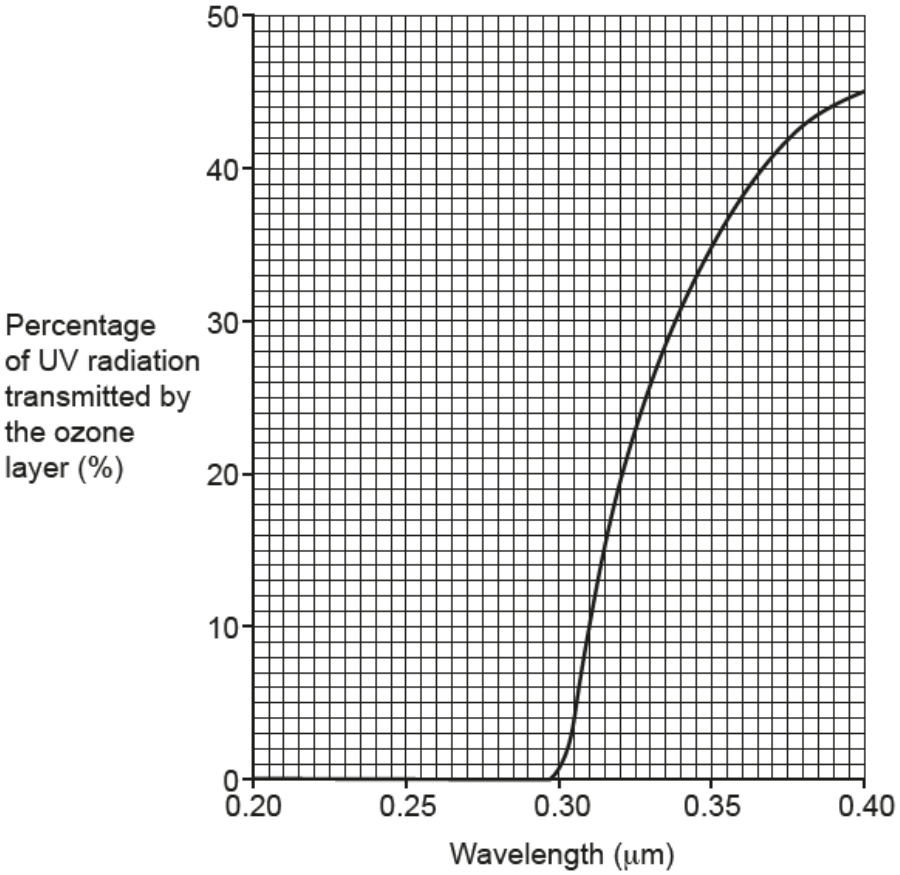
Use the equation: wave speed = frequency × wavelength

Give your answer to **2** significant figures.

Frequency = ... Hz **[5]**

(c) The ozone layer is part of the Earth's atmosphere.

This graph shows how the percentage of UV radiation **transmitted** by the ozone layer depends on wavelength:



(i) Describe the difference in the **absorption** of UV radiation at 0.31 μm and 0.37 μm.

Use data from the graph in your answer.

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..... **[3]**

(ii) Why is the ozone layer important for humans on Earth?

Use the graph to help explain your answer.

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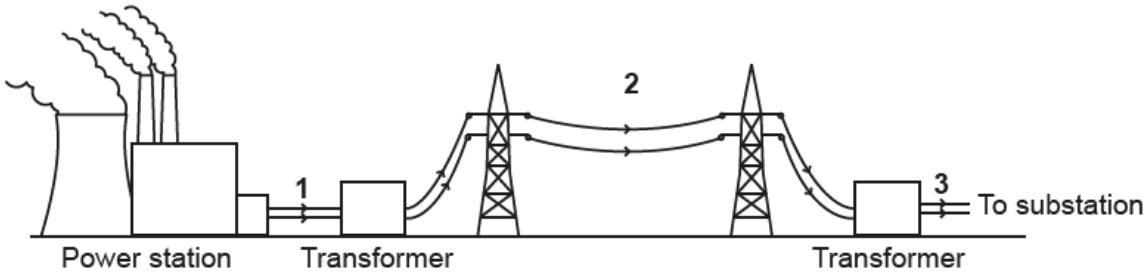
14. Nov/2020/Paper_J249/04/No.3

The diagram shows a simplified version of the national grid.



The potential difference (p.d.) is different at each point in the national grid.

Which row in the table is correct?

	p.d. at position 1 (V)	p.d. at position 2 (V)	p.d. at position 3 (V)
A	230	5000	11000
B	25000	450000	11000
C	450000	150	230
D	450000	5000	230

Your answer ☐ **[1]**

15. Nov/2020/Paper_J249/04/No.6

Which statement about a star that explodes into a supernova is correct?

A The star has more mass than the sun.

B The star is older than the sun.

C The star will become a white dwarf.

D The star's core expands.

Your answer ☐ **[1]**

16. Nov/2020/Paper_J249/04/No.14

Which statement about a star that explodes into a supernova is correct?

A The star has more mass than the sun.

B The star is older than the sun.

C The star will become a white dwarf.

D The star's core expands.

Your answer ☐ **[1]**

17. Nov/2020/Paper_J249/04/No.18

The UK generates some of its electrical power from wind turbines.

Fig. 18.1 shows the total electrical power generated by wind turbines in the UK.

The graph is for a single day in December which had very strong winds.

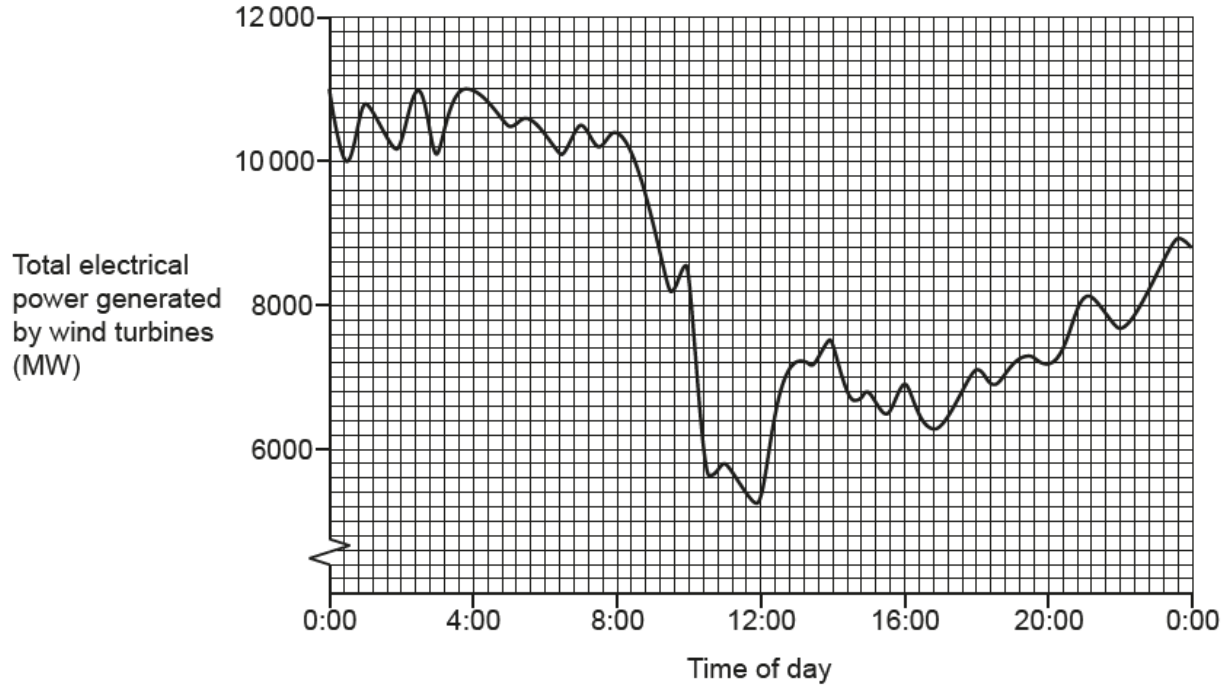


Fig. 18.1

Fig. 18.2 shows the total demand for electrical power in the UK on the same day.

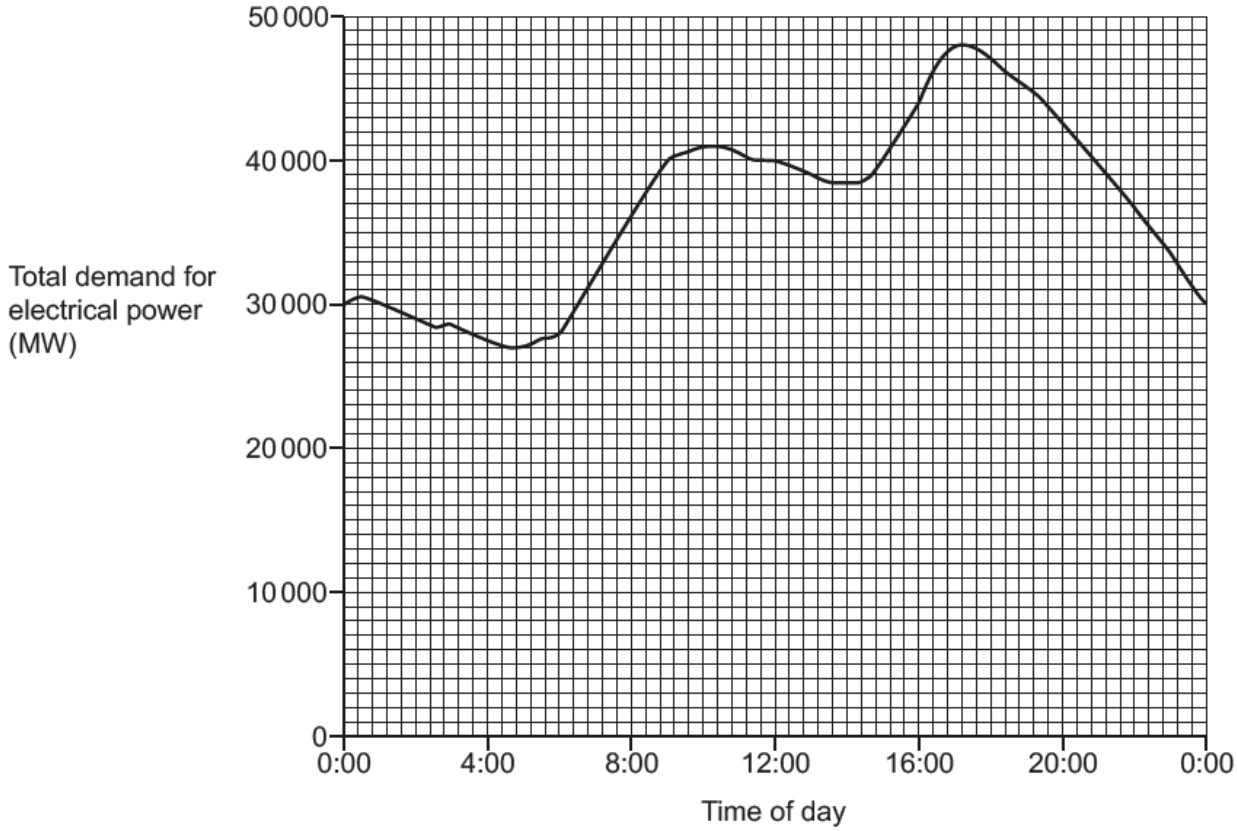


Fig. 18.2

Some experts believe the UK should generate most of its electrical power from wind.

Evaluate the advantages and disadvantages of this idea.

Use the graphs in **Fig. 18.1** and **Fig. 18.2** and your own ideas about wind turbines to support your answer.

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18. Nov/2020/Paper_J249/04/No.22

Edwin Hubble discovered that all distant galaxies were moving away from the Earth.

(a) Explain how he could tell that all distant galaxies were moving away from the Earth.

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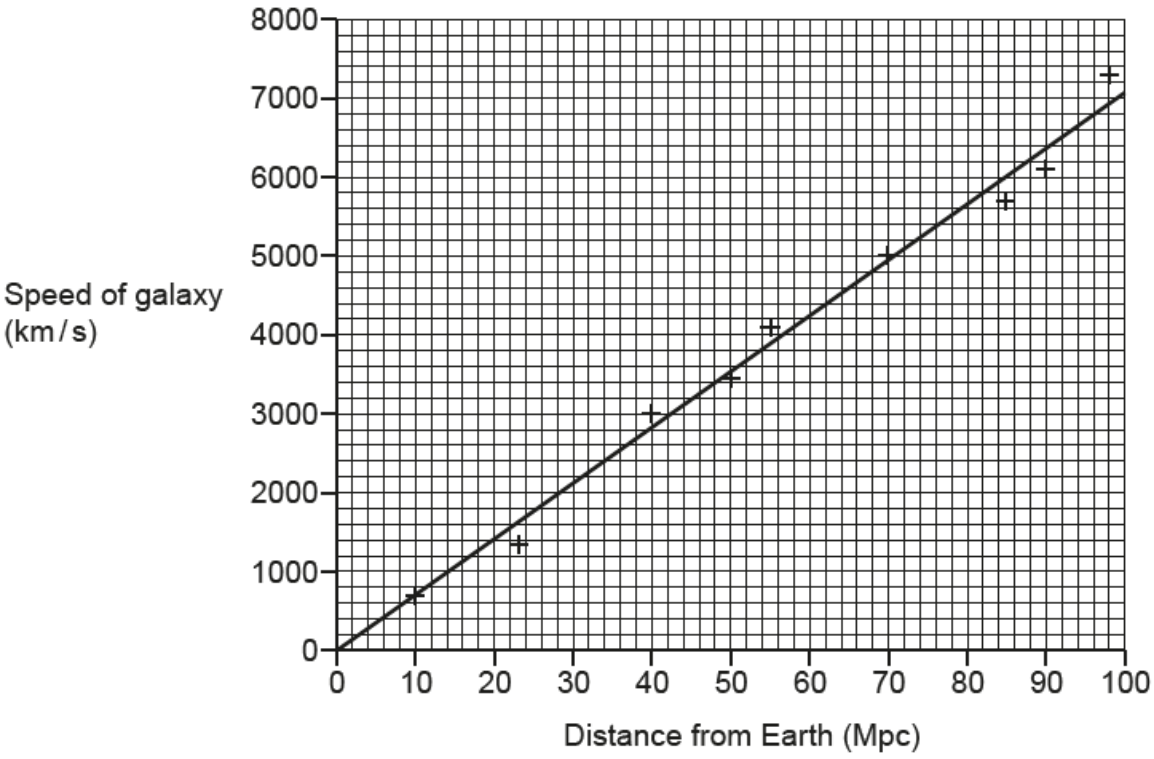
..... **[2]**

(b) This graph shows how the speed of a galaxy changes with distance from the Earth.



(i) Use data from the graph to show that the speed of the galaxy is proportional to the distance from the Earth.

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..... **[2]**

(ii) Explain how data from the graph provides evidence for the Big-Bang.

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..... **[1]**

(c) Before Edwin Hubble could publish his results, his work was peer reviewed.

Suggest why peer review is important.

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..... **[1]**

(d) The parsec (pc) is a unit used for measuring large distances in the Universe.

(i) A galaxy is at a distance of 82 Mpc from the Earth.

Use the graph to determine the speed of this galaxy.

Give your answer in metres per second (m/s).

Speed = ... m/s **[2]**

(ii) Calculate the time it takes for the galaxy to travel 2.53×10^{24} m.

Use your answer to **22(d)(i)** to help you.

Time = ... s **[3]**